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Forest Service Research Natural Areas in California



- Adorni • Agua Tibia • American Canyon • Antelope Creek Lakes • Babbitt Peak
- Backbone Creek • Bald Mountain • Bell Meadow • Big Grizzly Mountain • Big Pine
- Mountain • Bishop Creek Ponderosa Pine • Black Butte • Blacks Mountain • Bourland
- Meadow • Bridge Creek • Broom Flat • Broom Flat Ridge • Cahuilla Mountain •
- Cedar Basin • Church Dome • Clark Fork • Cleghorn Canyon • Cone Peak Gradient
- Craig's Creek • Crater Creek • Cub Creek • Devil's Basin • Devil's Garden
- Devil's Rock • Devil's Rock-Hosselkus • Doll Basin • Eagle Crag • Falls Canyon •
- Fern Canyon • Fisherman's Camp • Frenzel Creek • Graham Pinery • Grass Lake
- Green Island Lake • Grizzly Mountain • Guatay Mountain • Hale Ridge • Hal
- Canyon • Harvey Monroe Hall • Haypress Meadows • Hennessy Ridge • Highland
- Lakes • Home Camp Creek • Horse Meadow • Hosselkus Limestone • Indian Creek
- Indian Creek Brewer Spruce • Indiana Summit • Iron Mountain • Jawbone Ridge •

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Mailing address:
PO Box 245, Berkeley
CA 94701-0245

(510) 559-6300

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Abstract

Ecological descriptions of 98 research natural areas (of various statuses) in the Pacific Southwest Region of the USDA Forest Service are summarized in this report. These descriptions, basically based on ecological surveys conducted from 1975 through 2000, provide important but largely unknown information on the ecology of California. For each area, descriptions of location, target elements, distinctive features, physical characteristics, plant communities, plant diversity, and conflicting impacts are provided. Comparisons are made between similar vegetation types at different sites. Summaries of all research natural areas' target elements, plant communities, and ecological units can be found in tables and appendices. Maps and photographs are included.

Retrieval Terms: California vegetation, ecological survey, research natural area

Technical Editor

Sheauchu Cheng is a plant ecologist in the Station's Sierra Nevada Research Center at Albany, California.

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Forest Service Research Natural Areas in California

Sheauchi Cheng, Technical Editor

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Introduction

Research Natural Areas (RNAs) in National Forests are public lands protected permanently to maintain biological diversity and provide ecological baseline information, education, and research. Areas representing both widespread and unique ecosystems are selected for RNAs. Only nonmanipulative research and observation are allowed in the RNAs.

In California 52 RNAs have been formally established by the Chief of the USDA Forest Service and are managed to serve the objectives of the RNA system. The oldest is Indiana Summit, established in 1932 on the Inyo National Forest; the most recent is Ruth on the Six Rivers National Forest, established in 1998. More than 40 areas are yet to be established. The Forest Service RNAs in California contain a wide range of habitats, from the coast to the desert and from valley grassland to alpine fell-field.

Since 1975, the USDA Forest Service's Pacific Southwest Region (Region 5) Research Natural Areas Committee has contracted for the ecological surveys of established or proposed RNAs on Forest Service land in California. Typically included in the surveys are descriptions of vegetation communities and successional relationships, detailed plant lists, growth rates of important tree species, and maps of vegetation and soil. Produced by more than 30 plant ecologists and botanists outside the Forest Service, the surveys provide detailed descriptions of many natural plant communities heretofore poorly described in ecological literature. Copies of the completed, unpublished surveys are filed in the USDA Forest Service, Pacific Southwest Research Station at Albany and the Bioscience Library of the University of California, Berkeley, but a few have been published or even alluded to in print (e.g., Keeler-Wolf 1988b, Sawyer, Thornburgh, Griffin 1977). Three established RNAs have no ecological survey (Blacks Mountain, San Joaquin Experimental Range, and Backbone Creek), but have extensive studies conducted on site. Summaries of the ecological conditions of these three RNAs are included.

This publication is intended to bring these ecological data to the attention of scientists and the general public. The original ecological surveys are much too long and detailed to incorporate into a single publication. This report summarizes the most significant information collectively to make up a substantial body of ecological information on California's vegetation, particularly its forests and woodlands.

Of the 98 areas described in this report, 52 are established RNAs, 36 are proposed, candidate or recommended RNAs, and 10 have been dropped from RNA consideration because they duplicate more desirable candidates or are more appropriately classified in some other way (e.g., as Botanical Areas or Special Interest Areas).

Selection of RNAs

The selection of RNAs is based on the identification of "target elements" on all the National Forests in California. These target elements include plant communities described in various ecological references (e.g., Barbour and Major 1977, Eyre 1980, Kuchler 1966, Munz and Keck 1959) and unique ecosystems, such as aquatic and geologically unusual areas. Selection of RNAs is intended to accurately reflect the natural diversity of vegetation types on Forest Service land in California and lead to the long-term study of each.

Most RNAs contain a far greater diversity of vegetation types than just the designated target elements. The representation of these vegetation types within the RNA is as important as the representation of the target elements.

Locations of RNAs are shown in *Figure 1*. *Table 1* summarizes the status, target elements, and date of ecological survey of all the 98 areas. *Figure 2* shows

the ecological sections of California delineated by the Forest Service (Miles and Goudey 1997). Lists of RNAs by ecological subsections are provided in *Table 2. Appendix 1* cross-references the RNAs to the occurrence of vegetation types derived from the Terrestrial Plant Communities in California (Holland 1986).

Ecological Surveys

The following are included in most RNA ecological surveys:

- General overview of topography, geology, soils, climate, and flora of the study area
- Vegetation map and narrative descriptions (area, general characteristics, successional relationships, and scientific/educational values) of the principal plant communities in the study area
- Notation on the occurrence of any endangered, threatened, sensitive, or rare plant and animal species in the study area
- Estimates of composition, density, basal area, and growth rate for representative stands of timber types

Many ecological surveys include more than the above-mentioned information, such as detailed sampling of non-forest vegetation types, recommendations for protection and management, the ecological significance of real or potential human impact, boundary options based on ecological information, and other values (e.g., anthropological, paleontological). They also usually include a list of vascular plants identified during the fieldwork. Depending on the expertise of the researcher, such additional information as detailed lists of vertebrates, bird censuses, or data on mammal trapping may be included.

Format of the Summaries

Summaries of ecological conditions are arranged alphabetically by research natural area name, which may be different from the name used in the ecological survey report. The ecological survey name, if different, is in parentheses following the research natural area name.

Vegetation cannot be expected to remain the same as it is described here, since it is based on the conditions present when the surveys were conducted. For established RNAs, the establishment record usually contains additional, updated information on the area, especially in relation to management implications and conflicts on land use issues. The establishment record may have redefined certain vegetation types, or added to the plant list based on more recent fieldwork. Reference to the ecological survey and establishment record is listed after the name of the area.

Each summary includes:

RNA name with the name used in the ecological survey in parentheses (if different from the RNA name), and citations of the ecological survey and establishment record (when applicable).

Location: Latitude and longitude, distance to nearest town or standard map location, sections, Township and Range, National Forest, USGS 7.5 or 15 minute (depending on availability) topographic quadrangle coverage, and establishment status. Maps of each area are attached. These maps indicate the official (if established) and proposed boundaries (solid line) and the ecological survey study area boundaries (if different, dashed line).

Target Element(s): Target element(s) represented.

Distinctive Features: Important ecological features of plants or plant communities represented, and paleontological, geological, archeological, or

(Continues on page 9)

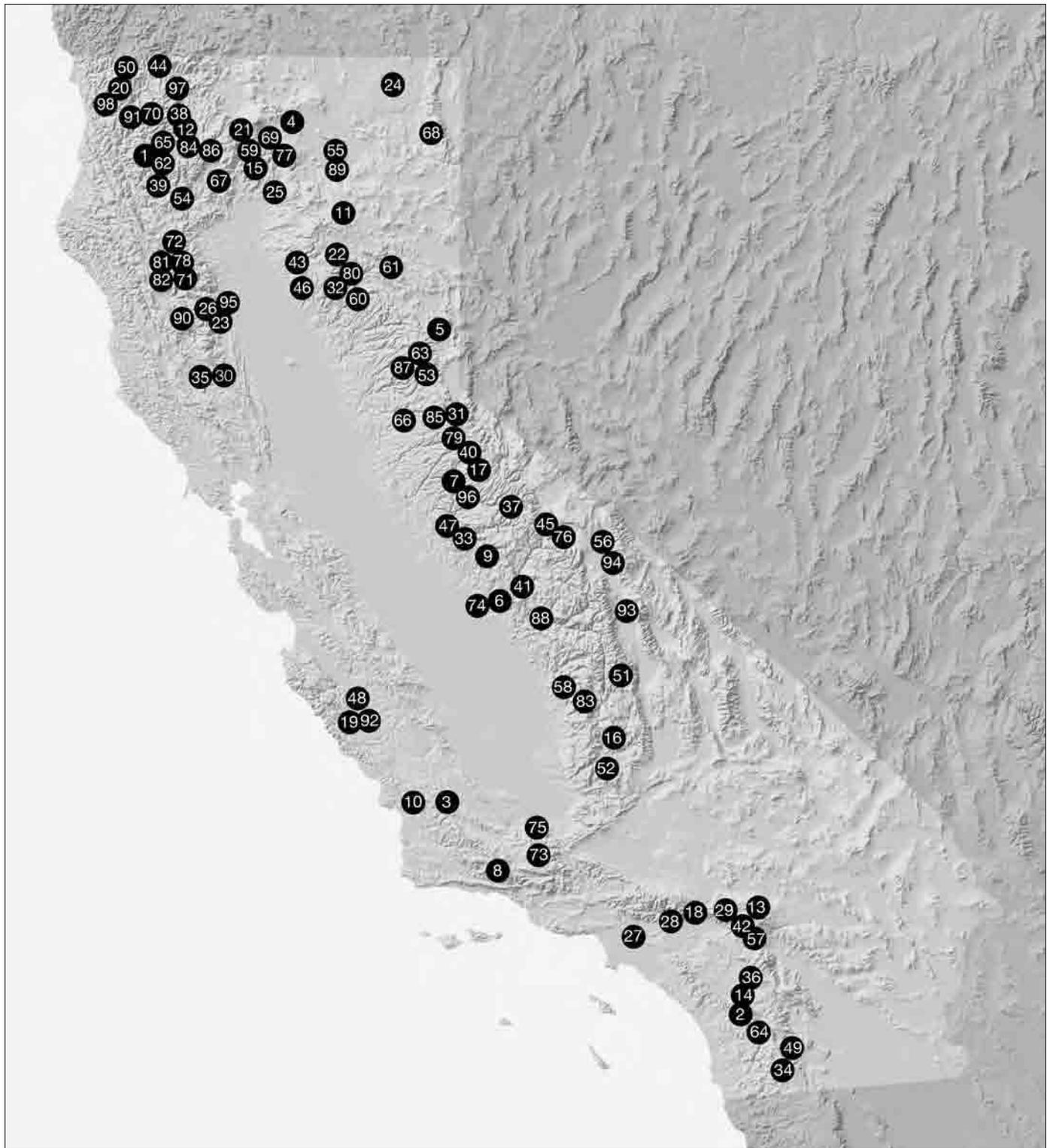


Figure 1—Locations of Forest Service research natural areas in California

Status Definitions for Table 1.

- E**= established
- R**= recommended in forest management plan
- C**= candidate, nominated and approved for establishment but not incorporated in forest management plan
- P**= proposed, recognized but not yet fully reviewed or approved
- D**= dropped for research natural area consideration

Table 1— Forest Service research natural areas in California.

Status	RNA name	National Forest	Target vegetation 1	Target vegetation 2 and other significant value	Ecological survey date
E	1-Adorni	Six Rivers	Port Orford-cedar	tanoak	1981
E	2-Agua Tibia	Cleveland	bigcone Douglas-fir	madrone	1989
E	3-American Canyon	Los Padres	Coulter pine - chaparral	riparian corridors	1989
C	4-Antelope Creek Lakes	Klamath	subalpine wet meadow	mountain hemlock/red fir	1987
E	5-Babbitt Peak	Tahoe/Toiyabe	Washoe pine	mountain mahogany	1977
E	6-Backbone Creek	Sierra	<i>Carpenteria californica</i>	unique ecosystem	no survey
E	7-Bell Meadow	Stanislaus	aspen	montane meadow	1985
C	8-Big Pine Mountain	Los Padres	mixed conifer forest	condor habitat, biogeography	1991
C	9-Bishop Creek Ponderosa Pine	Sierra	Pacific ponderosa pine	—	1979
E	10-Black Butte	Los Padres	knobcone pine	chaparral	1996
E	11-Blacks Mountain	Lassen	interior ponderosa pine	sagebrush	no survey
C	12-Bridge Creek	Klamath	Pacific Douglas-fir	giant chinquapin, Pacific yew	1985
C	13-Broom Flat	San Bernardino	pinyon	pinyon - juniper woodland	1992
E	14-Cahuilla Mountain	San Bernardino	Coulter pine	California black oak	1986
R	15-Cedar Basin	Shasta-Trinity	Port Orford-cedar	mixed conifer, <i>Darlingtonia</i> bog	1982
E	16-Church Dome	Sequoia	Jeffrey pine	—	1989
C	17-Clark Fork	Stanislaus	white fir	red fir	1991
C	18-Cleghorn Canyon	San Bernardino	southern sycamore alder riparian forest	white alder riparian forest, bigcone Douglas-fir - canyon live oak forest	1994
E	19-Cone Peak Gradient	Los Padres	unique ecosystem (Santa Lucia fir, sugar pine, mixed evergreen forest)	—	1977
R	20-Craig's Creek	Six Rivers	knobcone pine	coast redwood	1991
C	21-Crater Creek	Klamath	subalpine forest (foxtail/ mountain hemlock)	mountain mahogany	1987
E	22-Cub Creek	Lassen	mixed conifer forest	—	1978
E	23-Devil's Basin	Mendocino	California black oak	Douglas-fir	1987
E	24-Devil's Garden	Modoc	western juniper	<i>Artemisia</i> shrub-steppe	1984
E	25-Devil's Rock- Hosselkus	Shasta-Trinity	limestone ecosystem	California black oak, canyon live oak	1975
E	26-Doll Basin	Mendocino	mixed conifer forest	archeology	1986
E	27-Falls Canyon	Angeles	bigcone Douglas-fir	canyon live oak	1981
E	28-Fern Canyon	Angeles	chamise chaparral	canyon live oak	1979
E	29-Fisherman's Camp	San Bernardino	Coulter pine	mixed conifer forest	1992
E	30-Frenzel Creek	Mendocino	MacNab cypress	Sargent cypress, serpentine chaparral	1983
E	31-Grass Lake	Eldorado	moss bog	montane meadow	1987
R	32-Green Island Lake	Lassen	moss bog	montane coniferous forest	1986
E	33-Grizzly Mountain	Stanislaus	California black oak	—	1987
P	34-Guatay Mountain	Cleveland	Tecate cypress	gabbro endemics	1980
E	35-Hale Ridge	Mendocino	knobcone pine	serpentinite species	1987
E	36-Hall Canyon	San Bernardino	mixed conifer forest	adjacent to James UC Preserve	1986
E	37-Harvey Monroe Hall	Inyo	alpine meadows, subalpine forest	—	1984
C	38-Haypress Meadows	Klamath	red fir	wet meadow/riparian complex	1988
R	39-Hennessy Ridge	Six Rivers	Pacific Douglas-fir	succession and forest structure	1987
D	40-Highland Lakes	Stanislaus	mountain hemlock forest	—	1988
P	41-Home Camp Creek	Sierra	white fir	red fir	1992
E	42-Horse Meadow	San Bernardino	white fir	subalpine forest	1992

(Continues on next page)

Table I (continued)

Status	RNA name	National Forest	Target vegetation 1	Target vegetation 2 and other significant value	Ecological survey date
R	43-Indian Creek	Lassen	blue oak - foothill pine	—	1986
D	44-Indian Creek Brewer Spruce	Klamath	Brewer spruce	—	1978
E	45-Indiana Summit	Inyo	Jeffrey pine	archeology	1980
P	46-Iron Mountain	Lassen	Pacific ponderosa pine	California black oak	1992
D	47-Jawbone Ridge	Stanislaus	chamise chaparral	—	1986
D	48-Junipero Serra Peak	Los Padres	sugar pine	—	1975
E	49-King Creek	Cleveland	Cuyamaca cypress	gabbro endemics	1978
R	50-L. E. Horton	Six Rivers	<i>Darlingtonia</i> bog	serpentine endemics	1986
E	51-Last Chance Meadow	Inyo	foxtail pine	meadow / stream	1976
C	52-Long Canyon	Sequoia	Piute cypress	California juniper, pinyon pine	1990
E	53-Lyon Peak/Needle Lake	Tahoe	mountain hemlock	subalpine meadow	1988
E	54-Manzanita Creek	Shasta-Trinity	ponderosa pine-Douglas-fir	alder-dogwood, complete watershed	1979
C	55-Mayfield	Lassen	knobcone pine	geology	1991
R	56-McAfee	Inyo	alpine fell-field	—	1993
E	57-Millard Canyon	San Bernardino	interior live oak	bigcone Douglas-fir	1988
E	58-Moses Mountain	Sequoia	giant sequoia	riparian and meadow	1989
E	59-Mount Eddy	Shasta-Trinity	foxtail pine	—	1979
E	60-Mount Pleasant	Plumas	red fir	bog-fen	1981
E	61-Mud Lake	Plumas	Baker cypress	biogeography	1985
R	62-North Trinity Mountain	Six Rivers	white fir	noble fir forest	1981
D	63-Onion Creek	Tahoe	white fir	red fir	1977
E	64-Organ Valley	Cleveland	Engelmann oak	gabbro endemics	1985
D	65-Pearch Creek	Six Rivers	mixed evergreen forest (Douglas-fir - tanoak - Pacific madrone)	—	1987
E	66-Peavine Point	Eldorado	Pacific ponderosa pine	California black oak	1977
E	67-Preacher Meadows	Shasta-Trinity	mixed conifer	<i>Darlingtonia-Cypripedium</i> bog	1978
R	68-Raider Basin	Modoc	white fir	northern juniper woodland	1989
E	69-Red Butte-Red Fir Ridge	Shasta-Trinity	red fir	wet meadow	1988
C	70-Rock Creek Butte	Klamath	Brewer spruce	montane chaparral	1987
C	71-Rough Gulch	Shasta-Trinity	Douglas-fir	—	1975, partial
E	72-Ruth	Six Rivers	ponderosa pine - Douglas-fir	oak-conifer woodland	1981
E	73-San Emigdio Mesa	Los Padres	pinyon-juniper woodland	<i>Quercus turbinella</i> ssp. <i>californica</i>	1993
E	74-San Joaquin Experimental Range	Sierra	blue oak - foothill pine	—	no survey
R	75-Sawmill Mountain	Los Padres	Jeffrey pine	white fir	1993
E	76-Sentinel Meadow	Inyo	lodgepole pine	limber pine	1978
E	77-Shasta Mud Flow	Shasta-Trinity	Pacific ponderosa pine	unique ecosystem	1984
R	78-Smoky Creek	Shasta-Trinity	ponderosa pine - Douglas-fir	serpentine Jeffrey pine	1979
C	79-Snow Canyon	Eldorado	western white pine	subalpine meadow	1992
R	80-Soda Ridge	Lassen	white fir	mixed conifer forest	1980
R	81-Soldier	Six Rivers	Oregon white oak	foothill pine	1988
C	82-South Fork Mountain	Shasta-Trinity	Douglas-fir	—	1975, partial
C	83-South Mountaineer Creek	Sequoia	red fir	montane wet meadow	1991
D	84-Specimen Creek	Klamath	Pacific Douglas-fir	—	1977
E	85-Station Creek	Eldorado	transitional forest type (sugar pine - white fir - rattlesnake orchid)	—	1977

(Continues on next page)

Table I (continued)

Status	RNA name	National Forest	Target vegetation 1	Target vegetation 2 and other significant value	Ecological survey date
C	86-Sugar Creek	Klamath	mixed conifer	enriched conifer	1984
E	87-Sugar Pine Point	Tahoe	mixed conifer forest	montane chaparral	1981
D	88-Teakettle Creek	Sierra	red fir	—	1975
R	89-Timbered Crater	Lassen	Baker cypress	vernal pool	1990
D	90-Twin Rocks	Mendocino	foothill woodland	—	1987
R	91-Upper Goose Creek	Six Rivers	Douglas-fir - western hemlock	Port Orford-cedar	1987
R	92-Wagon Caves	Los Padres	valley oak woodland	alder - sycamore riparian	1989
E	93-Whippoorwill Flat	Inyo	pinyon - juniper	limber pine	1976
E	94-White Mountain	Inyo	bristlecone pine	limber pine	1979
E	95-Wilder Ridge	Mendocino	chamise chaparral	foothill pine - blue oak woodland	1992
E	96-William B. Critchfield	Stanislaus	red fir	montane meadow	1976
D	97-William's Point	Klamath	Douglas-fir	—	1977
E	98-Yurok	Six Rivers	coast redwood	red alder	1982

zoological distinctions. If extensive information regarding a community type or other feature of the area has been amassed (e.g., vegetation structure, growth rates, successional history) as a result of the survey or other previous study, it is discussed here.

Physical Characteristics: Acreage, elevational range, brief topographical description with principal rock types, soils, and climatic summary.

Association Types: Brief descriptions of all plant associations represented, with Holland (1986) community equivalents, extent (in the surveyed area unless otherwise noted), important species, and data on density, basal area cover, seedling and sapling densities, and sizes of dominant species, if available.

Plant Diversity: Based on numbers of taxa (specific and infraspecific) listed in the area; includes only vascular plants unless otherwise noted.

Conflicting Impacts: Real or potential human impact, which may need consideration in research plans or management of the area to maintain a natural state.

Standards and Conventions

All association types are listed with their Holland (1986) community-type equivalent. A list of Holland types and their representation on the research natural areas is presented as *appendix 1*. Society of American Foresters (Eyre 1980) and Kuchler (1966) types are not specifically listed, as these are not usually as precise as the Holland types.

Rare species: rare species known from an area are listed under the distinctive features section. Protection status of these species and subspecies under the Federal Government, State of California, USDA Forest Service, and California Native Plant Society (CNPS) are included in parentheses. For detailed explanation of each listing, please refer to *appendix 2*.

Plant names: all species names are in accordance with Munz (1968, 1974), unless otherwise noted.

(Continues on page 11)

Figure 2—Ecological sections of California (from Miles and Goudey 1997).

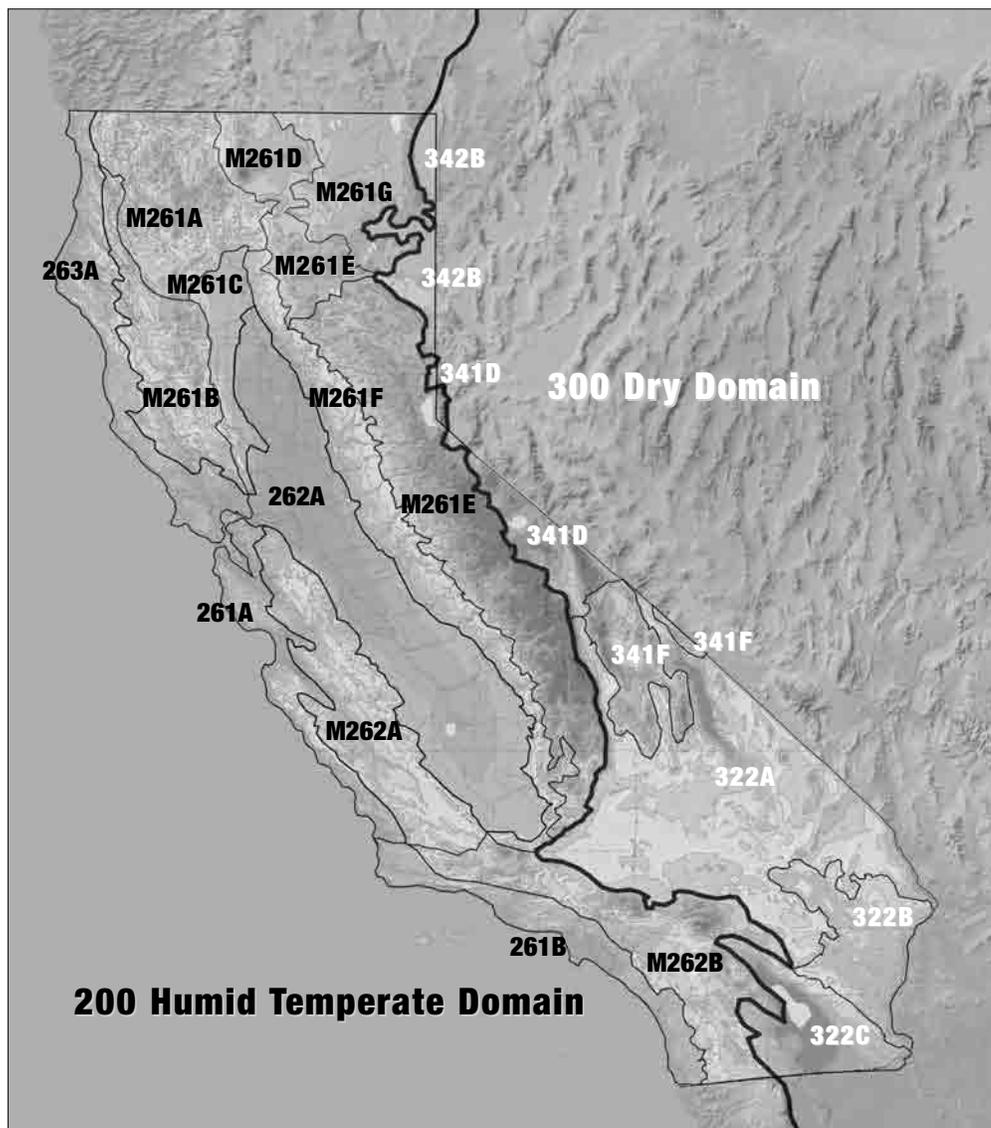


Table 2— Forest Service research natural areas by California’s ecological subsection. Ecological subsection codes and names (Miles and Goudey 1997) are in boldface; research natural area names (with ecological survey area name in parentheses, if different from the research natural area name) are in plain type.

200 Humid Temperate Domain

260 Mediterranean Division

261 California Coastal Chaparral Forest and Shrub Province

- 261A Central California Coast Section**
- 261Aj North Coastal Santa Lucia Range:** Cone Peak Gradient (Limekiln Creek, South Fork of Devil’s Canyon), Junipero Serra Peak, Wagon Caves
- 261Ak South Coastal Santa Lucia Range:** Black Butte

263 California Coastal Steppe – Mixed Forest – Redwood Forest Province

- 263A Northern California Coast Section**
- 263Ab Northern Franciscan:** Yurok

M260 Mediterranean Regime Mountains Division

M261 Sierran Forest – Alpine Meadows Province

- M261A Klamath Mountains Section**
- M261Aa Western Jurassic:** Rock Creek Butte, William’s Point, Craig’s Creek, Hennessy Ridge, Upper Goose Creek
- M261Ab Gasquet Mountain Ultramafics:** Adorni, Craig’s Creek, L. E. Horton (Stone Corral-Josephine Peridotite)
- M261Ad Siskiyou Mountains:** Rock Creek Butte

- M261Af Lower Salmon Mountains:** Bridge Creek, Indian Creek Brewer Spruce, Peach Creek
- M261Ag Upper Salmon Mountains:** Bridge Creek, Haypress Meadows, Sugar Creek
- M261Ai Eastern Klamath Mountains:** Devil’s Rock-Hosselkus (Devil’s Rock, Hosselkus Limestone), Preacher Meadows
- M261Aj Upper Scott Mountains:** Cedar Basin, Crater Creek, Mount Eddy, Preacher Meadows
- M261An Red Butte:** Indian Creek Brewer Spruce
- M261Ap Forks of Salmon:** Specimen Creek
- M261Aq North Trinity Mountain:** North Trinity Mountain, Manzanita Creek (Trelorita)
- M261Ar Trinity Mountain - Hayfork:** Manzanita Creek (Trelorita)
- M261Au Rattlesnake Creek:** Smoky Creek
- M261B Northern California Coast Ranges Section**
- M261Ba Eastern Franciscan:** Adorni, Devil’s Basin, Doll Basin, Hale Ridge, Rough Gulch (Yolla Bolla), South Fork Mountain (Yolla Bolla), Ruth, Twin Rocks
- M261Bb Central Franciscan:** Hale Ridge, Soldier
- M261Bc Stony Creek Serpentine:** Frenzel Creek
- M261C Northern California Interior Coast Ranges Section**
- M261Ca Western Foothills:** Frenzel Creek, Wilder Ridge

- M261D Southern Cascades Section**
- M261Dd Blacks Mountain - Susanville Peak:** Blacks Mountain
- M261Df High Cascades:** Antelope Creek Lakes, Red Butte-Red Fir Ridge (Shasta Red Fir)
- M261Dg McCloud Flat:** Shasta Mudflow (Mount Shasta Mud Flow)
- M261Dh Medicine Lake Lava Flows:** Mayfield, Timbered Crater
- M261Di Shingleton - Paradise:** Cub Creek, Iron Mountain (Graham Pinery)
- M261Dm Lassen - Almanor:** Cub Creek, Green Island Lake, Soda Ridge
- M261E Sierra Nevada Section**
- M261Ea Diamond Mountains - Crystal Peak:** Mud Lake (Mud Lake-Wheeler Peak)
- M261Eb Fredonyer Butte - Grizzly Peak:** Mud Lake (Mud Lake-Wheeler Peak)
- M261Ed Greenville - Graeagle:** Mount Pleasant
- M261Ee Bucks Lake:** Mount Pleasant
- M261Eg Upper Foothills Metamorphic Belt:** Grizzly Mountain (Big Grizzly Mountain), Jawbone Ridge
- M261Eh Upper Batholith and Volcanic Flows:** Bell Meadow, Clark Fork, Lyon Peak/Needle Lake, Onion Creek, Station Creek (Bald Mountain), Sugar Pine Point, William B. Critchfield (Bourland Meadow)
- M261Ej Tahoe - Truckee:** Babbitt Peak

Editorial Policy

Summaries of 68 areas in this report are based on the Forest Service's 1990 publication, GTR-PSW-125, "Ecological Surveys of Forest Service Research Natural Areas in California" (Keeler-Wolf 1990e). For these 68 areas, in addition to some revisions, updated information on significant events, such as fire or scientific discoveries, is included.

Literature citations are few. The principal references (ecological survey and establishment record) are cited at the beginning of the summary, next to each area's name. Additional references in the text are cited only to substantiate the distinctiveness of an area's particular feature(s); they are listed at the end of the summary. Detailed references can be found in the original surveys and establishment records.

Use of RNAs

The USDA Forest Service welcomes research and educational use of RNAs from interested parties within and outside the Forest Service. Use of an RNA or candidate RNA requires permission from the District Ranger on the Forest in which the RNA is located, and notification (with justifications) of the Director, Pacific Southwest Research Station, P. O. Box 245, Berkeley, CA 94701.

M261Ek	Glaciated Batholith and Volcanic Flows: Grass Lake, Highland Lakes, Snow Canyon	M261Gn	Big Valley Mountains: Timbered Crater	300	Dry Domain
M261Em	Batholith and Volcanic Flows: Peavine Point	M262	California Coastal Range Shrub – Forest – Meadow Province	340	Temperate Desert Division
M261Eo	Glaciated Batholith: Harvey Monroe Hall, Last Chance Meadow	M262A	Central California Coast Ranges Section	341	Intermountain Semi-Desert and Desert Province
M261Ep	Lower Batholith: Bishop Creek Ponderosa Pine (Merced River)	M262Ae	Interior Santa Lucia Range: American Canyon	341D	Mono Section
M261Eq	Upper Batholith: Home Camp Creek, Moses Mountain, South Mountaineer Creek (Mountaineer Creek), Teakettle Creek	M262B	Southern California Mountains and Valleys Section	341Dj	White Mountains: McAfee (White Mountain Summit), White Mountain White Mountain Natural Area),
M261Es	Tehachapi-Piute Mountains: Long Canyon	M262Ba	San Rafael-Topatopa Mountains: Big Pine Mountain	341DI	Glass Mountain: Indiana Summit, Sentinel Meadow
M261Eu	Kern Plateau: Church Dome	M262Bb	Northern Transverse Ranges: San Emigdio Mesa, Sawmill Mountain	341F	Southeastern Great Basin Section
M261F	Sierra Nevada Foothills Section	M262Bd	San Gabriel Mountains: Falls Canyon, Fern Canyon	341Fb	Inyo Mountains: Whippoorwill Flat
M261Fa	Tuscan Flows: Indian Creek, Iron Mountain (Graham Pinery)	M262Bg	San Gorgonio Mountains: Cleghorn Canyon, Millard Canyon	342	Intermountain Semi-Desert Province
M261Fc	Lower Granitic Foothills: Backbone Creek, San Joaquin Experimental Range	M262Bh	Upper San Gorgonio Mountains: Broom Flat (Broom Flat Ridge), Fisherman's Camp, Horse Meadow	342B	Northwestern Basin and Range Section
M261Fd	Southern Granitic Foothills: Long Canyon	M262Bm	San Jacinto Mountains: Cahuilla Mountain, Hall Canyon	342Ba	Surprise Valley: Raider Basin (Raider Creek)
M261G	Modoc Plateau Section	M262Bn	Western Granitic Foothills: King Creek, Organ Valley		
M261Gb	Devil's Garden: Devil's Garden	M262Bo	Palomar-Cuyamaca Peak: Agua Tibia (Eagle Crag), Guatay Mountain, King Creek		
M261Gf	Warner Mountains: Raider Basin (Raider Creek)				

I. Adorni (Cheng 1997a, Sawyer 1981a)

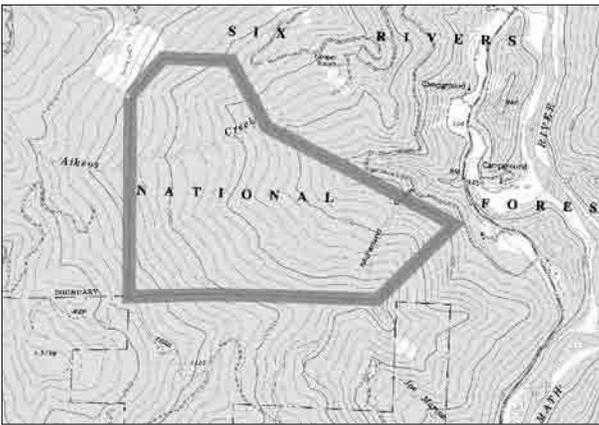


Figure 3—Adorni RNA

Location

This established RNA is on the Six Rivers National Forest. It lies about 3 miles (5 km) N. of Weitchpec, Humboldt County, covering portions of sects. 25 and 26 T10N, R4E HBM (41°14'N., 123°41'W.), USGS Weitchpec quad (fig. 3). Ecological subsections – Gasquet Mountain Ultramafics (M261Ab) and Eastern Franciscan (M261Ba).

Target Element

Port Orford-Cedar (*Chamaecyparis lawsoniana*)

Distinctive Features

Port Orford-Cedar (POC): This species is restricted to the Klamath Mountains and the adjacent S. Oregon Coast Ranges. Throughout much of its range it is threatened by

root rot disease (*Phytophthora lateralis*), and suitable areas for protection are needed. The area is representative of the low-elevation, mesic portion of the W. Klamath Mountains. In comparison with Upper Goose Creek (#91), however, it is less mesic, and such species as *Rhododendron macrophyllum*, western hemlock (*Tsuga heterophylla*), and giant chinquapin (*Chrysolepis chrysophylla*) are rare or absent. POC is more widespread in the forest away from drainage bottoms than at Upper Goose Creek. In comparison to Cedar Basin (#15), L.E. Horton (#50), and Rock Creek Butte (#70) candidate RNAs, Adorni is a warmer, less montane environment largely without ultramafic substrate. POC in Adorni is less restricted to stream courses than those in Cedar Basin, L.E. Horton, and Rock Creek Butte.

Rare Plants: *Erythronium citrinum* and *Lilium rubescens* are members of CNPS List 4 species.

Large Tanoak (*Lithocarpus densiflorus*): A small area in the SW. part of the site has several exceptionally large specimens of tanoak. The largest individuals reach 4 ft (1.2 m) dbh and heights of 170 ft (52 m).

Physical Characteristics

The area covers 700 acres (283 ha) and is drained by Aikens Creek, a tributary of the Klamath River. Topography is steep (30-70 percent slopes) with few terraces and typically abrupt ridges, particularly in the lower E. portion. Active slumping occurs along both of the major streams. Elevations range from 620 to 2580 ft (189-786 m).

The area is underlain by phyllites, schists, and outcroppings of sheared black slate, all part of the Upper Galice formation. There are also small outcroppings of Josephine Peridotite (serpentinite). Soils are primarily of the Sheetiron series with about 20 percent Hugo series. Precipitation is estimated at 70 inches/year (1778 mm/year), concentrated between November and March. Snow falls commonly during this period but does not accumulate. High temperatures in the 80s and 90s °F (about 27-32 °C) are expected in the summer, whereas winter average lows are in the low 30s °F (about 0 °C).

Association Types

Thirty releves are compiled to form association tables that suggest two types of forest occur in the area. Sizes of associations are not indicated.

The target element, Port Orford-cedar, is found in all areas of the RNA. It was not designated as a distinct vegetation type because of the overall dominance of Douglas-fir and tanoak. Keeler-Wolf (1990c) mapped the distribution of Port Orford-cedar; it is 209 acres (85 ha).

Douglas-Fir/*Goodyera oblongifolia* (81100): This association is typical of the two-storied Douglas-fir-hardwood forest of the Klamath Mountains ecological section (fig. 4). A canopy of Douglas-fir (138 trees/ha) and Port Orford-cedar (109 trees/ha) overlies a subcanopy of tanoak (198 trees/ha), Pacific madrone (*Arbutus menziesii*, 40 trees/ha), and California bay (*Umbellularia californica*, 10 trees/ha). Total basal area for this forest averages 149 m²/ha with Douglas-fir comprising 52 percent; Port Orford-cedar, 25 percent; and Pacific madrone, 15 percent of the cover. All trees are reproducing in these uneven-aged stands. The dense understory is dominated by *Vaccinium ovatum* and patches of *Gaultheria shallon*. Herbs include *Goodyera oblongifolia*, *Trillium ovatum*, *Oxalis oregana*, *Clintonia uniflora*, and *Hierochloa occidentalis*. In all, 22 species of shrubs and 22 species of herbs are noted in the releves.

The Douglas-fir/*Goodyera oblongifolia* forest has deeper and less rocky soils with steeper and more unstable slopes than the tanoak/*Rhamnus* type. One active slump (Holland 61510) is being colonized by white alder (*Alnus rhombifolia*), tanoak, Douglas-fir, and Port Orford-cedar. Much of the Douglas-fir/*Goodyera* forest in the sample was selectively logged in 1965. This disturbed area shows a heterogeneous mix of species, depending on the degree of disturbance. *Ceanothus velutinus* and white alder are common with dense *Vaccinium ovatum* and reproductions of Douglas-fir, Pacific madrone, and tanoak.

Tanoak/*Rhamnus californica* (81400): This is a more open forest, differing primarily in structure from the previous type. Trees have higher average density (674/ha), but lower average basal area (65 m²/ha), than the Douglas-fir/*Goodyera oblongifolia* type. Tanoak has the highest relative densities (35 percent) followed in order by Pacific madrone (22 percent), Douglas-fir (18 percent), sugar pine (*Pinus lambertiana*) (12 percent), Port Orford-cedar (5 percent), and incense-cedar (*Libocedrus decurrens*) (5 percent). Douglas-fir has the highest relative cover (37 percent) followed by sugar pine (24 percent), tanoak (12 percent), madrone (12 percent), Port Orford-cedar (10 percent), incense-cedar (4 percent), and canyon live oak (*Quercus chrysolepis*) (2 percent). This forest is less productive than the previous type because it contains slower growing Port Orford-cedar. The understory is more xeric than the other forest, with *Rhamnus californica*, *Arctostaphylos manzanita*, *Toxicodendron diversilobum*, and *Xerophyllum tenax* common (11 shrub and 18 herb species encountered on releves).

Both forest types appear to be climax with compositional and structural differences related to soil depth, slope steepness, and aspect.

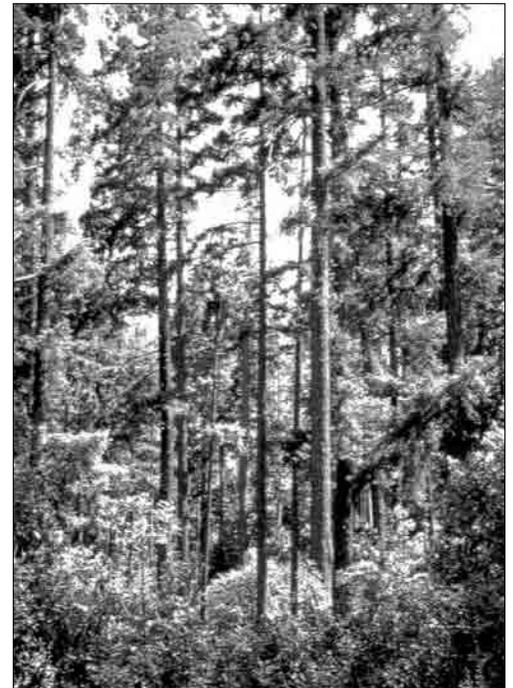
Plant Diversity

One hundred thirty-three taxa of vascular plants are listed.

Conflicting Impacts

Road building associated with clear-cutting upstream from the area threatens the Port Orford-cedar through potential root rot invasion, but the disease was not present in the area as of 1988. A portion of the western third of the area was logged in the 1960s; however, the operation was selective enough so that large continuous areas were not affected.

Figure 4—Adorni, general structure of Douglas-fir/*Goodyera oblongifolia* forest type in Adorni RNA. (1988)



2. Agua Tibia (Eagle Crag) (Frazier 1989, Martin 1990a)

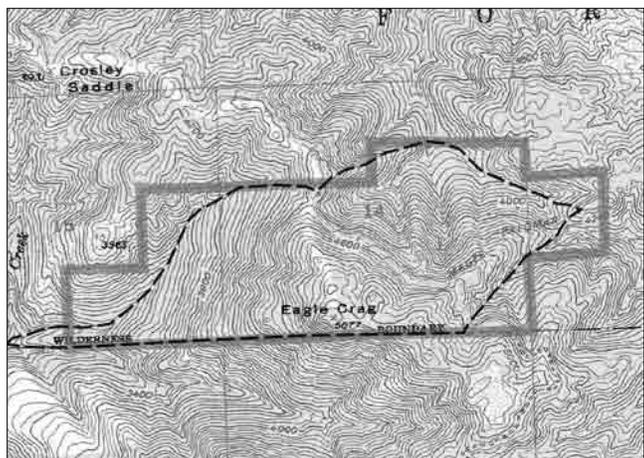


Figure 5—Agua Tibia RNA

Dashed line = Ecological study area
Solid gray line = RNA Boundary

Location

This established RNA is on the Cleveland National Forest, Palomar district, in the Agua Tibia Mountains in N. San Diego County. It lies approximately 50 miles (80 km) N. of San Diego and 75 miles (120 km) S. of Los Angeles. The RNA falls entirely within the Agua Tibia Wilderness. The study area is included in portions of sects. 13, 14, and 15 T9S, R1W (33°22'30"N., 116°56'W.), USGS Vail Lake quad (*fig. 5*). Ecological subsection – Palomar-Cuyamaca Peak (M262Bo).

Target Elements

Bigcone Douglas-Fir (*Pseudotsuga macrocarpa*) and Canyon Live Oak (*Quercus chrysolepis*)

Distinctive Features

Fossil evidence for bigcone Douglas-fir dates to the Pliocene, 7 million years ago. It is endemic to S. California and limited in its range, currently from the Mount Pinos region of Kern County to Chariot Canyon, S. of Banner, San Diego County. The population within the RNA is of interest for its great age, size, purity of stand, remoteness, and proximity to its S. limit. Dense stands are found on steep slopes in association with canyon live oak, comprising a fairly distinct and pure stand of a bigcone Douglas-fir-canyon live oak forest.

Pacific madrone (*Arbutus menziesii*) is common in the Pacific Northwest but quite rare in S. California. The grove within the RNA represents the extreme S. limit for this species; only one other grove, on Rodriguez Mountain (less than 10 miles [16 km] to the S. of this grove), is known to be farther S. As with the bigcone Douglas-fir, Pacific madrone seems to be limited to mesic sites.

Rare Plants: *Monardella macrantha* ssp. *halli* (Hall's *Monardella*) and *Linanthus orcutti* (both CNPS list 1B) are found within the RNA.

Southern Extents: *Arbutus menziesii*, *Bromus orcuttianus* var. *halli*, *Lonicera hispidula*, *Chimaphila menziesii*, *Pteris andromeda*, and *Sedum spathulifolium* are all at the S. limits of their ranges within the RNA.

Introduced Species: Only two introduced plant species are known to occur within the RNA: *Bromus tectorum* (cheatgrass) and *Vulpia myuros* var. *hirsuta* (foxtail fescue).

Fire History: Much of the area within this RNA burned in August 1989. The information presented here is pre-burn data from the ecological survey. Before the fire, the area had not burned in more than 100 years and was noted for the great age of its chaparral. According to Frazier (1989) in a post-fire examination of the area, the fire did not crown the bigcone Douglas-fir, and many of those trees were doing well. However, the fire did kill most of the seedlings and saplings of both bigcone Douglas-fir and canyon live oak.

Physical Characteristics

The established RNA covers 480 acres (194 ha) between 3240 and 5077 ft (1311-1547 m). The study area covers 471 acres (191 ha) between 3000 and 5077 ft (900-1550 m). The highest point of the Agua Tibia mountains, Eagle Crag, is included in the RNA (*fig. 6*). The Agua Tibia Range divide passes through this crag, separating the RNA into a less eroded, W.-facing slope and a N.-facing

slope cut by several minor drainages. The area surrounding the crag itself is a gently sloping saddle, with an average grade of 30 percent. Areas below the saddle have a slope of 60-70 percent.

The geology is dominated by the Peninsular Ranges batholith, a large body of intrusive, igneous rock. Granodiorite and quartz diorite are the most prevalent components of the batholith and form the majority of the foundations of the RNA. The two major soil series are formed from weathered granodiorite. On the W. side of Eagle Crag, the predominant soil type is of the Tollhouse series which is rocky, coarse, sandy loam. The soil layer is fairly shallow (5-20 inches [13-51 cm] over hard rock), and has 25 percent boulder and 10 percent rock outcroppings. Soils of the Crouch series predominates on the E. side. The slope is steeper, and soil is deeper and more acidic than that of the Tollhouse series. Boulder and rock outcroppings make up the same percentage as they do in the Tollhouse series. Both of these soil types have rapid to very rapid runoff and high erosion hazard. In some areas, slides have eroded large chunks of the trail to the basin below.

Temperatures are moderate, with rain falling mostly in winter. Rainfall varies greatly from year to year, and at the time of the ecological survey, the area was in the third year of a drought. Average yearly precipitation is 23 inches (585 mm) with 20 inches (510 mm) of snow at the saddle and 4 inches (100 mm) of snow at lower elevations. Many drainages exist within the RNA, but none hold water year-round. By mid-August, only a few pools of standing water remain.

Association Types

Bigcone Douglas-Fir-Canyon Live Oak (84150): In general, the E. portion of the RNA is dominated by two patches of bigcone Douglas-fir and canyon live oak. They cover a combined area of 192 acres (78 ha) and make up 40 percent of the total area of the RNA. Lower-elevation populations of bigcone Douglas-fir are somewhat disjunct, but those above 1300 m are contiguous, sometimes covering entire slopes. The best development of bigcone Douglas-fir is on the N.-facing slopes. Some trees were estimated to be 500-600 years old. Bigcone Douglas-fir has approximately 8 times the basal area/ha of canyon live oak. Approximately equal numbers of mature trees of both species occur in the stands, but there are 20 times more canyon live oak seedlings than bigcone Douglas-fir seedlings.

Understory shrub/herb cover is sparse (less than 7 percent). It is composed of the following species: *Chimaphila menziesii*, *Erigeron foliosus*, *Hieracium albiflora*, *Linanthus floribundus*, *Monardella macrantha*, *Osmorhiza chilensis*, *Silene lemmonii*, *Sedum spathulifolium*, *Toxicodendron diversilobum*, *Carex* sp., *Polystichum munitum*, and *Dryopteris arguta*. In occasional open areas, small patches of eastwood manzanita (*Arctostaphylos glandulosa*) and chaparral whitethorn (*Ceanothus leucodermis*) occur.

Montane Manzanita Chaparral (37520): 142 acres (57 ha). This association occurs on the SW.-facing slope through which the Magee Palomar Trail passes. The area extends upslope to 5000 ft (1540 m) where it continues along the windswept crest of the Agua Tibia divide. Coulter pines (*Pinus coulteri*) line the border between this patch and the bigcone Douglas-fir patch and are found scattered within the chaparral, although their numbers are decreasing due to



Figure 6—Agua Tibia, view northwest toward Eagle Crag. (around 1988/89)

infestation by bark beetles. Chaparral whitethorn and canyon live oak are scattered throughout the chaparral, but canyon live oak is found in higher numbers near the edges. The vegetation is composed mostly of eastwood manzanita. Other species include pink-bracted manzanita (*Arctostaphylos pringlei* ssp. *drupacea*), interior live oak (*Quercus wislizenii*), and chamise (*Adenostoma fasciculatum*).

Canyon Live Oak (81320): 146 acres (59 ha). This association occurs on the W. half of the RNA where there is a broad slope dropping more than 2000 ft (600 m). Canyon live oak is plentiful and found in monospecific stands which range in size from 0.2 acre (0.1 ha) to more than 25 acres (10 ha). Oak is most prevalent on N. aspects and is replaced by manzanita and *Ceanothus* on S. aspects. The vegetation is very dense with complete canopy closure.

Riparian Vegetation (61310): Not mappable. This association type occurs along the major drainages in the RNA. Cover varies greatly between drainages, ranging from quite open areas to impenetrable thickets. This vegetation type is significantly different from that of adjoining slopes. Tree species found here include incense-cedar (*Libocedrus decurrens*), box elder (*Acer negundo*), coast live oak (*Quercus agrifolia*), black cottonwood (*Populus balsamifera* ssp. *trichocarpa*), and California sycamore (*Platanus racemosa*). Dominant understory species include *Rubus ursinus*, *Ribes nevadense*, *Ribes amarum*, *Toxicodendron diversilobum*, *Rhododendron occidentale*, *Urtica dioica* ssp. *holosericea*, and *Epilobium canum*.

Madrone-Canyon Live Oak (no Holland equivalent): Unmappable. A small population of Pacific madrone is found in the lowest, westernmost part of the RNA, along the Agua Tibia Creek drainage below the canyon live oak forest. Pacific madrone occurs in clumps of individuals, each with several stems coming off the same root crown (indicative of the fire that occurred 100 years ago). Seedlings, saplings, and mature individuals were all observed, indicating that normal regeneration of the species is occurring. While the occurrence of Pacific madrone is significant, canyon live oak dominates the stand and attains larger sizes than on the slope above (some are as tall as 60 ft [18 m] and are up to 26 inches [65 cm] in dbh). Other species of trees found here are coast live oak and California sycamore. The understory is open and contains *Ceanothus oliganthus*, *Styrax officinalis*, *Toxicodendron diversilobum*, *Ribes amarum*, *Ribes nevadense*, *Rubus parviflorus*, *Rubus ursinus*, *Lilium ocellatum*, and *Keckiella cordifolia*.

Plant Diversity

One hundred nine species of vascular plants are listed.

Conflicting Impacts

In efforts to stop the spread of the fire in August 1989, diamonium phosphate fire retardant was dumped on much of the area, particularly the chaparral. The small population of *Linanthus orcutti* near the Magee Palomar Trail was plowed under when the trail was widened into a fire road. However, in the sections affected by the fire, the RNA may serve as an important biological study area for comparing burned and unburned areas and post-fire regeneration.

3. American Canyon (Schettler 1989, Martin 1990b)

Location

This established RNA is on Los Padres National Forest in San Luis Obispo County. It is approximately 22 air miles (35 km) E. of San Luis Obispo. The RNA lies within the Manchesa Mountain Wilderness of the Santa Lucia Ranger District. Its boundaries include sections 9 and 10 and portions of sections 14, 15, 16, and 23 of T30S, R16E MDM (35°19'N., 120°15'W.), straddling USGS Pozo Summit and La Panza quads (fig. 7). Ecological subsection – Interior Santa Lucia Range (M262Ae).

Target Elements

Coulter Pine (*Pinus coulteri*) and Northern Mixed Chaparral

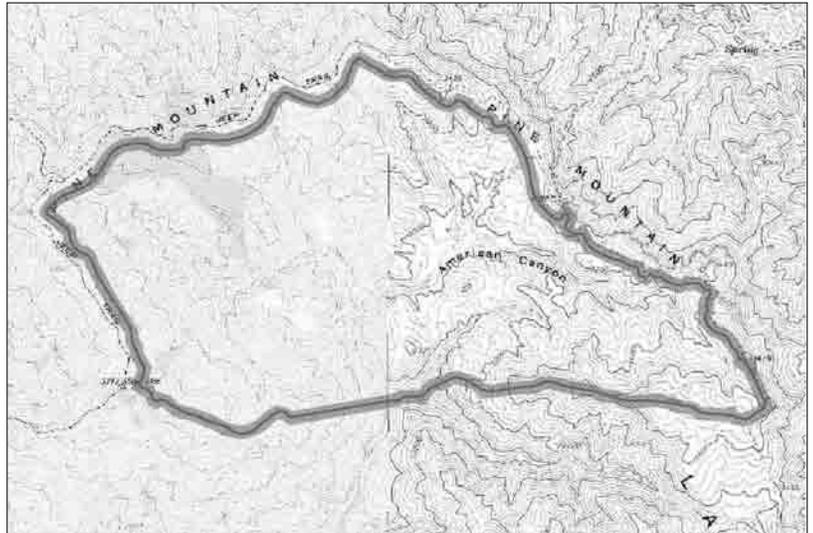


Figure 7—American Canyon

Distinctive Features

This is the only RNA identified to target Coulter pine forest in the S. Coast Ranges (Central California Coast Ranges ecological section). Additionally, the pine stands provide a mixture of age, density, and serotiny for study. The RNA also contains valley needlegrass grassland, which was formerly extensive throughout the valleys of California but now is much reduced (Holland 1986).

Rare Plants: The RNA contains six CNPS listed species: *Arctostaphylos pilosula* (CNPS List 1B), *Calochortus simulans* (CNPS List 4), *C. palmeri* (CNPS List 1B), *Malacothamnus niveus* (Jepson [Hickman 1993]: *Malacothamnus jonesii*) (CNPS List 4), *Sidalcea hickmanii* (CNPS List 1B), and *Monardella macrantha* ssp. *hallii* (CNPS List 1B).

Fire History: Most of the RNA burned in 1939 except for the NW. portion, which burned in 1921. Another small fire in 1926 burned a part of the N. area.

Because Coulter pine does not self prune, its lower branches form a continuous “ladder” allowing fire to reach the tree canopy. Thus, it is vulnerable if a hot fire starts in the dense chaparral below. Prescribed burning may be necessary. Additionally, periodic fires enhance Coulter pine regeneration by breaking the cones’ serotiny.

Physical Characteristics

The area covers 1500 acres (607 ha) with an elevation range of 2800-3784 ft (854-1153 m). The RNA is situated on the S. slope of Pine Mountain, located in the La Panza Range. Its boundaries are defined to the N. by Pine Mountain. The E.-W. ridgeline between San Jose peak and peak 3784 defines its S. boundary. The RNA encompasses the uppermost watershed of American Canyon, ultimately draining into the Salinas River.

The RNA consists of conglomerates, arkosic (feldspar bearing) sandstones, and shales of the Upper Cretaceous and Lower Tertiary that were uplifted along the La Panza Fault (SW. of the RNA) during the Pleistocene epoch. All soils of the RNA lie within the Millsholm-Exchequer-Stonyford families association, which has a shallow surface layer (0-4 inches [0-10 cm]) of sandy or gravelly loam.

3. American Canyon

No permanent weather stations exist within the RNA. General climate in the region is Mediterranean. The nearest weather station is in San Luis Obispo, which is approximately 22 air miles (35 km) W. of the RNA, at 315 ft (96 m) elevation.

Temperatures at that station range from 51-59 °F (11-15 °C) between November and April, and from 61-68 °F (16-20 °C) between May and October. At San Luis Obispo, most precipitation falls from November to April, and ranges from 1 to 4 inches (30 to 100 mm) per month. Located on elevations considerably higher (2415-3467 ft [736-1057m]) than San Luis Obispo, American Canyon RNA should have lower temperatures (approximately 13-18 °F [7-10 °C] lower, based on the rate of -0.96 °C for 100-m rise in elevation) and higher precipitation.

Association Types

Coulter Pine Forest/Northern Mixed Chaparral (84140/37110): 1473 acres (596 ha). The representative area for this association type generally fits the Holland classification, although the RNA is depauperate in a few other tree species normally found as associates.

This association occurs on all slopes; however, most slopes in the RNA are S.-facing. Coulter pine ranges from a few scattered individual trees to dense stands that suppress the undergrowth. Saplings are found in all but the densest stands. A typical stand contains 379 trees/acre (936 trees/ha) and has a basal area of 0.44 ft²/acre (0.1 m²/ha) and a 77 percent shrub cover. The bulk of the pines were 30-35 years old due to regeneration after the 1939 fire. However, an older stand of trees (125-145 years old) occurs on an E.-facing slope of the RNA where most of the trees survived the 1939 fire. Here, tree density is lower (98 trees/acre [242 trees/ha]), while basal area and shrub cover increase (137 ft²/acre [31.4 m²/ha] and 96 percent cover).

Pine is completely missing from 20-25 percent of the area incorporating the association type, leaving only chaparral present. The chaparral cover varies with slope, aspect, and soil depth, predictably densest on N.- and E.-facing slopes. Overall cover ranges from 50 to 98 percent. Most of the chaparral is mature (50 years old), having last burned in 1939, and is generally species poor. Species here include *Adenostoma fasciculatum*, *Arctostaphylos glandulosa*, *A. glauca*, *Quercus dumosa*, *Q. wislizenii* var. *frutescens*, *Ceanothus cuneatus*, *C. oliganthus* var. *sorediatus*, *C. foliosus*, *Cercocarpus betuloides*, and *C. montanus* var. *blanchae*. *Pedicularis densiflorus* is the most common forb under the chaparral shrubs.

Central Coast Live Oak Riparian Forest (61220): 15 acres (6 ha). The survey was conducted in the second and third years of a drought; therefore, the stream conditions observed could be different from wetter years.

Figure 8—American Canyon, potrero grassland near the center of American Canyon RNA. Coulter pines at this site are among the largest in the RNA. (1988)



This association type exists as mostly narrow corridors restricted in width by steep topography. The association is also found on some steep, N.-facing slopes where shade and greater humidity help extend the community. Associated species include *Quercus agrifolia*, *Q. chrysolepis*, *Q. wislizenii*, *Calochortus palmeri* (CNPS List 1B), *Arnica discoidea* var. *alata*, *Castilleja stenantha*, *Centaurium exaltatum*, *Delphinium nudicaule*, *Heterocodon rariflorum*, *Horkelia bolanderi*, *Leptodactylon californicum*, *Monardella macrantha*, *Populus fremontii*, *P. trichocarpa*, *Psoralea orbicularis*, and *Zigadenus venenosus*.

Valley Needlegrass Grassland (42110): 12 acres (5 ha). This association type (fig. 8) is restricted to small potreros that are mostly less than 1 acre (0.4 ha). It does not entirely fit in this Holland type description, as the potreros are somewhat depauperate in native bunchgrasses.

The potreros are located on old landslides, most lying in an E.-central cluster between 2920 and 3000 ft (890-914 m). The largest one is near the stream at the bottom of trail P12/FS3. An additional potrero lies alongside the NW. ridge at 3480 ft (1061 m). Associated species include *Calochortus* sp., *Clarkia speciosa*, *Sidalcea hickmanii*, and *Malacothamnus niveus* (Jepson [Hickman 1993]: *M. jonesii*, CNPS List 4).

Blue Oak Woodland (71140): Less than 1.5 acres (0.6 ha). This association type is located in the far SE. tip of the study area, outside the RNA boundary. It is a small savanna-form stand of *Quercus douglasii* (blue oak). The stand occupies a gentle SE.-facing slope at 3560-3700 ft (1085-1128 m). The majority of the trees are mature, and a few appear quite old. Evidence of regeneration is apparent by the presence of young trees. Diversity within the community appears only moderate, and introduced grasses and forbs are noticeably mixed with natives. *Calochortus simulans* (CNPS List 4) is found here.

Plant Diversity

Two hundred thirty-nine species of vascular plants are listed.

Conflicting Impacts

Recreational use of the area is generally light, although evidence of target shooters and mountain bikers was observed on trail 16E01 defining the N. and E. boundaries.

4. Antelope Creek Lakes (Fiedler 1987, Keeler-Wolf 1989c)

Location

This candidate RNA (cRNA) is on the Klamath National Forest in Siskiyou County. The center of the area lies about 12 miles (19 km) NE. of the summit of Mount Shasta. It occupies the majority of sect. 20 T42N, R1W MDBM (41°27'N., 121°59'W.), USGS Rainbow Mountain quad (fig. 9). Ecological subsection – High Cascades (M261Df).

Target Element

Subalpine Wet Meadow

Distinctive Features

Meadow Vegetation: The meadows, although small in area, are diverse and include about half of the meadow types described for the Sierra Nevada (Ratliff 1985). They include stringer types along creeks and lake-margin types (fig. 10).

Aquatic Resources: The four lakes are largely unstratified with continuous circulation due to their shallow depth and wind action. They vary in their physical and biotic characteristics. One has introduced brown trout, and some have breeding populations of long-toed salamanders (*Ambystoma macrodactylum*) and Pacific tree frogs (*Hyla regilla*). All are rich in aquatic invertebrates. Aquatic plants such as *Isoetes bolanderi* and *Sparganium angustifolium* occur in some lakes.

Rare and Uncommon Vertebrates: Wolverine (*Gulo gulo*, State-listed threatened species), northern goshawk (*Accipiter gentilis*, State-listed species of special concern, Forest Service-listed sensitive species), golden eagle (*Aquila chrysaetos*,

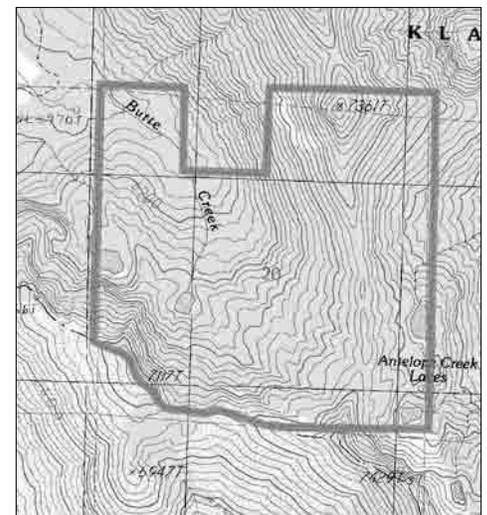


Figure 9—Antelope Creek Lakes cRNA



Figure 10—Antelope Creek Lakes, the southern Antelope Creek Lake looking south toward ridgecrest near Dry Creek Peak. Meadow borders the lake with mountain hemlock forest surrounding. (1988)

State-listed species of special concern), and prairie falcon (*Falco mexicanus*, State-listed species of special concern) have been sighted in the area.

Well-Developed Mountain Hemlock (*Tsuga mertensiana*) and Shasta Red Fir (*Abies magnifica* var. *shastensis*) Forests: The mountain hemlock forests range from dense young stands in avalanche or high snow accumulation areas to large mature trees of 4 ft (1.2 m) dbh in sheltered areas. Shasta red fir forest occupies relatively xeric exposures and is also represented by a range of types from young to senescent.

Rare Flora: One rare species, *Polystichum lonchitis* (CNPS List 3), is known from the area.

Low Elevation Subalpine Vegetation: Whitebark pine (*Pinus albicaulis*) forest occurs as low as 6900 ft (2103 m) along ridgetops in the area. This is the lowest-elevation whitebark pine forest represented in the California RNA system. Associated with this forest in shady crevices and on talus slopes are several plant species characteristic of high elevation subalpine or alpine zones in the South Cascades.

Physical Characteristics

The area covers 544 acres (220 ha). Elevations range from about 6000 ft (1829 m) in the valley of Butte Creek to 7361 ft (2244 m) at a high point along the ridge dividing the Antelope and the Butte Creek drainages. Four permanent lakes are included within the boundary. They are glacially

formed and rest in cirques at the head of the aforementioned drainages. Slopes range from very gradual at the valley bottoms to very steep at the headwalls. Slopes are predominantly W.-, N.-, and E.-facing.

Rocks are entirely Pliocene andesite resulting from volcanic episodes of the local Cascade Mountains. Soils are Sheld-iller families complex and Oosen-Avis families complex, the latter occupying the valley bottom of Butte Creek. Climate is cool. Mean January temperatures are estimated at 16.7 °F (-8.5 °C), mean July 53.5 °F (11.9 °C), and mean annual 34.9 °F (1.6 °C). Mean annual precipitation is about 40 inches (1016 mm) while mean April 1 snow depth probably averages 75-100 inches (191-254 cm).

Association Types

This discussion of associations follows the arrangement in the draft establishment record, because more attention is given to the target element and other forest types than in the ecological survey. The sampling (point center-quarter method) of the mountain hemlock (34 points) and Shasta red fir (7 points) forests was all done in conjunction with the ecological survey.

Whitebark Pine-Mountain Hemlock Forest (86210, 86600): 245 acres (99 ha). This forest is divided into two subtypes: mountain hemlock and whitebark pine. The mountain hemlock forest occurs on most slopes in the N. of W. and E. aspects above 6200 ft (1890 m). This subtype has sparse understory vegetation and less litter and duff than typical red fir forest. Reproduction occurs mainly in areas of disturbance such as avalanche sites or heavy snow accumulation sites. In a mixed red fir-mountain hemlock sample, mountain hemlock has 83 percent frequency, 59 percent cover, and a mean distance of 15.3 ft (4.7 m) between

trunks. The mean diameter is 14.8 inches (37.6 cm). Other trees in the sample include Shasta red fir (57 percent frequency) and lodgepole pine (*Pinus contorta* ssp. *murrayana*) (3 percent frequency).

The whitebark pine subtype occurs in a narrow strip along the southern boundary ridge. Whitebark pine is often dominant, but occasionally it codominates with mountain hemlock and Shasta red fir. The trees are typically widely spaced, wind-flagged, and stunted. The open understory has scattered individuals of *Chrysolepis sempervirens*, *Arctostaphylos patula*, *Haplopappus bloomeri*, and *Stipa occidentalis*.

Shasta Red Fir Forest (85310): 194 acres (79 ha). This forest occurs on W.- and SW.-facing slopes in the Butte Creek drainage and on steep ESE.-facing slopes in the NE. portion of the site. Typically it is even-aged with trees 2-3 ft (0.6-0.9 m) dbh and 140-160 ft (43-49 m) tall. There is little understory vegetation, and reproduction is most prolific in tree fall gaps. A young (approximately 90-year-old) stand on SW.-facing slopes is a result of crown fire. Samples indicate a mean cover of 90 percent for fir with 10 percent for hemlock and an average distance between trees of 20 ft (6.1 m). Mean dbh for red fir is 20.4 inches (51.8 cm), and for hemlock it is 18.7 inches (47.5 cm). However, there are two distinct cohorts of both species, the older averaging 33 inches (84 cm) dbh and the younger 3.5 inches (8.9 cm) dbh. Fir is present at 100 percent of the samples, whereas hemlock occurs at only 14.3 percent.

Alpine Talus and Scree Slope (91200): 47 acres (19 ha). On N.-facing slopes of the S. boundary, ridge outcrops and active talus areas support populations of several high-montane species. Cover is light, precluded by boulders, scree, and bedrock. The following species are characteristic: *Cryptogramma acrostichoides*, *Phyllodoce breweri*, *Oxyria digyna*, *Cardamine bellidifolia*, *Arnica longifolia* ssp. *myriadenia*, *Epilobium angustifolium*, *Sambucus microbotrys*, *Athyrium alpestre* var. *americanum*, *Solidago multiradiata*, and *Potentilla glandulosa* ssp. *pseudoruprestris*.

Wet Montane Meadow (45100, 45210): 27 acres (11 ha). Ten subtypes of meadow are discussed in the establishment record. These are named by their dominant species and include *Deschampsia caespitosa*, *Carex rostrata*, *Phyllodoce breweri*, *Ligusticum grayi*, *Calamagrostis canadensis*, *Heleocharis acicularis*, sedge meadow, *Muhlenbergia filiformis*, *Trifolium longipes*, *Trifolium monanthum*, and *Mimulus guttatus*.

Montane Chaparral (37510): 16 acres (7 ha). This may be broken into two subtypes. The most extensive is the *Holodiscus microphyllus*-*Chrysothamnus nauseosus* ssp. *albicaulis* subtype. It occurs on stabilized talus and ridgetops at high elevations, up to 7361 ft (2244 m), in the N. part of the RNA. Other species include *Eriogonum umbellatum*, *Haplopappus bloomeri*, *Purshia tridentata*, and *Chrysolepis sempervirens*.

The *Arctostaphylos patula*-*Ceanothus velutinus* subtype occupies small openings in red fir forest. On SW.-facing slopes *Ceanothus velutinus* often dominates. Other species include *Arctostaphylos nevadensis*, *Chrysolepis sempervirens*, and *Monardella odoratissima* ssp. *pallida*. This subtype is successional except on rocky ridgetops.

Montane Freshwater Marsh (52430): 10 acres (4 ha). This vegetation is not well developed; it occurs sporadically at all four lakes. The most characteristic species are *Sparganium multipedunculatum*, *Carex rostrata*, and *Potamogeton richardsonii*.

Montane Riparian Scrub (63500): 5 acres (2 ha). This association is dominated by *Alnus tenuifolia*. It occurs around springs, rivulets, and in patches along the main Butte Creek channel. Associated species include several willows (*Salix* spp.), *Sorbus cascadiensis*, *Senecio triangularis*, *Aquilegia formosa* var. *truncata*, and *Aconitum columbianum*.

Plant Diversity

One hundred sixty-two taxa are listed in the establishment record.

Conflicting Impacts

Cattle grazing in the stringer meadows along Butte Creek is the major impact, although it is not severe. Grazing is not apparent around the lake margin meadows. Few other impacts occur except the periodic stocking of the streams and lakes. Recreational impact associated with fishing is light.

5. Babbitt Peak (Talley 1977a, Keeler-Wolf 1989i)

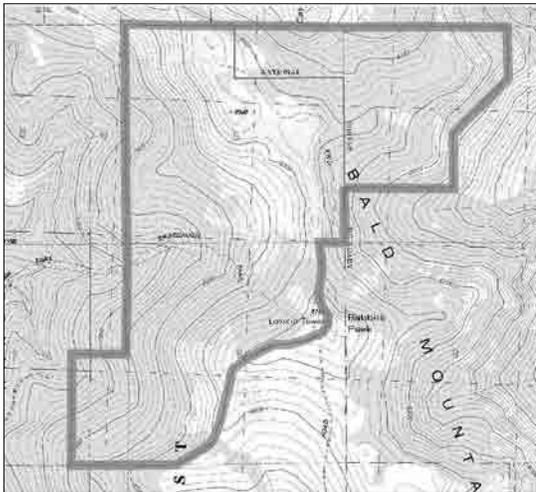


Figure 11—Babbitt Peak RNA

Location

This established RNA is on Tahoe National Forest, adjacent to Toiyabe National Forest. It lies about 16 miles (26 km) NW. of Reno, Nevada, in Sierra County and lies within portions of sects. 4, 5, 8, and 17 T20N, R17E MDBM (39°36'N., 120°06'W.), USGS Sardine Peak and Dog Valley quads (*fig. 11*). Ecological subsection – Tahoe-Truckee (M261Ej).

Target Elements

Washoe Pine (*Pinus washoensis*) and Mountain Mahogany (*Cercocarpus ledifolius*)

Physical Characteristics

The ecological survey covers about 1747 acres (707 ha), including a small portion of Toiyabe National Forest, but the final boundaries include 1061 acres (429 ha). Babbitt Peak, the highest point of the Bald Mountain Range (8760 ft, 2670 m), lies along the E.-central boundary of the area. Watersheds within the area drain to the W. as a portion of the upper tributaries of the Feather River. The main ridge of the Bald Mountain Range runs NW.-SE. The topography on the central ridge consists of gentle convex or concave slopes interrupted by occasional rock outcrops. Two lateral spur ridges occur in the area. One runs for over a mile (1.6 km) before dropping below 7808 ft (2380 m) elevation. W.- and E.-facing slopes predominate and become increasingly convex away from the main ridge.

The area is underlain by Tertiary volcanic rock (primarily andesite). Soils are divided into 11 mapping units comprising the Aldi, Kyburz, Fugawee, Tahoma, Trojan, Meiss, Waca, Franktown, and Windy complexes. Average annual precipitation is slightly more than 30 inches (762 mm). Prevailing SW. winds have distorted many of the trees along the main ridge. Average annual temperature is estimated to be 33.5 °F (0.8 °C).

Distinctive Features

Washoe Pine: The species is endemic to the western Great Basin mountains. It occurs only in a few areas. The populations on the Babbitt Peak RNA and to the S. on Mount Rose are the only large ones that are morphologically distinct and geographically isolated from the closely related ponderosa pine (*Pinus ponderosa*) (Griffin and Critchfield 1976). This site is unusual for its pure stands of Washoe pines and the genetic uniqueness of the population.

The ecological requirements for local restriction of Washoe pine are unclear. Its dominance solely on E.-facing (leeward) slopes suggests that desiccating winds on the S.- and W.-facing slopes and the fires that the winds occasionally carry upslope from the lower-elevation Jeffrey pine-white fir forests may inhibit growth elsewhere in the area. Natural rock barriers surrounding the best stand of Washoe pine and small fire scars at the base of mature trees also suggest that

the Washoe pine forest has been protected from crown fire for at least the past 500 years. The limited distribution, long intervals between periods of successful establishment, and slow growth of mature Washoe pine suggest that intense fires would be detrimental. There is some danger that the lower slope Washoe pine forests, which are being invaded by western white pine (*Pinus monticola*) and white fir (*Abies concolor*), may soon lose their resistance to fire through the increased fuel buildup by the invading species.

Pure Western White Pine Forest: Western white pine rarely forms pure forests in the Sierra Nevada. At Babbitt Peak, pure stands result from the presence of N.-facing slopes above the climatic limits of white fir. These slopes are too dry for red fir (*Abies magnifica*), the normal dominant on these aspects and elevations in the Sierra Nevada. The relatively xeric climate of Babbitt Peak provides the conditions for western white pine dominance and highlights the subtle differences between ecological requirements of the typically co-occurring red fir and western white pine in the California region.

Growth Rate and Forest Structure: Many saplings and trees have been sampled for height, diameter, and age at breast height (1.4 m) to establish growth trends for red fir, white fir, western white pine, and Washoe pine. To summarize: maximum growth rates for both white fir and western white pine occur under similar conditions at lower elevations. Early growth rates for Washoe pine are relatively rapid (to reach breast height in about 38 years). Young ridgetop and low-elevation, E.-facing slope trees are particularly slow growing (5 inches or 13 cm height growth per year between 20 and 100 years old [age determined at breast height]); at 100 years old [age at breast height] the height of trees is about 44.3 ft or 13.5 m.

Diameter growth for white fir and red fir are about equal (16 inches or 40 cm dbh in 100 years). Subsequent growth slows greatly, with an additional 120 years required to reach 2 ft (60 cm) dbh. Washoe pine growth is more uniform over time, attaining similar dbh after 100 years, but attaining 60 cm after only 180 years. Given the slow growth rate of mature trees, the largest of the local white firs (1.24 m dbh) may be among the oldest specimens known for this species (about 600 years). Years having heavy white fir reproduction correlate well with moist periods. Recent resurgence of white fir may result from lack of periodic fires.

Western white pine regeneration is strongly gap-phase, with the oldest trees being 500-600 years. Gap-phase regeneration is also the rule for Washoe pine, with greatest ages up to and possibly exceeding 800 years.

Potential Solar Beam Irradiation (PSBI): According to theoretical calculations, the red fir-western white pine forests receive the least amount of light, and white fir-Jeffrey pine forests receive the highest. Washoe pine PSBI is nearly as high as that of the white fir-Jeffrey pine forest type. These calculations are discussed in conjunction with other microclimatic influences (e.g., undulating topography creating local snow traps, etc.) and provide a good view of basic environmental situations for each major vegetation type.

Rare Vertebrates: northern goshawk (*Accipiter gentilis*, State-listed species of special concern, Forest Service-listed sensitive species), prairie falcon (*Falco mexicanus*, State-listed species of special concern), and mountain lion (*Felis concolor*, not on any protection list) have been seen several times in the area.

Association Types

Vegetation was sampled using 75- by 100-ft (0.07-ha) plots. Twenty-three plots were sampled, covering all major vegetation types. The data were arranged in an association table.

White Fir Forest (84240, 85210): 425 acres (172 ha). This forest varies from nearly pure, dense, 100-year-old white fir stands to more mature forest with white fir and western white pine codominating. The younger forest has densities of more than 1000 stems/ha with canopy cover of 90 percent and basal area cover of about 70 m²/ha. The older white fir-western white pine forests have lower density, lower cover, and greater basal area.

White fir-western white pine forest varies from dominance by white fir at lower elevations to a broad mixing zone at mid-elevations and finally to western white pine dominance at higher elevations. All exhibit moderate density (329 stems/ha), high percent cover (64 percent), and a total basal area cover of 82 m²/ha.

Jeffrey pine (*Pinus jeffreyi*) is also important in some white fir forest on S.- and W.-facing slopes. Although Jeffrey pines are few, they are large and contribute about 20 percent each to basal area cover and canopy cover figures. Low relative density of Jeffrey pine is a result of prolific regeneration by white fir.

There is a trend toward total dominance by white fir in these forests, with the dense white fir creating a severe fire hazard. Burned forest similar to this forest results in dominance by *Ceanothus velutinus* (Holland 37530).

Western White Pine (no Holland equivalent): 232 acres (94 ha). This association occurs between 7600 and 8695 ft (2316-2650 m) on gentle NW.- to NE.-facing exposures near ridge summits. Two sampled essentially pure western white pine stands average 400 stems/ha for 57 percent cover and 78 m²/ha basal area. On steep concave N.-facing slopes or below ridge crests, white fir and red fir may codominate. Ecotone between western white pine forest and sagebrush scrub is typically sharp.

Red Fir Forest (85310): 212 acres (86 ha). This type is restricted to concave N.-facing slopes between 7800 and 8400 ft (2377-2560 m). The largest stands occur at the far N. end in a selectively logged area. A smaller grove (54 acres, 22 ha) of old-growth red fir occurs on NW.-facing slopes of the spur ridge running SW. from Babbitt Peak. Here red fir, western white pine, and, to a lesser extent, white fir form mixed stands with red fir dominant (importance values > 200). There are complex boundary relationships with vegetation adjacent to this small old-growth stand. Atop ridges this stand may grade into a mixed community with red fir, western white pine, Jeffrey pine, lodgepole pine (*Pinus contorta* ssp. *murrayana*), western juniper (*Juniperus occidentalis*), and white fir occurring among *Ceanothus velutinus*, mountain mahogany, and other sagebrush scrub species. Other boundaries are with white fir forest (W. and N.) and mixed white fir, Jeffrey pine, and Washoe pine forest (along the NE. boundary). A few old Washoe pines still occur within the WNW.-aspect red fir forest, suggesting that this area was once more open.

Annual and perennial understory species are similar among all the conifer forests and include *Pyrola picta* ssp. *dentata*, *P. picta*, *Kelloggia galioides*, *Penstemon heterodoxus*, *Poa* sp., and *Paeonia brownii*. *Pterospora andromedea* and *Hieracium albiflorum* are largely confined to Washoe pine and white fir forests, respectively, and *Chimaphila umbellata* occurs only in western white pine and red fir forests. Widespread subordinate species in several conifer forest types include *Viola purpurea*, *Symphoricarpos vaccinioides*, *Bromus marginatus*, *Sitanion hystrix*, *Monardella odoratissima*, *Lupinus* sp., *Gayophytum ramosissimum*, *Haplopappus* sp., *Osmorhiza occidentalis*, *Penstemon speciosus*, *Ribes roezlii*, *Phacelia* sp., and *Ceanothus velutinus*.

Mountain Mahogany Woodland (no Holland equivalent): 194 acres (79 ha). This scrubby woodland occurs on SW.-, S.- and SE.-facing exposures (best developed on steep, convex S.- and SE.-facing slopes above 8000 ft [2438 m]). On

gentle SW.-SE. aspects this type overlaps with sagebrush scrub, degraded sagebrush scrub, aspen groves, and conifer forest species. On gentle slopes, the soil is rocky, there is exposure to SW. winds, or both.

Stands may be pure or contain occasional Washoe pine or western white pine or both. Importance value of typical mountain mahogany is high (on three 0.07-ha plots, averaging 1052 stems/ha, 34 percent cover, and 41 m²/ha basal area). Such herbs as *Penstemon newberryi*, *Cryptantha microstachys*, and *Chrysopsis breweri* are common, with several other taxa spilling over from adjacent coniferous associations (e.g., *Pedicularis semibarbata*, *Silene lemmonii*, *Poa* sp.) and the sagebrush association (e.g., *Artemisia tridentata*, *Wyethia mollis*).

Sagebrush Scrub (35210, 37510): 170 acres (69 ha). This association occurs on even-graded slopes of S. to W. aspects and steep slopes with E. aspect. *Artemisia tridentata* is dominant. Other common shrubs and subshrubs include *Ribes cereum*, *Purshia tridentata*, *Symphoricarpos vaccinoides*, *Monardella odoratissima*, *Eriogonum umbellatum*, *Ribes roezlii*, *Eriophyllum confertiflorum*, and mountain mahogany. Steep E.-facing exposures have more mesic taxa such as *Arctostaphylos nevadensis*, *Ceanothus velutinus*, *C. prostratus*, *Holodiscus microphyllus*, and occasional western white pine. Herbaceous taxa include *Sitanion hystrix*, *Bromus marginatus*, *Gayophytum ramosissimum*, *Carex* sp., *Lupinus* sp., and *Leptodactylon pungens*. An overgrazed area (44 acres, 18 ha) is dominated by *Wyethia mollis* (called the degraded sagebrush scrub).

Washoe Pine Forest (85220): 102 acres (41 ha). This association prevails on gentle to moderate upland slopes and benches with S. and, less importantly, W. and E. aspects at elevations between 7600 and 8500 ft (2316-2590 m). The majority of this population (86 acres, 35 ha) is a nearly pure stand on the spur ridge extending NE. from Bald Mountain. Here, Washoe pine accounts for 90 percent frequency, cover, and basal area. On the W. slope of Bald Mountain only a small grove exists; however, it contains large specimens up to 112 ft (34 m) high and 4.6 ft (1.4 m) dbh. Mixed Washoe pine, western white pine, and white fir forest occurs in the NE. corner of the RNA. In the mixed forest, Washoe pine accounts for about 50 percent of basal area and cover but only 30 percent frequency. White fir has recently increased densities, accounting for the lower relative density of the Washoe pine.

Washoe pine also occurs as a subordinate member of Jeffrey pine, white fir, and western white pine forest, within 20 acres (8 ha) of white fir and Jeffrey pine forest, and in marginal red fir forest.

Aspen Forest (81B00): 67 acres (27 ha). Several groves of aspen (*Populus tremuloides*) are scattered within sagebrush scrub. They occur on gentle S. to W.-facing slopes and range from shrubby ridgetop thickets to dense clusters of small trees with verdant understories, adjacent to conifer forests. These aspen forests currently are not being invaded by conifer forest. Associated taxa vary depending upon location of the grove, but typically they do not include moist or wet meadow species.

Plant Diversity

Eighty-five taxa are listed in the establishment record.

Conflicting Impacts

Controlled burning may be required to maintain viable populations of Washoe pine because of increasing colonization of western white pine and, especially, white fir. Should a fire occur, the increased density of these species may have a devastating effect on the Washoe pines. Past heavy grazing of the sagebrush scrub has degraded portions of it to *Wyethia mollis*-dominated herb land. Selective logging in the 1960s of the largest stand of red fir has altered the natural regeneration cycle and age structure of that association.

6. Backbone Creek (no ecological survey, Clines 1994, Pacific Southwest Forest and Range Experiment Station 1970)

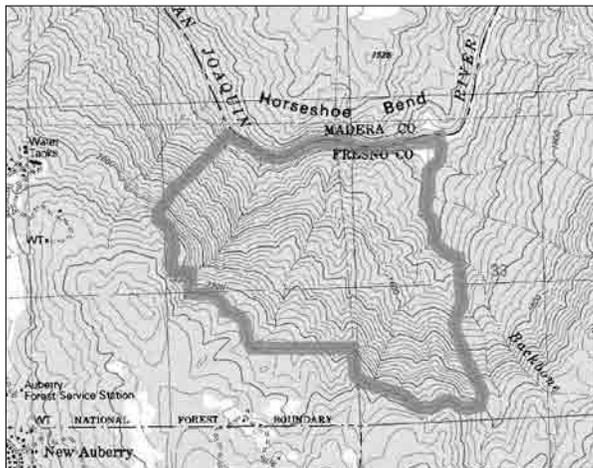
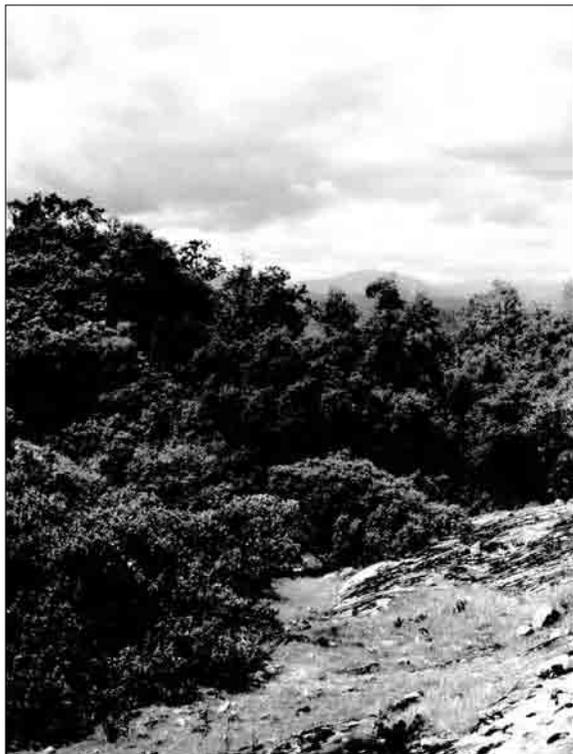


Figure 12—Backbone Creek RNA

Figure 13—Backbone Creek, typical view of Backbone Creek RNA, *Arctostaphylos manzanita* in the foreground, various scrub oaks in background. Note granite outcrop. (around 1970)



Location

This established RNA lies within the Sierra National Forest, approximately 1.5 miles (2.4 km) N. of the town Auberry in Fresno County. The RNA comprises portions of sections 32 and 33 in T9S, R23E MDM (37°07'N., 119°31'W.), USGS Shaver Lake 15' quad (fig. 12). Ecological subsection – Lower Granitic Foothills (M261Fc).

Target Element

Carpenteria californica

Distinctive Features

***Carpenteria californica*:** This rare native California shrub is the primary reason for establishing this RNA. This species is of interest not only in terms of its limited natural range (Clines 1994), about 225 square miles (585 km²), but also in terms of its taxonomy. *Carpenteria* evolved in this region of the Sierra National Forest and is taxonomically unique; only one species is in this genus. In the Jepson Manual (Hickman 1993), it is placed in the family of *Philadelphaceae*, but other floras have placed it in the *Saxifragaceae* (Munz and Keck 1959) or *Hydrangeaceae* (Abrams 1944). Some scientists consider it a primitive link between two main orders of flowering plants: the *Rosales* and *Violales*. Because it has survived over the geologic ages, it is a relict species (Wickenheiser 1989).

Unique Ecosystem of Native Shrubs: Along with *Carpenteria californica*, included in this RNA are numerous other native California shrubs, such as *Aesculus californica*, *Cercis occidentalis*, *Dendromecon rigida*, and *Fremontia californica*. Together, they are an unusual variation of the woodland/chaparral vegetation commonly observed in the foothills (fig. 13).

Rare Flora: *Carpenteria californica* (State-listed endangered species, CNPS 1B)

Physical Characteristics

The RNA covers 430 acres (174 ha), and the elevations range from 1250 to 2400 ft (381-731 m).

With the San Joaquin River as the N. boundary, the RNA consists mainly of N.-facing slopes. Three intermittent streams dissect the area. Soils of the RNA are all of the Auburn series: they are noncalcic brown soils, a fine-loamy, mixed, thermic family of ultic haploxerales. The surface soil is grayish brown, slightly acid, coarse sandy loam; the subsoil is brown, strongly acid, sandy clay loam, overlying on weathered acid igneous bedrock. The annual precipitation is approximately 25 inches (6361 mm).

Association Types

Interior Live Oak Chaparral (37A00): The whole RNA can be classified into this type, although the classification does not depict the unique presence of *Carpenteria californica*. Within the RNA, there are approximately 262 acres (106 ha) of scattered thickets, mostly of *Carpenteria*, as well as an

abundance of associated shrub species common to the area. Major species are *Aesculus californica*, *Carpenteria californica*, *Cercis occidentalis*, *Dendromecon rigida*, *Fremontia californica*, *Quercus wislizenii*, and *Pinus sabiniana*.

Fire History

A fire occurred in July 1989.

Plant Diversity

Twenty-two taxa are listed in a preliminary study for the Forest Service Multiple Use Plan in 1971.

Conflicting Impacts

Trampling by cattle posed a tremendous problem for seedling establishment after the fire in 1989. A fence built on the E. boundary of the RNA corrected the problem.

Note: for Bald Mountain, see Station Creek, #85

7. Bell Meadow (Keeler-Wolf 1985a, Petersen 1994a)

Location

This established RNA is on the Stanislaus National Forest about 3 miles (5 km) S. of Pinecrest. It lies within portions of sects. 25 and 26 T4N, R18E and sects. 29, 30, 31, and 32 T4N, R19 MDBM (38°10'N., 119°56'W.), USGS Pinecrest quad (fig. 14). Ecological subsections – Upper Batholith and Volcanic Flows (M261Eh).

Target Element

Aspen (*Populus tremuloides*)

Distinctive Features

Aspen Forest: The aspen stands are extensive and well developed (fig. 15). They occur on both flat, deep meadow soil and on sloping, shallower upland soil. Variation in sucker reproduction, understory density, species composition, and conifer invasion add to the research potential. Typical meadow aspens are more than 90 ft (27 m) tall, and some attain dbh of more than 40 inches (1.02 m).

Aspen vegetation of the Sierra Nevada is usually stable and not successional to coniferous vegetation. This characteristic distinguishes it from the extensive seral stands of the species in the Rocky Mountains. Local rejuvenation of stands appears to take place largely when the short-lived stems die and create light gaps, initiating renewed sucker sprouting. Conifer invasion, largely from white fir (*Abies concolor*), is not pronounced in most areas of aspen dominance.

History of Meadow Change: A combination of monitoring studies (on grazing and browsing pressure from both livestock and deer), and aerial photography in the Bell Meadow area from the early 1950s provide a useful history of the area. An important change in the upper meadow occurred over a short period in the mid-1960s when a large area of wet meadow was converted by stream downcutting to dry meadow. This event coincided with major floods in 1964, but it also may have been exacerbated by heavy grazing pressure. At present, the woody riparian vegetation has not suffered as a result of the downcutting. However, the process will continue relatively rapidly until the entire upper meadow is lowered by several feet.

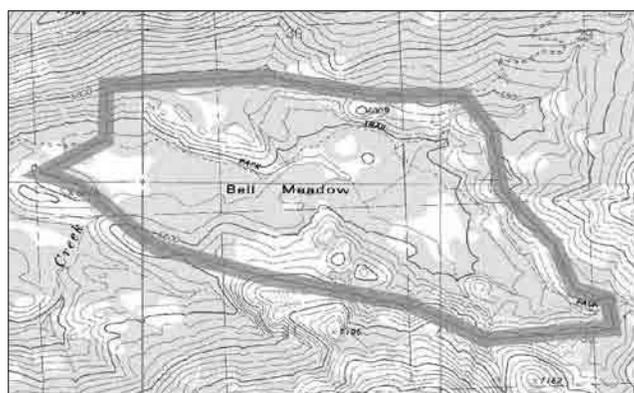


Figure 14—Bell Meadow RNA



Figure 15—Bell Meadow, upper meadow aspen forest with *Elymus glaucus* and *Mertensia ciliata* dominant in understory. (1984)

is divisible into upper and lower sections, which are separated by a narrow area about 300 ft (91 m) wide between granitic outcrops. The entire meadow stretches about 1.25 miles (2 km) from E. to W. and is up to 2700 ft (823 m) wide. It slopes gradually from about 6600 ft (2012 m) at the E. to about 6550 ft (1996 m) on the W.

Surrounding slopes are both granitic (quartz monzonite and granodiorite) and volcanic (Miocene latites of the Stanislaus formation), with the granitics prevailing. The meadow is underlain by up to 14 ft (4.3 m) of fine sandy-to-gravelly alluvium. Soils have been differentiated into seven mapping units. The meadow is underlain by deep Entic Cryumbrepts. The other units principally comprise combinations of Gerle family and rock outcrop. Climate is typical Sierran montane, with annual precipitation averaging 50-55 inches (1270-1397 mm). Mean annual temperature is 44-46 °F (6.7-7.8 °C).

Association Types

Twenty-one 100-m² plots were sampled from three forest associations. The remaining associations are qualitatively described.

Jeffrey Pine (*Pinus jeffreyi*) Woodland (85100): 262 acres (106 ha). This open-to-very-open woodland occupies the shallow soils of the slopes surrounding the meadow. A variant, with western juniper (*Juniperus occidentalis* ssp. *australis*) as a subdominant, occurs on the Miocene volcanics at the E. edge of the area. The shrub understory is dominated by mountain chaparral species and forms a mosaic with tree-dominated vegetation and sparse herbaceous cover on rock outcrops.

A fine-grained view of this association would differentiate Jeffrey pine woodland from mixed montane chaparral (Holland 37510), huckleberry oak (*Quercus vaccinifolia*) scrub (Holland 37542), and rock outcrop (Holland 91200). Overall shrub dominants include *Quercus vaccinifolia*, *Arctostaphylos nevadensis*, and *A. patula*. *Holodiscus boursieri* and *Acer glabrum* var. *torreyi* occur on N.-facing slopes. Herbs include many species typical of mid-elevation rock outcrops, such as *Raillardella scaposa*, *Stipa occidentalis*, *Eriogonum umbellatum*, *E. marifolium*, *Cryptogramma acrostichoides*, *Arenaria kingii* var. *glabrescens*, *Sedum lanceolatum*, *Lomatium tracyi*, *Penstemon laetus*, *P. newberryi*, and *Hieracium horridum*.

Aspen Riparian (81B00, 61520): 90 acres (36 ha). Of the three deciduous plant associations, this is the driest with little or no surface water and a water table in mid-summer from 2 to 14 ft (0.6-4.3 m). The largest aspen groves occur on the E. end of the meadow with smaller fringing stands surrounding most of the remainder and a broad band covering the central portion of the lower meadow

Significance of Riparian Vegetation to Wildlife: Bell Meadow is an excellent summer range for Sierra mule deer (*Odocoileus hemionus californicus*) because of the interspersed wet meadow, timber, brush, and open areas. Many deer have been seen in the area. The abundant willows (*Salix* spp.) and aspens are relished by pregnant and lactating does. In addition, the riparian habitats afford forage, breeding sites, and protection for many other animals including more than 60 species of birds.

Physical Characteristics

The area covers 645 acres (261 ha) and ranges in elevation from 6540 to 6800 ft (1993-2073 m). The area occupies a part of the bottom and lower slopes of the Bell Creek drainage. Bell Meadow

(together making up the meadow flat subtype). Typically, aspen forms an even monospecific canopy from 60 to 90 ft (18-27 m) tall with few young small stems. However, in the central lower meadow, stands are multi-layered resulting from numerous young- to middle-aged suckers growing among a sparse canopy of large, senescent stems. On 11 plots, total tree density averages 910 trees/ha with a cover of 69 m²/ha. On these plots aspen averages an importance value of 240 with both a relative density and relative cover of 89 percent. In addition to the aspen, only a few small white fir, Jeffrey pine, and lodgepole pine (*Pinus contorta* ssp. *murrayana*) occur in the tree strata.

Shrub cover is light, but the herbaceous understory is dense (typically nearly 100 percent) and diverse (63 taxa in the sample). Only seven herbaceous species have a frequency of 50 percent or greater. These are *Elymus glaucus*, *Lupinus andersonii*, *Veratrum californicum*, *Hackelia jessicae*, *Descurania richardsonii*, *Thalictrum fendleri*, and *Osmorhiza chilensis*. *Elymus* may reach 6 ft (2 m) tall in wet years. *Rudbeckia californica* may dominate in certain areas of heavy grazing.

An upland subtype occurs in several small stands at the edge of the main meadow or on benches above it. These stands are similar to the meadow flat subtype, but more white fir and Jeffrey pine are present here than in the meadow flat. Herbaceous understory is less dense compared to the main meadow stands, primarily because of higher grazing pressure on these areas.

Salix Riparian (63500): 59 acres (24 ha). This association is extensive on the upper and lower meadow flats. It is dominated by the willow *Salix ligulifolia*, which forms thickets 10-13 ft (3-4 m) tall. These thickets are interspersed with small openings dominated by wet meadow vegetation. Other shrubs include *Salix melanopsis*, *S. lasiandra*, *S. drummondiana* var. *subcaerulea*, *S. scouleriana*, *Sambucus microbotrys*, and *Sambucus caerulea*. A number of herbaceous species are typical of the shady thickets and include *Delphinium glaucum*, *Heracleum lanatum*, *Epilobium adenocaulon*, *Castilleja miniata*, *Senecio triangularis*, *Habenaria sparsiflora*, *Circaea alpina* var. *pacifica*, *Smilacina stellata*, *Lilium kelleyanum*, and *Aquilegia formosa*.

White Fir-Red Fir Forest (85310): 55 acres (22 ha). This dense forest occurs in the valley of the S. branch of Bell Creek upstream from the meadow. Dominant red fir (*Abies magnifica*) attains heights of 200 ft (61 m) and dbh of 5 ft (1.5 m). Red fir dominates the basal area (157 m²/ha, relative cover 46 percent), but white fir may occur in higher density (460 trees/ha, relative density 59 percent). Both species have near equal importance values on the five sample plots (white 141, red 127). The understory is typically sparse, and duff cover is heavy. Density of saplings and seedlings is higher for red fir than white fir.

White Fir-Jeffrey Pine Forest (84240, 85210): 52 acres (21 ha). This forest typically occurs as a narrow fringe surrounding the meadow flat. The soil is rockier than the meadow, but deep. The dominants are white fir and Jeffrey pine, with lodgepole pine and red fir as subdominants (total density on five plots averages 920/ha, total basal cover averages 108 m²/ha). White fir has the highest importance value (150) followed by Jeffrey pine (77), lodgepole pine (59), and red fir (14). White fir has the highest importance values for seedlings and saplings, as well. The most frequent shrubs are *Quercus vaccinifolia* and *Symphoricarpos acutus*. Both account for 20-40 percent cover in many areas. The most conspicuous herbs are *Pteridium aquilinum* and *Kelloggia galioides*.

Wet Meadow (45100, 52430): 49 acres (20 ha). Since the recent erosion cycle in the upper meadow, the reduction in this association has been drastic. However, extensive areas of wet meadow still exist, particularly in the lower meadow. This association is divided into three types:

The saturated subtype (Holland 52430) occurs in slough-like channels of Bell Creek and around an ephemeral pond in the S. of the area. *Carex rostrata*

dominates as a ring around open water (which remains through mid-summer). Additional species include *Sparganium multipedunculatum*, *Elatine gracilis*, *Potamogeton nutans*, *Puccinellia pauciflora*, *Scirpus microcarpus*, *Juncus orthophyllus*, *Carex aquatilis*, *C. athrostachya*, and *C. fracta*.

A wet subtype is dominated by sedges and grasses, often forming a well-consolidated sod. This type has standing water in the spring and remains moist throughout the summer. Other species shared with the *Salix* riparian association typically include *Carex fracta*, *C. nebrascensis*, *C. stramineiformis*, *C. paucicaustata*, *C. festivala*, *C. hoodii*, *C. jonesii*, *Trifolium cyathiferum*, *T. montanum*, *Ranunculus orthorhynchus*, *Epilobium brevistylum*, *Polygonum bistortoides*, *Juncus howellii*, *Glyceria elata*, *Allium validum*, *Deschampsia caespitosa*, *Agrostis exarata*, and *Dodecatheon alpinum*.

A moist subtype is the most extensive and diverse. It commonly is interspersed with *Salix* riparian vegetation. Ground cover ranges from 50 to 100 percent. The drier fringe sections are dominated by *Danthonia californica* var. *americana*, *Perideridia parishii*, *Trifolium longipes*, *Deschampsia elongata*, *Calamagrostis inexpansa*, *Penstemon rydbergii*, *Achillea millefolium*, *Solidago californica*, *Horkelia fusca*, and *Gilia capillaris*. Slightly moister areas are dominated by *Hordeum brachyantherum*, *Erigeron peregrinus* ssp. *calliantherus*, *Aster occidentalis*, *Agrostis scabra*, *A. oregonensis*, *Poa pratensis*, *Ranunculus occidentalis*, *Juncus confusus*, *J. balticus*, *Luzula comosa*, *Helenium hoopesii*, and *Veratrum californicum*.

Dry Meadow (45120): 47 acres (19 ha). This association is dominated by grasses and herbs with cover from 10 to 90 percent. The largest dry meadows are in upper Bell Meadow on deep, well-drained soil that supported wet meadow before stream downcutting. Three subtypes occur.

The most extensive subtype is dominated by *Stipa columbiana*. Additional species include *Agropyron trachycaulum*, *Elymus macounii*, *Madia glomerata*, *Perideridia parishii*, *Polygonum douglasii*, *Navarretia divaricata*, *Cryptantha torreyana*, *Cordylanthus tenuis*, *Bromus orcuttianus*, *Lotus purshianus*, and *Gayophytum diffusum* ssp. *parviflorum*.

The second subtype occurs in peripheral areas of the upper meadow. It is characterized by a coarse, sandy substrate with low vegetation cover (<25 percent) dominated by *Madia glomerata*.

The third subtype is dominated by the annuals *Lotus argophyllus* and *Euphorbia spathulata*. It occurs on more pebbly or rocky soils than the previous type, typically bordering on Jeffrey pine and lodgepole pine forests.

Lodgepole Pine-Fir Forest (86100): 30 acres (12 ha). This association borders meadow and riparian vegetation. The forest is dominated by lodgepole pine, but Jeffrey pine, white fir, and red fir also occur. Stem density is high, but because of the moist substrate and deep soil, the understory is well developed. Many herbs are shared with aspen and meadow associations, but several are characteristic. These include *Botrychium multifidum* ssp. *silaeifolium*, *Antennaria rosea*, *Prunella vulgaris*, and *Hypericum anagalloides*. Other common species include *Aster occidentalis*, *A. integrifolius*, *Deschampsia elongata*, *Calamagrostis inexpansa*, *Perideridia parishii*, *Muhlenbergia filiformis*, *Pyrola secunda*, and *Juncus confusus*.

Rocky Stream Riparian (61530): 1 acre (0.4 ha). This association occurs sporadically along the main branch of Bell Creek, largely on rocky stretches with steeper gradients than in the main meadow area. Black cottonwood (*Populus trichocarpa*) is the most conspicuous tree. Cottonwoods are typically scattered in small clumps and attain heights of 100 ft (30 m) and dbh of 49 inches (1.25 m). Shrubby species include *Cornus stolonifera*, *Rhamnus purshiana*, *Spiraea densiflora*, *Ribes nevadense*, *Rosa gymnocarpa*, and, occasionally, *Alnus tenuifolia*.

Plant Diversity

Two hundred forty-seven taxa are listed in the establishment record, which updates the list in the ecological survey.

Conflicting Impacts

The area has been used for grazing for more than 100 years. The downcutting of the upper meadow stream may have begun because of reduced vegetation cover caused by overgrazing. After establishment, most of the area will be excluded from grazing. At present the core area of the meadow is fenced, and herbaceous cover is generally high, indicating good potential for recovery of the entire area. Various options for dealing with the downcutting problem in the upper meadow are discussed in the ecological survey and the establishment record. Downcutting in the meadows will be allowed to continue unimpeded. So far, no detrimental impact to the aspen or the *Salix* riparian zones has occurred. Recreational use of the area has been high. After establishment, a major trail to the adjacent Emigrant Wilderness will be re-routed around the RNA.

Note: for Big Grizzly Mountain, see Grizzly Mountain, #33

8. Big Pine Mountain (Keeler-Wolf 1991a)

Location

This candidate RNA is on the Santa Lucia Ranger District, Los Padres National Forest. The cRNA lies within the San Rafael and Dick Smith Wilderness, except for the narrow right-of-way surrounding Forest Service Road 9N11. It lies within portions of sections 5, 6, 7, 8, and 9 of T7N, R26W and sections 1 and 12 of T7N, R27W SBM (34°42'N., 119°40'W.), USGS Big Pine Mountain quad (*fig. 16*). Ecological subsection – San Rafael-Topatopa Mountains (M262Ba).

Target Element

Sierra Nevada Mixed Conifer Forest for the Central California Coast Ranges ecological section

Distinctive Features

The stands of mixed conifer forest are limited to elevations above 5100 ft (1554 m) and are diverse and variable topographically and compositionally. Floristic variation in the area results from the well-balanced diversity of plant associations covering a range from low-elevation chaparral and riparian to montane chaparral and mixed conifer forest. In addition to the target vegetation, the cRNA also contains a number of other well-developed plant communities, including bigcone Douglas-fir/canyon live oak (*Pseudotsuga macrocarpa/Quercus chrysolepis*) forest, Coulter pine (*Pinus coulteri*)/chaparral vegetation, and such locally unique communities as shale barrens. The riparian vegetation found in the cRNA is some of the best remaining vegetation of this type in the Central California Coast Ranges ecological section.

Rare Plants: The cRNA contains one CNPS listed species. *Sidalcea hickmanii* ssp. *parishii* (CNPS List 1B) is found on dry, disturbed, sandy areas around fuel breaks and on fire roads along mountain summits.

Rare Fauna: The cRNA is only 2.5 miles (4 km) E. of the Sisquoc Condor Sanctuary. California Condors (*Gymnogyps californianus*, Federally and State-listed endangered species) were regularly seen in the cRNA until 1986. Peregrine fal-



Figure 16—Big Pine Mountain cRNA

con (*Falco peregrinus anatum*) is an endangered species on both Federal and State lists. Species listed as California state species of special concern include the spotted owl (*Strix occidentalis*), Cooper's hawk (*Accipiter cooperi*), sharp-shinned hawk (*Accipiter striatus*), golden eagle (*Aquila chrysaetos*), prairie falcon (*Falco mexicanus*), purple martin (*Pogone subis*), yellow warbler (*Dendroica petechia*). Other wide-ranging montane species atypical of the S. Coast Ranges are also found in the cRNA.

Species such as the mountain chickadee (*Parus gambeli*) and the white-headed woodpecker (*Picoides albolarvatus*) are typical sedentary nonmigrant residents of the mixed conifer zone. Their presence indicates relatively stable conditions here.

Biogeographic Significance: 41 montane plant species within the cRNA are at or near their westernmost distribution in S. California.

Fire History: Based on fire scar analysis, fire frequency of the main stand of mixed conifer forest before European settlement averaged one fire every 12 years. Aside from a large fire approximately 50 years ago in the Coulter pine forest, there is no evidence of more recent widespread fire. Unlike the surrounding lower-slope vegetation, the open nature of the mixed conifer forest prevents it from carrying damaging crown fires.

Physical Characteristics

The study area covers 2963 acres (1199 ha), although the estimated size of the cRNA in Los Padres National Forest Land and Resource Management plan is 1000 acres (405 ha). Elevations range from 3600 to 6828 ft (1109-2081 m). The cRNA lies along the crest and the N. slopes of the E. San Rafael Mountains, the southernmost and highest of the S. Coast Ranges. Several side branches of Big Pine Canyon dissect the slopes between W. Big Pine Mountain and the base of the Big Pine Canyon cliffs, creating a stepped topography.

The cRNA is dominated by Eocene and Upper Cretaceous sedimentary rocks including massive sandstone (eroded into cliffs along the S. boundary and parts of Big Pine Canyon) and thinner beds of shale. The Riconada Fault (Sur-Nacimiento) and the Big Pine Fault converge in the immediate vicinity of the cRNA.

The majority of the soils in the cRNA lie within the Livermore-Agua Dulce-Hambricht families association, 30-80 percent (17°-39°) slopes. The Livermore component is a brown, gravelly, sandy clay loam, 0-3 inches (0-8 cm) deep. The Agua component is a light brownish gray, gravelly loam, 0-38 inches (0-97 cm) deep. The Hambricht component is a grayish brown, extremely cobbly loam, 0-11 inches (0-28 cm) deep. The remainder of the soils of the cRNA fall within the Millsholm-Exchequer-Stonyford families association. These are shallow soils on 30-75 percent (17°-37°) slopes.

Due to altitude variations of more than 3000 ft (914 m), there are substantial climatic differences between upper and lower elevations in the cRNA. No weather stations exist in the cRNA, but climatic information is estimated from nearby Bluff Camp Guard Station at 4400 ft (1341 m), approximately 1 air mile (1.6 km) S. of the cRNA. Average temperature at Bluff Camp (during a 4-year period from 1972 to 1975) was 56 °F (13 °C) with an average high of 101 °F (38 °C) and an average low of 16 °F (-9 °C). Temperatures at the upper elevations of the cRNA are likely to average 6-8 °F (3-4 °C) colder than at Bluff Camp, while temperatures at the lower elevations along the Sisquoc River will likely average 3-4 °F (2-2.5 °C) higher. Average annual precipitation along the crest of the San Rafael Mountains is slightly more than 30 inches (762 mm); it is about 25 inches (635 mm) along the upper Sisquoc River. Most precipitation falls between November and March.

Association Types

Sierran Mixed Coniferous Forest (84230): 653 acres (264 ha). The mixed conifer forest in the cRNA is remarkably diverse in density, composition, and successional status. It occurs in fragmented stands ranging from tall, dense-canopied alluvial flat forests with a sparse understory of white-fir (*Abies concolor*) and incense-cedar (*Libocedrus decurrens*) saplings to open ridgetop stands with low canopies and a shrubby understory of chaparral shrubs and canyon live oak. Even within individual stands there is variation due to elevation, juxtaposition to other vegetation types, slope aspect, soils, and so forth.

White fir appears to be the overall dominant in all age classes in most stands, and it is the most active colonizer of the adjacent canyon live oak and chaparral habitats. Jeffrey pine (*Pinus jeffreyi*), sugar pine (*Pinus lambertiana*), and incense-cedar dominate or codominate with white fir at various degrees (fig. 17).

Ponderosa pine (*Pinus ponderosa*) is absent in this forest. Borchert and Hibberd (1984) suggest that the colder, drier high-elevation habitats typical of S. California mountains allow Jeffrey pine to out-compete ponderosa.

Understory species common in most stands include *Erigeron foliosus*, *Amorpha californica*, *Eriogonum nudum*, *Gayophytum diffusum parvifolium*, and *Phacelia curvipes*.

Northern Mixed Chaparral (37110): 640 acres (259 ha). This classification is broad and somewhat artificial, encompassing all chaparral types found in the lower and mid-elevation parts of the cRNA. There is little pure chamise (*Adenostoma fasciculatum*), pure manzanita (*Arctostaphylos* spp.) or scrub oak (*Quercus dumosa*) chaparral. Thus the general title of Northern Mixed Chaparral is suitable.

On steep, SW.-facing slopes at low elevations, chamise tends to dominate in a mixed chaparral with *Arctostaphylos glauca*, *Salvia leucophylla*, *Eriogonum fasciculatum*, *Leptodactylon californicum*, *Lotus scoparius*, *Ephedra viridis*, *Mimulus longiflorus*, and *Ceanothus* spp. On W. and E. aspects at this elevation, *Cercocarpus betuloides*, *Prunus ilicifolia*, *Ceanothus leucodermis*, and *Quercus dumosa* also are found. At elevations 1000 ft (305 m) higher, on NW. and NE. aspects, the chaparral is typically dominated by additional species such as *Garrya flavescens* ssp. *pallida*, *Arctostaphylos glandulosa*, *Yucca whipplei*, *Marah fabaceus* var. *agrestis*, and *Lonicera interrupta*. At even higher elevations, the chaparral assumes a more montane character with shrubby canyon live oak dominating.

Canyon Live Oak Forest (81320): 532 acres (215 ha). This forest is widespread on the mid- and upper slopes, and ranges from below 4000 ft to over 6400 ft (1219-1950 m). It is restricted to N.-facing, concave slopes at lower elevations. At upper elevations it may occur on steep W.- and E.-facing exposures with scrubby individuals. The best developed trees are found in ravines and low-lying concavities (dbh up to 3.5 ft [1.1 m], and heights of 90 ft [27 m]). Crown cover is usually high, and the understory is poorly developed, consisting largely of duff. Stem age of the majority of these stands is about 50 years, dating back to the last major fire in the area.

Coulter Pine Forest (84140): 420 acres (170 ha). Two types of this association occur within the cRNA. The most extensive type is the Coulter pine/chaparral. This type occupies open slopes and ridges at 4800-6000 ft (1463-1829 m). It is dominated by even-aged Coulter pine, averaging 50-60 ft (15-18 m) tall and approximately 50 years old. Average density and dbh are, respectively, 324-405 trees/acre (800-1000 trees/ha) and 6-12 inches (15-30 cm). A few large individuals



Figure 17—Big Pine Mountain, the sugar pine-white fir phase of the mixed conifer forest on the north slope of Big Pine Mountain. (1989)

also exist. A Coulter pine found in this forest may be one of the largest Coulter pines in the region, measuring 59 inches (1.5 m) dbh and 125 ft (38 m) tall. The understory is dominated by *Arctostaphylos glandulosa*, *Quercus dumosa*, *Q. wislizenii* var. *frutescens*, *Cercocarpus betuloides*, and *Garrya flavescens* var. *pallida*.

The other type, Coulter pine/canyon live oak, is found on the N. slope of Big Pine Mountain. It occurs in smaller stands, and pine densities are not as high as in the previous phase. The Coulter pine here exhibits serotiny, most likely as an adaptation to fire in this area (Borchert 1985).

Bigcone Douglas-Fir/Canyon Live Oak Forest (84150): 306 acres (124 ha). This forest is restricted to ravines and steep concave slopes between 4200 and 5700 ft (1280-1737 m). Individual stands are usually small and linearly oriented along the topographic gradient. The dominant bigcone Douglas-firs have rough, deeply furrowed bark and may be up to 6 ft (1.8 m) dbh and 130 ft (39 m) tall. The canopy is typically open, with a relatively dense subcanopy of canyon live oak. There is a fairly distinct transition between the upper slope, mixed conifer forest and the bigcone Douglas-fir/canyon live oak type. The restriction of this vegetation type to ravines and steep concave slopes appears to be due to the susceptibility to crown fire. The sheltered sites dominated by bigcone Douglas-fir are among the most highly protected from fire of any in the cRNA.

According to McDonald and Littrell (1976), the bigcone Douglas-fir/canyon live oak forest is a well-defined ecological unit which may have changed little for thousands, if not millions, of years. Evidence of this relict nature lies in its mesic moisture requirements within a relatively xeric climatic zone.

Montane Chaparral (37500): 155 acres (63 ha). As with the northern mixed chaparral (37110), this is an aggregation of types not strictly defined by a single set of dominants. Three main phases occur: the parry manzanita (*Artostaphylos manzanita*), the *Ceanothus integerrimus*, and the bitter cherry-chokecherry (*Prunus emarginata*-*P. virginiana* var. *demissa*).

The parry manzanita phase is dominated by parry manzanita, scrub oak, and low canyon live oak, among other chaparral species. This type of chaparral is scattered on shale and sandstone outcrops at the head of the Big Pine Canyon drainage, and is closely associated with Jeffrey pine and mixed conifer forests.

The *Ceanothus integerrimus* phase occurs in several patches as a transitional position between mixed conifer forest and canyon live oak. Its dynamic position here may be an indication of secondary succession following the most recent fire. There are typically high numbers of white fir saplings associated with these areas. Other species associated include *Prunus virginiana* var. *demissa* and *Amorpha californica*.

The bitter cherry-chokecherry phase is restricted to about 24.7 acres (10 ha) on the upper NW. slope of Big Pine Mountain. There is little else associated with the dense stand, although *Amelanchier pallida* and *Ceanothus integerrimus* may occur. As with the *Ceanothus integerrimus* type, this type appears to be successional, with numerous pole sizes and large sizes white fir and sugar pine.

Rock Outcrop (No Holland equivalent): 112 acres (45 ha). Rock outcrops of massive sandstone occur in many parts of the cRNA. Cover is restricted to scattered plants in cracks and crevices. Typical species include *Dudleya cymosa* ssp. *minor*, *Eriogonum saxatile*, *Zauschneria californica*, *Keckiella brevifolia*, *Cirsium californicum*, *Mimulus longiflorus*, *Eriogonum wrightii*, *E. umbellatum*, and *E. fasciculatum*.

Jeffrey Pine Forest (85100): 78 acres (32 ha). This is an open forest associated with the mixed conifer forest of upper elevations. It typically occupies shallower soil or more exposed positions on ridges and outcrops. Because of the harsh conditions, the trees are usually stunted; the average size is about 3 ft (1 m) dbh

and 50 ft (15 m) tall. Most of the dominant Jeffrey pines appear to be 200-300 years old. The most common associate on rocky sites is canyon live oak, along with *Symphoricarpos parishii*, *Parry manzanita*, *Quercus dumosa*, *Holodiscus microphyllus*, and *Ceanothus integerrimus*.

The Jeffrey pine forest atop Big Pine Mountain is underlain by deeper, sandier soils, and its understory is dominated by herbs. Herbaceous species common for both this site and the rockier site include *Lupinus excubitus* ssp. *austromontanus*, *Bromus tectorum*, *Dichelostemma pulchella*, and *Lupinus elatus*.

Montane Riparian Forest (61500): 29 acres (12 ha). The riparian associations in the cRNA are patchily distributed, ranging from the lowest elevation (3600 ft, 1109 m) at the confluence of Big Pine Canyon and the Sisquoc River to elevations up to 6200 ft (1890 m). Three Holland types of riparian vegetation actually exist within the cRNA, but they are combined under the general heading above.

The best developed of these three Holland types is the White Alder (*Alnus rhombifolia*) Riparian Forest (61510). It is extensive along the Sisquoc River and Big Pine Canyon, as well as at several springs near Upper Bear Camp. White alders here are often associated with California bay (*Umbellularia californica*) and bigleaf maple (*Acer macrophyllum*), and the understory is often lush. The alders are frequently large, up to 32 inches (81 cm) dbh and 100 ft (31 m) tall, and relatively old, which makes this perhaps the best example of white-alder-dominated riparian forest in the S. Coast Ranges.

A representative of Holland Southern Cottonwood-Willow Riparian Forest (61330) occurs at lower elevations along the Sisquoc River. Understory species include *Brickellia californica* and *Datisca glomerata*.

The Central Coast Live Oak Riparian Forest (61220) occurs on natural levees 5-10 ft (1.5-3 m) above the level of the stream. Understory species include *Rhus trilobata*, *Amorpha californica*, *Symphoricarpos mollis*, *Collinsia heterophylla*, and *Galium nuttallii*.

The Montane Riparian Scrub (63500) occurs along the upper reaches of intermittent creeks in Big Pine Canyon and near the head of Sisquoc River. The vegetation is dominated by scrubby willows, typically *Salix scouleriana* and *S. lasiolepis*. The understory is a rich hydrophyllic herbaceous layer.

Other areas on the upper reaches of Big Pine Canyon contain no willows but are instead a unique mixture of low-elevation, relatively xerophytic vernal pool and montane meadow species. The site conditions resemble vernal pools, and the soil is derived from very fine-grained shale with a relatively high clay content.

Shale Barrens (No Holland equivalent): 29 acres (12 ha). This vegetation type is characteristic of the high-elevation shale outcrops in the upper drainages of Big Pine Canyon between 5700 and 6500 ft (1737-1981 m). The parent material is highly fractured, dark gray shale, which has little or no true soil component. Vegetative cover is variable, from less than 1 percent to about 40 percent. The harsh substrate supports a unique assemblage of plants including *Psoralea californica*, *Lomatium dasycarpum*, *Frasera neglecta*, and *Allium monticola* var. *keckii*. More sheltered areas with higher soil moisture support *Madia elegans* and *Eriophyllum confertiflorum*.

Valley and Foothill Grassland (42000): 9 acres (4 ha). This association occurs on a small glade at upper Bear Camp, along alluvial deposits of the Sisquoc River, and at Bear Meadow along upper Big Pine Canyon. The dominant species at Bear Camp is *Muhlenbergia rigens*. Species along the Sisquoc River include *Bromus diandrus*, *B. rubrum*, *Lianathus androsaceus* ssp. *micranthus*, and *Camissonia campestris*. Bear Meadow includes a different type of grassland dominated by annual grasses and herbs such as *Hordeum leporinum*, *Bromus tectorum*, *Vulpia megalura*, *Vulpia reflexa*, and *Elymus caput-medusae*.

Plant Diversity

Two hundred eighty-six species of vascular plants are listed.

Conflicting Impacts

The isolated wilderness location of the cRNA precludes most human impacts and conflicts. Recreational use is relatively light. Mountain bikers are the most common visitors to the summit area, followed by Sierra Club hikers and researchers. The campsites at Big Pine Camp appear not to have been used for several years.

**9. Bishop Creek Ponderosa Pine (Merced River)
(Talley 1979)**



Location

The Bishop Creek Ponderosa Pine candidate RNA lies within the Mariposa Ranger District in the NW. part of the Sierra National Forest. It is 10 miles (16 km) SW. of Yosemite Valley, bordered on the N. by Bishop Creek, on the SW. by S. Fork Merced River, and on the E. by Yosemite National Park in Mariposa County. The cRNA comprises portions of sects. 1, 12, and 13 in T4S, R20E, and sects. 5, 8, and 17 T4S, R21E SBM, (37°34'N., 119°41'W.), USGS Yosemite SW 7.5' quad (fig. 18). Ecological subsection – Lower Batholith (M261Ep).

Target Element

Pacific Ponderosa Pine (*Pinus ponderosa*)

Distinctive Feature

This cRNA contains typical stands of the Pacific ponderosa pine forest type. Undisturbed samples of this type are extremely rare in the S. Sierra Nevada. This area also contains extensive stands of scrub forest that form ecotones between

conifer forest and the chaparral, mixed evergreen forest, and oak woodland communities occurring at lower elevation.

Figure 18—Bishop Creek Ponderosa Pine cRNA

Dashed line = Ecological study area;
Solid gray line = RNA Boundary

Physical Characteristics

The ecological survey area covers 1764 acres (714 ha), including the area N. of the cRNA (1140 acres [461 ha]). Elevations are 3200-4700 ft (975-1432 m). Topographically, two basic types occur within the area: steep slopes rising from the S. Fork Merced River on the W. and a gently sloping terrace on a ridge separating the Bishop Creek and Alder Creek watersheds.

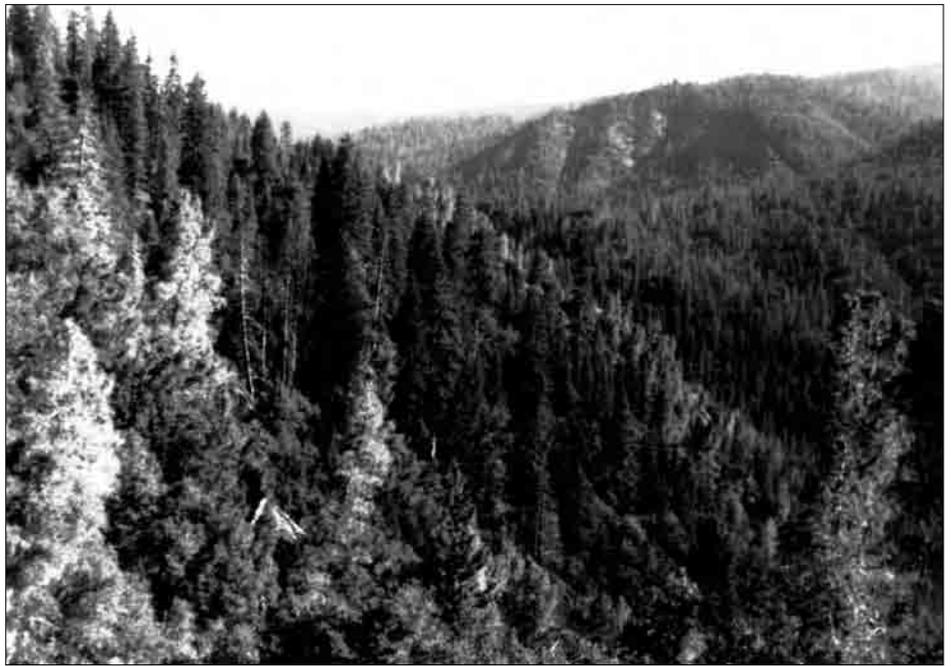
Information on geology, soil, and climate is not available.

Association Types

Vegetation was field mapped according to dominant species. Representative stands of forest types were sampled using 75- by 100-ft (0.07-ha) plots to produce an importance value. Three types were delineated.

Chaparral (37510, 37520): 116 acres (47 ha). Chaparral occurs on S. to SW. exposures between 3480 and 5410 ft (1060-1650 m), mostly in the N. third of the survey area. Slope at chaparral sites is usually 20-35°. *Cercocarpus betuloides* is dominant, accounting for approximately 45 percent of combined herb and shrub stratum cover. *Ceanothus cuneatus* contributes another 25 percent cover. Another 5-10 percent cover may be contributed by *Arctostaphylos viscida*, *A. mariposa*, and annual grasses (mostly *Bromus tectorum*). Other associated species are *Pinus sabiniana*, *Eriodictyon californica*, *Fremontia californica*, and *Rhamnus crocea* var. *ilicifolia*.

Scrub Forest (71322): 57 percent of the study area, 1013 acres (410 ha), consists of steep to moderate W., SW., and SE. exposures and less-steep S. exposures vegetated by a scrub forest. Scrub forest forms a transitional community between chaparral and ponderosa pine forest with dominants coming from chaparral (*Ceanothus cuneatus*, *Arctostaphylos viscida*, *Cercocarpus betuloides*), oak woodland (*Aesculus californica*, *Pinus sabiniana*, *Quercus wislizenii*), mixed evergreen forest (*Quercus chrysolepis* and *Q. kelloggii*), and ponderosa pine forest (*Pinus ponderosa* and *Quercus kelloggii*) (fig. 19). At one site, hybrids between *Quercus wislizenii* and *Q. kelloggii* (*Q. x morehus*) also occur. Abundance of sprout



clusters of *Q. chrysolepis* and *Q. kelloggii* (44 acres [18 ha]) within the scrub forest suggest that large areas might develop into mixed evergreen forest if disturbance, presumably by fire, was less frequent. The transition from chaparral to scrub forest is usually manifest as a gradual increase in sprout clusters of oak (*Q. wislizenii*, *Q. chrysolepis*, *Q. kelloggii*) or *Pinus sabiniana*, or both, accompanied by a decrease in dominance of *Cercocarpus betuloides* and *Ceanothus cuneatus*. Conversely, the transition from scrub forest to mixed conifer forest is usually well defined, as along the crests of ridges with scrub forest predominant on S. to W. exposures and ponderosa pine dominant on relatively level terrain on N.- to W.-facing exposures. Within the mixed conifer forest, local areas with S. exposure and rocky soil support patches of scrub forest despite the existence of ponderosa pine on nearby slopes that are tall enough to cast shade onto these regions.

Mixed Conifer Forest (84210): This type occurs over approximately 568 acres (230 ha). At least three phases of mixed conifer forest occur within the area: Open *Pinus ponderosa*-*Quercus kelloggii* forest with a dense understory of *Chamaebatia foliolosa*, closed *Pinus ponderosa*-*Quercus kelloggii* forest with a sparsely vegetated understory, and riparian conifer forest dominated by incense-cedar (*Libocedrus decurrens*).

Forests on gently sloping terrain (6°-19°) between 4000 and 4800 ft (1220-1465 m) are typically open stands of *Pinus ponderosa* with occasional *Quercus kelloggii* and incense-cedar. Except for sites dominated by young trees, the forest understory possesses well-developed populations of *Chamaebatia foliolosa* penetrated by clusters of *Arctostaphylos mariposa*, *A. viscida*, and increasingly, by saplings of incense-cedar and *Pinus ponderosa*. Localized xeric areas within the open *Pinus ponderosa*-*Quercus kelloggii* forest that are not exposed or rocky enough, or both, to support scrub forest are vegetated by stands of scrubby *Q. kelloggii* with understories of *Arctostaphylos mariposa* and *Chamaebatia foliolosa*.

Riparian mixed conifer forest occurs above 4000 ft (1220 m) on level to gently sloping topography along Bishop Creek. Here incense-cedars occur among mature specimens of *Pinus ponderosa*, *Quercus kelloggii*, *Alnus rhombifolia*, *Abies concolor*, *Corylus cornuta*, and *Cornus nuttallii*. Dominant incense-cedars at these sites all appear to be the same age. Large *Pinus ponderosa* and *Quercus*

Figure 19—Bishop Creek Ponderosa Pine, looking south up the South Fork Merced River from approximately 4265 ft. (1300 m) elevation. Vegetation in the foreground is scrub forest, a mixture of chaparral, oak woodland, mixed evergreen forest, and mixed conifer forest species, which dominates warm-xeric slopes below the ponderosa pine phase of mixed conifer forest. (1979)

kelloggii are present, but neither species has vigorous specimens in the understory. Incense-cedar saplings, however, appear to be maintaining a steady growth rate.

Below 3600 ft (1100 m) incense-cedar is rare except on steep N.-facing slopes and along streams. Besides an occasional *Pseudotsuga menziesii* or *Pinus sabiniana*, *Pinus ponderosa* is the only conifer present in the lower-elevation mixed conifer forests. Tree stratum cover of *Quercus kelloggii* increases such that the forest canopy is now continuous, and the herb stratum can support only a discontinued cover of *Chamaebatia foliolosa*. Examples of woody species present in closed *Pinus ponderosa-Quercus kelloggii* forest, but rare or absent in open *Pinus ponderosa-Quercus kelloggii* forests at higher elevation, are *Umbellularia californica*, *Aesculus californica*, *Toxicodendron diversiloba*, and *Ceanothus thyrsiflorus*. *Quercus chrysolepis* is infrequent in both open and closed canopy *Pinus ponderosa-Quercus kelloggii* forests except along the bottoms of small ravines.

Fire/Insect: Some trees show fire scars from fires that occurred before 1930. Fire suppression in the area started in the 1920s. A fire interval of 5 to 15 years in the area is estimated for the century before approximately 1870. Bark beetle activities prevailed in the 1970s. Mortality rate of ponderosa pine caused by the insects was about 5 percent during 1978 and 1979.

Plant Diversity

A list of plant species in the area was not provided.

Conflicting Impacts

No major conflicts in land use have been identified.

Under current conditions, uncontrolled fire entering the area could eliminate much of the canopy of the best-developed terrace ponderosa-pine-California black oak forest. Fire/fuel management plan need to be developed to maintain the target element.

10. Black Butte (Hrusa and Hunter 1996, Phillips 1998a)

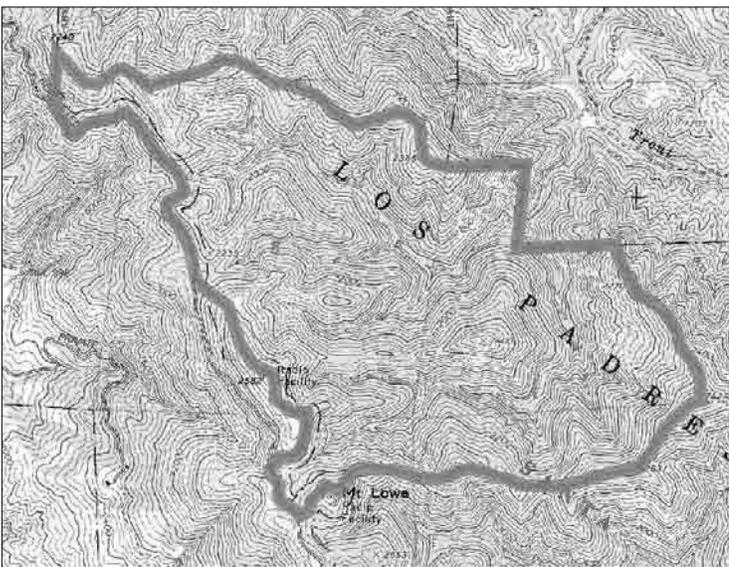


Figure 20—Black Butte RNA

Location

This established RNA lies within the Santa Lucia Wilderness, Los Padres National Forest, NE. of the city of San Luis Obispo, San Luis Obispo County. The RNA comprises portions of sections 5, 6, 7, 8, 9, 16, and 17 in T30S, R13E MDM (35°18'N., 120°40'W.), USGS Lopez Mtn. 7.5' quad (fig. 20). Ecological subsection – South Coastal Santa Lucia Range (261 Ak).

Target Element

Knobcone Pine (*Pinus attenuata*)

Distinctive Features

Diverse Vegetation: Because of its location and steep elevation gradient, this RNA supports a complex mosaic of vegetation types. These include extensive stands of knobcone pine, various forms of chaparral including areas dominated by the narrow endemic Santa Lucia manzanita, and woodlands dominated by coast live oak (*Quercus agrifolia*). In addition, relictual stands of tanoak (*Lithocarpus densiflora*) occur in mesic, mixed evergreen woodlands

dominated by canyon live oak (*Quercus chrysolepis*), which also contain significant proportions of madrone (*Arbutus menziesii*) and California bay (*Umbellularia californica*). Scattered individuals of Coulter pine (*Pinus coulteri*) are found on steeply dipping rock outcrops at ecotones between chaparral and the mixed woodlands. Riparian habitats are present in the bottoms of the two unnamed streams.

Rare Flora: Santa Lucia manzanita (*Arctostaphylos luciana*, CNPS 1B), Hoover's bentgrass (*Agrostis hooveri*, CNPS 4), and Club-haired mariposa lily (*Calochortus clavatus* var. *clavatus*, CNPS 4)

Physical Characteristics

The RNA covers 540 acres (218 ha). Elevations range from 1400 to 2742 ft (427-836 m). It is situated near the S. end of the Santa Lucia Mountains. Along the ridge summit, the RNA occupies the NW. side of the steep, SE.-trending ridge. Terrain is steep, rising 1300 ft (396 m) in approximately 0.6 mile (1.0 km). Slopes of 80 percent or more are common (fig. 21). The underlying parent material of the RNA is of the Monterey formation, a moderately acidic, siliceous marine shale of Miocene age. The RNA is considered part of a syncline; it contains many areas of steeply tilted bedrock typical of such geologic formations. Most of the soils are shallow and well drained, with a very gravelly clay loam surface layer. Some areas have moderately deep, well-drained soil with a clay loam surface layer. Two unnamed streams drain E. from Mount Lowe. The annual precipitation is approximately 12 inches (3047 mm). Temperatures range from about 47.2-70.7 °F (8.4-21.5 °C).

Association Types

Knobcone Pine Forest (83210): The knobcone pine forms more or less even-aged on ridges, and occasionally, on steep side slopes. On ridges, Santa Lucia manzanita may be an understory component, but often there is no understory at all. Typical associated shrub species are *Arctostaphylos glandulosa* var. *cushingiana*, *Garrya veatchii*, and *Quercus wislizenii* var. *frutescens*.

Chamise Chaparral (37200) and Interior Live Oak Chaparral (37A00): Santa Lucia manzanita dominates or sometimes mixes with *Lotus junceus* and *Adenostoma fasciculatum* on less steep ridgetops. Nearly pure stands of chamise form on some steep slopes, but they also mix with knobcone pine on ridgetops and upper slopes. Scrub oak (*Quercus berberidifolia*) and interior live oak most often occur near ridgetops where soil conditions are less amenable to Santa Lucia manzanita, but these three species may also occur together. The shrubby oak types sometimes occur on steep, rocky slopes from which chamise appears to be excluded and on the edges of knobcone pine stands, although rarely within them. Less common are *Garrya veatchii*, *Quercus durata*, *Pickeringia montana*, *Dendromecon rigida*, *Eriodictyon traskiae*, *Helianthemum scoparium*, *Rhamnus ilicifolia*, *Prunus ilicifolia*, *Cercocarpus betuloides*, *Artemisia californica*, and *Lupinus albi-frons*. Coulter pine (*Pinus coulteri*) is restricted to areas with rock outcrops, which have played a role helping the pine survive frequent fires in the area.

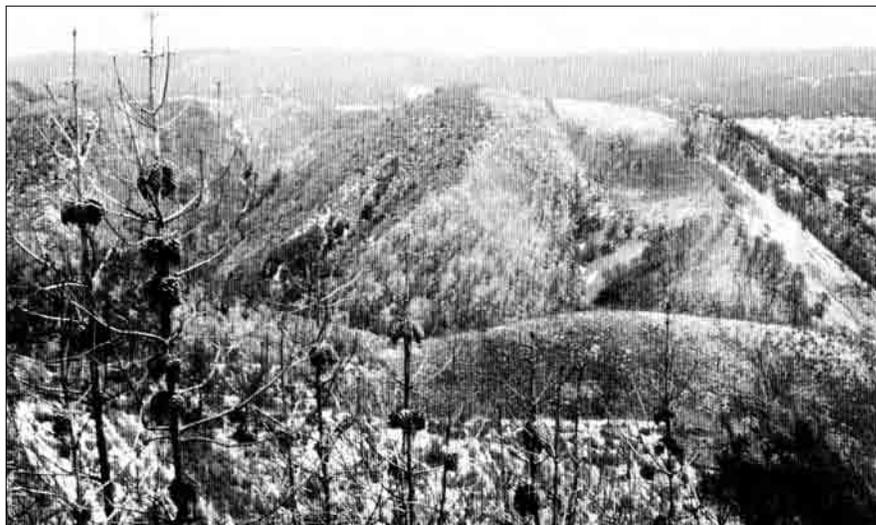


Figure 21—Black Butte, northeast view from near Mt. Lowe summit. This site had experienced fires in 1985 and 1994. (1995)

11. Blacks Mountain

Coast Live Oak Woodland (71160): Areas with deeper soils on S.-facing or sometimes W.-facing slopes have open, nearly pure stands of coast live oak. Associated shrubs are *Holodiscus discolor*, *Antirrhinum multiflorum*, *Rhamnus californica*, and *Lupinus albifrons*. Herbaceous species in the understory and openings are *Bromus diandrus*, *Pteridium aquilinum*, *Avena barbata*, and *Melica imperfecta*.

Mixed Evergreen Forest (81100): Mixed evergreen forest primarily occurs on higher N.-facing slopes or on lower sites where shading provides cool, moderately moist conditions. Biogeographically, this vegetation type is a remnant of the cool, moist, late-Pleistocene climates, and many species are near their S. range limits. The overstory is dominated by tanoak, canyon live oak, and madrone. Bigleaf maple (*Acer macrophyllum*), coast live oak, and California bay are locally important. In canyon bottoms these forests are more or less closed-canopied, reaching 66 ft (20 m). The understory is composed of a shrub layer and a diverse herbaceous layer. Where the forest extends upslope, the tree layer becomes shorter and more open and the herbaceous layer is sparse and has fewer species.

Fire History: Two major occurrences have been recorded, in 1985 and 1994. Vegetation and floristic observations before and after the 1994 fire are available from the ecological survey.

Plant Diversity

Two hundred seven taxa are listed.

Conflicting Impacts

Potential development of the Santa Margarita Ranch may increase horse use in the lowest portions of the canyon; however, the use is unlikely to be at levels detrimental to the RNA's integrity.

11. Blacks Mountain (no ecological survey, Pacific Southwest Forest and Range Experiment Station 1976)

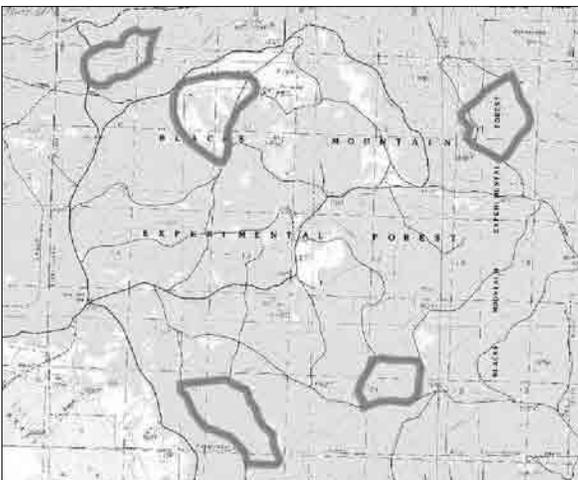


Figure 22—Blacks Mountain RNA

Location

This established RNA lies within the Blacks Mountain Experimental Forest on Lassen National Forest, Lassen County. It is approximately 45 miles (72 km) by road NW. of the town Susanville. The RNA consists of five separate compartments within parts of T33N, R7E and R8E MDM (40°40'N., 121°15'W.), USGS Poison Lake, Harrey Mtn., Corders Reservoir, and Straylor Lake 7.5' quads (fig. 22). Ecological subsection – Blacks Mountain-Susanville Peak (M261Dd).

Target Element

Interior Ponderosa Pine (*Pinus ponderosa*)

Distinctive Features

The RNA contains five compartments of virgin ponderosa pine forest (fig. 23), which is rather uncommon in NE. California. Ponderosa pine in the region, commonly called the eastside pine, was heavily logged in the late nineteenth century, then in the late 1920s it suffered severe losses to bark beetles. The RNA includes a good range of representation of ponderosa

pine forest, from inclusions of small areas of grassland and sagebrush flats with adjacent pure pine, to higher elevations where white fir (*Abies concolor*) and incense-cedar (*Libocedrus decurrens*) are associated commonly with pine.

Physical Characteristics

The RNA covers 521 acres (211 ha) at elevations from 5600 to 6400 ft (1707-1951 m). The surrounding area consists of high plateau at 5600 ft (1707 m), with mountains emerging to about 7000 ft (2133 m). Topography is relatively gentle, with slopes seldom exceeding 20-30 percent. The whole area is uniformly volcanic, the lava is basaltic, much of it vesicular. Soils are often shallow and contain varying amounts of boulders. No live streams exist on the experimental forest. Annual precipitation, principally snow, is 22.55 inches (5738 mm). Summers are dry, except for infrequent thunderstorms. Temperatures range from -15 to 85 °F (-26 to 29 °C).

Association Types

Eastside Ponderosa Pine (84220): Vegetation of the whole RNA is grouped into this type. Most of the RNA contains pure ponderosa pine forest with regenerations of white fir and incense-cedar. One compartment has ponderosa pine forest with openings of grass and sagebrush flats. In small areas of higher elevation, white fir codominates with ponderosa pine. Other trees found in the RNA are Jeffrey pine (*Pinus jeffreyi*) and western juniper (*Juniperus occidentalis*).

The most prominent brush species are greenleaf manzanita (*Arctostaphylos patula*), tobacco brush (*Ceanothus velutinus*), squaw carpet (*C. prostratus*), basin sagebrush (*Artemisia tridentata*), currants, gooseberries (*Ribes* spp.), snowberry (*Symphoricarpos* sp.), stone-fruits (*Prunus* spp.), and antelope brush (*Purshia tridentata*). Sedges (*Carex* spp.) and bunch grasses, predominantly represented by Idaho fescue (*Festuca idahoensis*), mountain brome (*Bromus marginatus*), and squirreltail (*Sitanion* spp.), are important components of the cover. The most characteristic forbs are mints (*Monardella* spp.), lupines (*Lupinus* spp.), and mule-ears (*Wyethia mollis*).

Plant Diversity

There are no plants listed in the establishment report except those mentioned above.

Conflicting Impacts

No major conflicts on the land uses of the RNA are observed. The USDA Forest Service Blacks Mountain Ecological Research Project includes four of the five RNA components in its long-term research. Two of the four RNA units have been prescribed burned, and all are fenced to exclude livestock.



Figure 23—Blacks Mountain,
view of ponderosa pine,
Compartment C4-21. (around
1975)

Note: for Bourland Meadow, see William B. Critchfield, #96

12. Bridge Creek (Keeler-Wolf 1985c, 1989d)

Location

This candidate RNA is on the Klamath National Forest, Siskiyou County, approximately 10 miles (16 km) NE. of Somes Bar. It occupies portions of sects. 23, 26, 27, 28, 34, and 35 T13N, R7E HBM (41°30'N., 123°21'W.), USGS Medicine Mtn., Orleans Mtn., and Forks of Salmon quads (fig. 24). It lies entirely within the Marble Mountain Wilderness. Ecological subsections – Upper and Lower Salmon Mountains (M261Af, M261Ag).

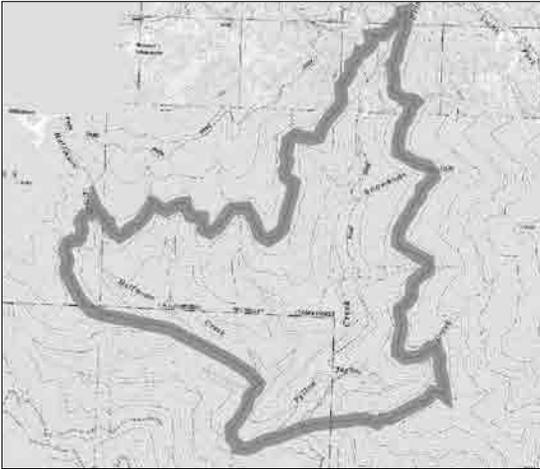


Figure 24—Bridge Creek cRNA

Target Element

Pacific Douglas-Fir (*Pseudotsuga menziesii*)

Distinctive Features

Old-Growth Douglas-Fir Forest: The majority of Douglas-fir/hardwood forest at Bridge Creek has not burned for more than 150 years. Thus, the forest has a distinctly multilayered structure. Tall (up to 220 ft, 67 m) canopy trees overlie a subcanopy of hardwoods and young conifers up to 120 ft tall (37 m), which overlies well-developed low tree, shrub, and herb strata (fig. 25). These mature, multilayered forests are uncommon in California and demonstrate the climax type of Douglas-fir forest. Young Douglas-fir is growing faster than white fir at mid-elevation and thus should continue to reproduce and dominate without the threat of takeover by white fir (*Abies concolor*).

Rare Plants: *Rubus nivalis*, a rare understory component of the upper elevation Douglas-fir/hardwood forest, is a member of CNPS List 2.

Giant Chinquapin (*Chrysolepis chrysophylla*) Reproduction: Giant chinquapin is the major hardwood subdominant in the Douglas-fir/hardwood forest of Bridge Creek. Compared to very mesic coastal sites and more xeric inland sites, this area has the highest rate of sexual reproduction for giant chinquapin and also the highest diversity of understory species (Keeler-Wolf 1988b). The first distinction is the result of mesic understory conditions allowing giant chinquapin seedlings to germinate and survive, but not to be so moist as to create extremely dense shrub understories, which shade out giant chinquapin seedlings.

Physical Characteristics

The area covers 1806 acres (731 ha) of mid- and lower slopes and creek bottoms along the middle portion of the Bridge Creek drainage, including the lower portion of Halfmoon Creek and the Yellowjacket Creek drainages. Elevations range from 2500 to 4200 ft (762-1280 m). All main slope exposures are represented, with E. and W. predominating. Topography is steep at the upper elevations and side valleys; it is moderately steep along Bridge Creek.

Rocks are Jurassic granitics of the Wolley Creek Pluton. Soil-mapping units include the Gilligan-Goldridge families association, Gilligan-Chawanakee families association, and Entic Xerumbrepts-Gerle family association. Average annual precipitation is estimated between 65 and 70 inches (1651-1778 mm) with much falling as snow above 4000 ft (1219 m). Maritime fog occasionally enters the lower valleys during summer. Mean annual temperature is estimated to be about 55 °F (12.7 °C) at the lowest elevations.

Association Types

Twenty-nine 100-m² plots were sampled in the Douglas-fir/hardwood forest. For additional sampling in this area, see Keeler-Wolf (1988a).

Douglas-Fir/Hardwood Forest (82420): 1400 acres (567 ha). On E.-facing plots, Douglas-fir dominates (basal area) 14 of 20 plots, and white fir dominates 6. On W.-facing plots, Douglas-fir dominates eight of nine plots and giant chinquapin dominates one. Importance values, (relative density + relative frequency + relative basal area) × 100, for all plots are: Douglas-fir 114, giant chinquapin 55, white fir 73, tanoak (*Lithocarpus densiflorus*) 8, sugar pine (*Pinus lambertiana*) 6, Pacific yew (*Taxus brevifolia*) 7, Pacific madrone (*Arbutus menziesii*) 4, Pacific dogwood (*Cornus nuttallii*) 15, *Acer circinatum* 13, incense-cedar (*Libocedrus decurrens*) 3, canyon live oak (*Quercus chrysolepis*) 1, bigleaf maple (*Acer macrophyllum*) 1, and *Salix scouleriana* 1. Total basal area cover is 163 m²/ha, and total stem density for trees is 1750/ha. Douglas-fir seedlings have the highest importance values, (relative density + relative frequency) × 100, whereas, among saplings, white fir has the highest values. Giant chinquapin follows white fir and Douglas-fir in sapling importance, but giant chinquapin seedlings are rare.

Sixteen species of shrubs and 36 species of herbs are noted in the sample. These species form a relatively dense ground cover averaging about 65 percent. The most important species include *Berberis nervosa*, *Quercus sadleriana*, *Rosa gymnocarpa*, *Rubus ursinus*, *Chimaphila umbellata*, *Goodyera oblongifolia*, *Achlys triphylla*, and *Linnaea borealis*.

Mixed Evergreen Forest (81100, 81320, 81400): 246 acres (100 ha). This association has a higher density of broad-leaved sclerophyllous evergreens than conifers. Typically, there is an overstory of Douglas-fir with less than 50 percent cover and a closed canopy of tanoak, Pacific madrone, and canyon live oak. On most sites tanoak is dominant. Most mixed evergreen forest in the area is on relatively xeric exposures (S. and W.) and characterized by numerous stems of 8-12 inches (20-31 cm) dbh tanoak with scattered clumps of Pacific madrone and scattered emergent Douglas-fir. Occasionally, there are areas with large tanoak and Pacific madrone up to 36 inches (91 cm) dbh. On steep upper xeric exposures, low shrubby canyon live oak may dominate (Holland 81320).

The understory is poorly developed on xeric exposures dominated by sclerophylls, but more mesic lower-slope sites may average 25 percent ground cover. Understory species include *Toxicodendron diversilobum*, *Chimaphila umbellata*, *Pyrola picta*, *Symphoricarpos mollis*, *Whipplea modesta*, *Iris* sp., *Rosa gymnocarpa*, *Arnica discoidea*, *Vicia americana*, *Pteridium aquilinum*, *Goodyera oblongifolia*, *Disporum hookeri*, *Bromus marginatus*, and *Polystichum munitum* var. *inbricans*.

White Fir/Douglas-Fir Forest (84240): 133 acres (54 ha). This is a transitional forest between upper-elevation white fir- and lower-elevation Douglas-fir-dominated forests. It occurs along the upper elevation boundary on N.-facing



Figure 25—Bridge Creek, old-growth Douglas-fir towering over understory of Pacific dogwood, Pacific yew, and giant chinquapin. (1984)

exposures. Douglas-fir usually dominates the canopy, with white fir strongly dominating the understory. Average canopy height is about 150 ft (46 m) with emergent Douglas-fir to 180 ft (55 m). As a result of heavy snows and shade, the shrub and herb layers are poorly developed, averaging 10-25 percent cover. Shrub species include *Corylus cornuta*, *Rubus parviflorus*, *Quercus sadleriana*, *Rosa gymnocarpa*, and *Paxistima myrsinites*. Herbs include *Apocynum pumilum*, *Anemone quinquefolia*, *Vancouveria hexandra*, *Achlys triphylla*, *Chimaphila umbellata*, *Smilacina racemosa* var. *amplexicaulis*, *Trillium ovatum*, *Penstemon anguineus*, *Trientalis latifolia*, and *Pyrola picta*.

Knobcone Pine (*Pinus attenuata*) Forest (83210): 29 acres (12 ha). Small areas of this vegetation occur in xeric upper slopes that may have incurred recent fires. Montane chaparral species form the understory and include *Quercus vaccinifolia*, *Arctostaphylos patula*, *Ceanothus velutinus*, and *Garrya fremontii*.

Riparian Zone (61510, 63500): No acreage given. The steep gradient of all of the streams and frequent high runoff tend to restrict riparian growth. However, sporadic clumps of riparian species occur along all of the major streams. Typical species adjacent to permanent water are *Alnus sinuata*, *Peltiphyllum peltatum*, *Salix* sp., and *Carex nudata*. In seasonally inundated alluvium away from the main streambeds, such species as bigleaf maple (*Acer glabrum* var. *torreyi*), white alder (*Alnus rhombifolia*), *Salix scouleriana*, *Petasites palmata*, *Aruncus vulgaris*, *Stachys rigida*, *Actaea rubra* ssp. *arguta*, *Penstemon deustus*, *Rubus leucodermis*, *Ribes sanguineum*, and *Castilleja miniata* occur.

Spring, Seep, and Rivulet (45400): No acreage given. Numerous small springs and other moist spots occur which vary in their degree of shadiness and moisture. The following species are typical: *Euonymus occidentalis*, *Cornus stolonifera*, *Rhododendron occidentale*, *Sorbus cascadiensis*, *Equisetum hymale* var. *robustum*, *Thelypteris oregana*, *Glyceria elata*, *Juncus effusus* var. *gracilis*, *Juncus xiphoides*, *Lotus oblongifolius* var. *nevadensis*, *Agrostis exarata*, *A. alba*, *Epilobium glaberrimum*, *E. angustifolium*, *Aralia californica*, *Carex nervina*, *Tellima grandiflora*, *Boykinia elata*, *Adiantum pedatum*, and *Aquilegia formosa*.

Plant Diversity

One hundred forty taxa are listed.

Conflicting Impacts

The area is relatively free of human alteration. A little-used trail passes through the area. The low elevation and steep slopes tend to discourage recreational use, despite its wilderness area status. Access to the area is somewhat difficult and time consuming, requiring a 4.5-mile (7.2-km), 3-hour walk to the central portion of the RNA.

13. Broom Flat (Broom Flat Ridge) (Burke 1992a)

Location

This candidate RNA is on the San Bernardino National Forest, 10 miles (16 km) S. of Big Bear City, San Bernardino County. It includes portions of sects. 25, 26, 35, and 36 of T2N, R2E (34°15'N., 116°45'W.), USGS Onyx Peak quad (fig. 26). Ecological subsection – Upper San Gorgonio Mountains (M262Bh).

Target Elements

Single-Leaf Pinyon (*Pinus monophylla*) and Pinyon-Juniper Woodland

Distinctive Features

Pinyon-juniper woodland distributes in the Great Basin (the basin lies between the Rockies and the Sierra Nevada) and Colorado Plateau regions. California's pinyon-juniper woodland is the westernmost extent of this widespread vegetation type. In the arid transmontane regions of California, pinyon-juniper woodlands occur on foothills, low mountains, plateaus, and mesas. In the Great Basin, the distribution of juniper and pinyon largely overlaps. However, in most of California, juniper and pinyon occupy relatively distinct ecological niches throughout their ranges. At Broom Flat Ridge, distributions of pinyon and juniper overlap to form a habitat strongly reminiscent of the typical Great Basin pinyon-juniper woodlands. Pinyon pine, western juniper (*Juniperus occidentalis* var. *occidentalis*), and mountain mahogany (*Cercocarpus ledifolius*) are all present in a wide range of age classes and widely distributed on the site. Notably large specimens of these species add great interest, as does the Great Basin aspect of the understory. This pinyon-juniper-mountain mahogany type is relatively uncommon in the San Bernardino Mountains. At Broom Flat Ridge and to the S., at Onyx Summit, are massive individuals of mountain juniper (*Juniperus occidentalis* var. *australis*) with trunk diameters of 6 ft (nearly 2 m) (fig. 27). These may be the oldest trees in S. California. With vegetation more typical of Modoc County in the far NE. of California, Broom Flat is unique to S. California.

Rare Flora: An unusual, disjunct stand of quaking aspen (*Populus tremuloides*), one of only two known occurrences in the San Bernardino Mountains, is found in a dry tributary of Arrastre Creek. *Astragalus leucolobus* (CNPS List 1B) and *Castilleja martinii* ssp. *ewanii* (Jepson Manual [Hickman 1993]: *Castilleja applegatei* ssp. *martinii*, also called *C. montigena* Heckard, Heckard's Indian paintbrush [CNPS List 4]) are also present within the cRNA boundaries.

Physical Characteristics

Broom Flat Ridge is a high-elevation, semi-arid site that shows characteristic desert influence. It lies E. of the main crest of the San Bernardino Range, in the rain shadow of San Gorgonio and Sugarloaf mountains. Elevations within the cRNA range from 7100 to 8095 ft (2165 to 2468 m). Slopes vary from 0° along the ridgetop to 43° along the steep terrain of W.- and E.-facing slopes. Several intermittent streams drain the ridge. Arrastre Creek runs along the W. boundary

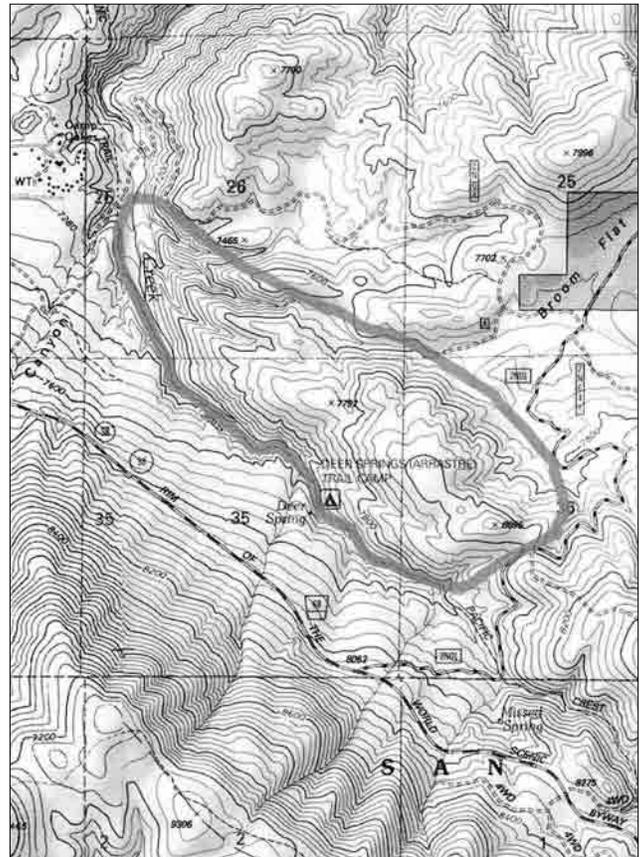


Figure 26—Broom Flat cRNA

of the cRNA. Deer Spring, a year-round spring except in severe drought conditions, occurs just outside the W. boundary of the site and feeds into Arrastre Creek at the Deer Springs Trail Camp on the Pacific Crest Trail.

Most of Broom Flat Ridge is composed of undifferentiated gneissic rocks of Precambrian age. A small area of Saragossa quartzite, a metasedimentary rock of Paleozoic age, is found along the ridgetop. Stream channels are filled with unconsolidated alluvium of very late Pleistocene and recent age, and a small area of intrusive plutonic rocks of Mesozoic age occurs near the S. boundary of the cRNA site. Soils are mapped as a single soil type, the Olete-Goulding families association. They are described as shallow to deep, well drained, and formed from material weathered from metamorphic rocks. Small areas of a deep, well-drained alluvial soil, the Morical and Hecker families complex, may occur inside the proposed E. boundary near Arrastre Creek along the Pacific Crest Trail.

The climate in the San Bernardino Mountains is characterized by infrequent winter rains and prolonged summer drought. Within the mountains, the varied terrain and elevation produce a wide range of local climatic conditions. Broom Flat Ridge is E. of the main crest of the mountain range and thus receives less precipitation than falls at the nearest year-round weather station, Big Bear Lake. No rainfall data are available for the site. Winter and summer temperatures should be comparable to those at Big Bear Lake, where average temperatures range from 30 to 65 °F (-1 to 18 °C), with extremes of 7 °F (-22 °C) and 87 °F (31 °C) possible. Frost-free days number about 100 per year.

Figure 27—Broom Flat, massive individuals of mountain juniper (*Juniperus occidentalis* var. *australis*), some with trunk diameters over 6 feet (1.8 m), on Broom Flat Ridge near Onyx Summit. These may be the oldest trees in southern California. (around 1991)



Association Types

Great Basin Pinyon Juniper Woodland (72121): 295 acres (118 ha). Due to the variety of slopes and exposures along the N.-S.-trending ridge, the percentage of tree cover, relative proportion of the dominant tree species, and understory vegetation vary significantly within a small area, and many variants of the vegetation type are found close together. On steep, dry slopes, mountain mahogany shares dominance with pinyon pine while scattered individuals of mountain juniper and Jeffrey pine (*Pinus jeffreyi*) together account for up to 10 percent of the tree cover. Bare ground or rock may cover 50 percent of such sites. On drier, upper slopes, Jeffrey pine drops out and pinyon-juniper tree cover increases. In this open woodland, species typical of the Great Basin occur as shrubby associates. *Artemisia tridentata*, *Chrysothamnus nauseosus*, *C. parryi*, *C. viscidiflorus*, and *Purshia glandulosa*, together with the grass *Sitanion hystrix*, can account for 5-30 percent cover. Other associated herbs and grasses occur in scattered locations but provide very little cover.

On the relatively flat, broad ridgetop at the S. end of Broom Flat Ridge, the pinyon-juniper woodland can be dense, with 40-60 percent tree cover. Tall specimens of mountain mahogany occur as dense stands or scattered individuals, and occasional Jeffrey pine and canyon live oak (*Quercus chrysolepis*) are also present. Needle duff about 0.5 to 3 inches (1 to 8 cm) deep occurs together with decomposing pine cones, and the shrub and herb layers are relatively sparse. Scattered in the understory are *Arctostaphylos patula*, *Chrysothamnus viscidiflorus*, *Artemisia tridentata*, *Astragalus leucolobus*, *Caulanthus major*, *Chenopodium fremontii*, *Cordylanthus filifolius*,

Cryptantha pterocarya var. *purpusii*, *Erigeron aphanactis*, *Eriodictyon angustifolium*, *Eriogonum* spp., and *Eriophyllum confertiflorum*. The cactus *Opuntia basilaris* var. *basilaris* occurs among the rocks throughout this woodland, and *Echinocereus engelmannii* is present on the main ridgetop. Gaps in the woodland are characterized by clumps of *Stipa coronata*, *Eriogonum kennedyi*, *Eriophyllum confertiflorum*, *Sitanion hystrix*, and *Opuntia basilaris*. Sites in the woodland with a grassy understory support relatively dense stands of *Poa fendleriana* or *Stipa coronata*. *Oryzopsis hymenoides* and *Stipa comata* are also associated with this pinyon-juniper woodland.

Great Basin Mixed Scrub (35100): 58 acres (23 ha). Species typical of Great Basin mixed scrub occur at Broom Flat Ridge as an important understory of the pinyon-juniper woodland, as noted above. On S.-facing slopes or other xeric sites, where tree cover decreases and may drop out completely, these species form patches of Great Basin mixed scrub. Extensive areas of bare ground or rock cover up to 50 percent at these sites. The moderately tall and fairly open shrub land is dominated by *Artemisia tridentata* and various *Chrysothamnus* species, most notably *C. nauseosus*. Shrub cover varies from 35 to 50 percent, with the grass *Sitanion hystrix* contributing 5-15 percent cover in places. *Stipa coronata*, *Bromus tectorum*, *Oryzopsis hymenoides*, *Leptodactylon pungens*, and *Galium angustifolium* are other typical associates in the sparse herbaceous layer. This vegetation occurs in relatively small patches, although an extensive patch with a few pinyon or Jeffrey pines in the overstory occurs on a S.-facing slope visible from a pullout of Highway 38.

Montane Manzanita Chaparral (37520): 12 acres (5 ha). Along the top of Broom Flat Ridge, near the center of the site, occurs an extensive patch of 6- to 15-ft (2- to 5-m) tall chaparral, dominated by *Arctostaphylos patula*, as a post-fire successional stage. This area is underlain by a different rock type, *Saragossa quartzite*, which may control the boundaries of the vegetation. Gaps in the chaparral support a sparse assemblage of plants, including *Artemisia tridentata*, *Sitanion hystrix*, *Cordylanthus filifolius*, *Hymenopappus filifolius* var. *lugens*, *Cryptantha pterocarya* var. *purpusii*, *Tetradymia canescens*, *Bouteloua gracilis*, and *Eriogonum parishii*.

Jeffrey Pine Forest (85100): 102 acres (41 ha). A narrow strip of a mesic, tall, open forest dominated by Jeffrey pine forms the W. boundary of the cRNA. It supports diverse understory shrubs and herbs typically found in riparian sites in the S. California mountains. The tree layer, predominantly Jeffrey pine, accounts for 30-40 percent cover, with occasional white fir (*Abies concolor*) and juniper in scattered locations. The shrub layer is diverse and changes in response to local environmental conditions such as slope, aspect, and soil moisture. Immediately along the creek is a distinct vegetation type, the southern willow scrub (63320). Thickets of *Salix lasiolepis*, with *Potentilla glandulosa* and *Carex senta* in the dense, shady understory, occur in a mosaic with the Jeffrey pine forest and sometimes with an overstory of Jeffrey pine. Away from the creek, but still on moist soils at relatively flat sites, the willows are joined by *Ceanothus cordulatus* and *Rosa californica*. *Artemisia tridentata* is found in scattered locations throughout, especially at the dry upper edge of the forest. Under an open tree layer, in some particularly mesic sites, are bright green swales consisting of a diverse mixture of herbs dominated by *Smilacina stellata* and *Solidago californica*. Frequent associates include *Artemisia ludoviciana*, *Geranium richardsonii*, *Mimulus pilosus*, *M. rubellus*, *Potentilla glandulosa*, *Stachys albens*, and *Taraxacum officinalis*. In more heavily wooded and drier sites, *Poa fendleriana*, *Sitanion hystrix*, and *Stipa comata* are typical grass associates. Shrubby elements include *Arctostaphylos patula* ssp. *platyphylla*, *Purshia glandulosa*, *Ribes cereum*, *Rosa woodsii*, and *Symphoricarpos parishii*.

Jeffrey pine forest also occurs along the E. margin of Broom Flat cRNA, often climbing the E. canyons. A variant of the Jeffrey pine forest is found in cold air

drainage basins along the top of Broom Flat Ridge. In these gently sloping ridgetop depressions, Jeffrey pine shares dominance with pinyon pine and mountain mahogany, accompanied by an understory of perennial grasses.

Aspen Forest (81800): 0.74 acres (0.30 ha). Near the N. tip of the cRNA is an unusual disjunct grove of quaking aspen. Although abundant E. of the Sierra Nevada crest and again in the mountains of Baja California, aspen is largely absent from the mountains of S. California. In the San Bernardino Mountains, it is found only here, along a tributary of Arrastre Creek, and on Fish Creek, just NE. of the San Geronio Wilderness. These two groves, separated from the nearest populations by more than 200 miles (322 km), are believed to be relicts from the late Pleistocene when the climate was much cooler and wetter. This zonal aspen forest can occur away from stream banks, and the transition between the aspen grove and other plant communities can be abrupt. The Arrastre Creek aspen grove occurs in a steep canyon, about 200 yards up a rocky, dry tributary amid a woodland typical of the upper limits of the Jeffrey pine forest. *Poa fendleriana* is the most widespread understory associate; others include *Artemisia dracuncululus*, *A. ludoviciana*, *A. tridentata*, *Carex* sp., *Eriophyllum lanatum*, *Erysimum capitatum*, *Galium* sp., *Leptodactylon pungens*, *Opuntia basilaris*, *Penstemon eatonii*, *Purshia glandulosa*, *Salvia pachyphylla*, *Stipa* sp., *Brickellia californica*, *Chrysothamnus nauseosus*, and *Echinocereus triglochidiatus*.

Species Diversity

Eighty-four plant species are listed.

Conflicting Impacts

Before 1900, mining occurred E. of Broom Flat and a sawmill was operated at Broom Flat itself. Although easily accessible by two Forest Service roads and bordered on the W. edge by the Pacific Crest Trail, the site is surprisingly free of disturbance. Hikers tend to stay near the trail, and Deer Springs Trail Camp has only a local impact. The most significant current disturbance is near the top of the ridge, near Road 2N01, where there is evidence of off-road parking, illegal firewood gathering, and some camping. A few fire rings can be found nearby. The impact of the campsites appears confined to this region and to several sites on the ridge near the E. boundary. Cattle may occasionally wander from a Bureau of Land Management allotment N. of the forest, but significant damage has not been documented. Feral burros are reported in this general area. Like the cattle, the burros' main impact on the site is some trampling and grazing.

Note: for Broom Flat Ridge, see Broom Flat, #13

14. Cahuilla Mountain (Keeler-Wolf 1986a, 1989j)

Location

This established RNA is on the San Bernardino National Forest, Riverside County. It is about 11 miles (18 km) SW. of the town of Idyllwild. The area lies within portions of sects. 4, 8, 9, and 17 of T7S, R2E SBBM (33°35'N., 116°47'W.), USGS Cahuilla Mountain quad (fig. 28). Ecological subsection – San Jacinto Mountains (M262Bm).

Target Elements

Coulter Pine (*Pinus coulteri*) and California Black Oak (*Quercus kelloggii*)

Distinctive Features

Coulter Pine: Coulter pine woodland reaches its optimum development in the mountains of S. California (Holland 1986). This RNA contains diversely developed, well-defined stands of this vegetation showing a range from scattered old trees, to a large cohort of trees 50-60 years old, to a number of saplings and seedlings.

California Black Oak: California black oak vegetation is widespread in California, but varies in its components and site characteristics. The stands of black oak at Cahuilla Mountain represent great variation in density, successional state, and associated species. They range from pure and relatively dense black oak, to open black oak savanna, to mixed woodlands of pine and oak.

Native Grass- and Herb Lands: The openings dotting the summit of the area are dominated by native herbs, grasses, and subshrubs that often have been swamped out by aggressive non-natives in such openings elsewhere in S. California. These openings have been free of livestock grazing for many years and are a mixture of coastal sage, Great Basin sagebrush, mid-montane, and valley grassland species (fig. 29). In some cases they occur as a melange, and in some cases as distinct units. The close association of so many different biogeographic elements, which are often separated by many miles, offers some unique research opportunities.

Rare Plant: A population of *Delphinium hesperium* ssp. *cuyamaca* (CNPS List 1B) occurs in one of the grassy openings.

Successional Trends: There is a dynamic relationship between the major vegetation types in the area based on the frequency and intensity of fire. Several forms of chaparral are presently giving way to Coulter pine and black oak vegetation. The date and extent of the last fire in the area is known (1928), and there is a record of aerial photos extending back to at least 1948. These baseline data coupled with analysis of growth and colonization rates of the principal species could provide many answers to questions regarding sound ecological guidelines for fire management of these vegetation types.

Physical Characteristics

The original survey area covers 880 acres (356 ha). Final established boundaries include 929 acres (376 ha). Elevations range from 4360 ft (1329 m) at the NE. corner to 5635 ft (1718 m) atop the S. summit of Cahuilla Mountain. However, the majority of the area lies above 5200 ft (1585 m). The RNA encompasses the summit and upper slopes of the mesa-like mountain. All slope exposures are well represented.

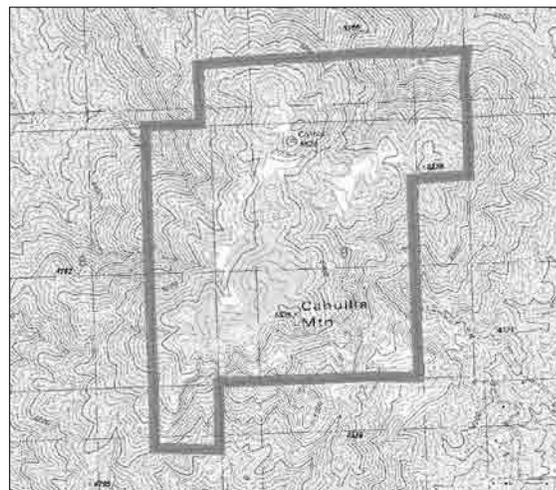


Figure 28—Cahuilla Mountain RNA



Figure 29—Cahuilla Mountain, large southeast-facing open herbland with black oak savanna on crest of hill. (1985)

Mean annual temperature for the mountain is about 53 °F (11.7 °C). Snow falls regularly in the winter. Average annual precipitation is estimated at 25 inches (635 mm).

Association Types

The vegetation of the black oak and Coulter pine forests and woodlands was sampled using the point-centered quarter technique (20 points). The remaining vegetation types are described qualitatively. The black oak savanna and Coulter pine-black oak vegetation are considered together in the survey but separated in the establishment record.

***Arctostaphylos* Chaparral (37520):** 220 acres (89 ha). There are two forms; both occur on the summit on gentle-to-moderate slopes. The first, the mixed *Arctostaphylos* chaparral, occurs on SE.-facing slopes and is dominated by *Arctostaphylos pringlei* var. *drupacea*, *A. glandulosa*, *Adenostoma fasciculatum*, and *Quercus wislizenii* var. *fructescens*. The second is the *Arctostaphylos parryi* var. *drupacea* type. It occurs on NE.-facing slopes on deeper soils than the former type. Both types are apparently successional to black oak woodland and Coulter pine forest. Invading Coulter pines in both types are about 20-30 years old and 20-26 ft (6-8 m) tall. Herb cover is sparse and restricted to small openings between the shrubs.

Coulter Pine-Black Oak Woodland (84140, 71120): 200 acres (81 ha). This association and the related black oak savanna form a complex in the RNA. The Coulter pine forest is the most variable of these two types, with mixed composition pine-oak woodlands prevalent in the SW. part of the RNA and Coulter pine-chaparral more common in the NE. portion. These mixed woodlands consist of various stocking levels of Coulter pine and black oak, from relatively large stands of robust specimens adjacent to grassland to early successional stands invading *Arctostaphylos* chaparral. The largest Coulter pines reach 4 ft (1.2 m) dbh and 75 ft (23 m) tall.

At eight points sampled in the mixed pine-oak phase, Coulter pine is stocked twice as densely as black oak, covers more than twice the basal area of oak, and occurs at all points versus 75 percent of points for black oak.

The area is underlain by two rock types. The spectacular S. escarpment is composed of Cretaceous granitic rock (S. California Batholith); the remainder of the rocks are part of a series of older (as old as Carboniferous) intrusive and migmatic rocks (principally granitics and gneiss, with small areas of schist and marble). Soils have been divided into four map units: Morical and Wind River families complex 15-30 percent slopes; Trigo family-Lithic Xerothents, Warm complex 50-75 percent slopes; Lithic Xerothents, Warm-Rock Outcrop complex 50-100 percent slopes; and Rock Outcrop.

Mean density of trees throughout the entire complex is 160/ha, with black oak averaging 9.6 m²/ha and Coulter pine averaging 5.1 m²/ha basal area (total basal area 14.8 m²/ha). Coulter pine has seedlings associated with 35 percent, and black oak 15 percent, of the 20 points sampled.

Understory vegetation is made up of scattered shrubs of *Arctostaphylos pringlei* and *A. glandulosa* with many of the herbs and grasses also represented in the herb land-grassland vegetation type. The most common species include *Eriophyllum confertiflorum*, *Bromus carinatus*, *Galium angustifolium*, *Eriogonum wrightii*, *Castilleja martinii*, *Agoseris grandiflora*, *Vicia americana*, and *Koeleria macrantha*. Much of this vegetation in the SW. portion of the RNA appears to have recently invaded the herb land-grassland.

Interior Live Oak (*Quercus wislizenii*) Chaparral (37A00, 71150, 81330): 190 acres (77 ha). This type is divided in the ecological survey into woodland chaparral and escarpment chaparral, but it is merged, following Holland's system in the establishment record. On steep, rocky NE.-facing slopes, it is the most mesic of the local chaparrals, verging on a woodland or forest with some individual interior live oak and canyon live oak (*Quercus chrysolepis*) up to 16 ft (5 m) tall and 6 inches (15 cm) dbh. However, in most areas the oaks are shrubby. The relatively mesic and diverse understory consists of *Cercocarpus betuloides*, *Ceanothus integerrimus*, *Garrya veatchii*, *Fraxinus dipetala*, *Solanum xantii*, *Polystichum munitum*, *Dryopteris arguta*, *Monardella macrantha*, *Melica imperfecta*, and *Tauschia arguta*.

In contrast, the escarpment phase is the most open form of chaparral locally, with only scattered *Q. wislizenii* var. *frutescens*, shrubby canyon live oaks, and several understory plants characteristic of rock outcrops. These include *Mimulus longiflorus*, *Zauschneria californica* ssp. *latifolia*, *Haplopappus squarrosus*, *Lotus argophyllus*, *Eriogonum saxatile*, *E. davidsonii*, *Poa nevadensis*, and *Selaginella asprella*.

Scrub Oak Chaparral (37900, 37110): 150 acres (61 ha). This is a diverse chaparral consisting of dense shrubs 6.5-13 ft (2-4 m) in height. It occurs on relatively open N.-facing exposures. Scrub oak (*Quercus dumosa*) dominates marginally over other shrubs including *Cercocarpus betuloides*, *Adenostoma sparsifolium*, *A. fasciculatum*, *Arctostaphylos glandulosa*, *Fraxinus dipetala*, *Quercus wislizenii* var. *frutescens*, *Keckiella antirrhinoides*, *Rhamnusi licifolia*, *Ribes malvaceum*, *Ceanothus cuneatus*, and *Haplopappus squarrosus* ssp. *grindeloides*.

Herb Land-Sage Vegetation (32500, 35210, 35400, 42110, 42200): 51 acres (21 ha). This association is divided into four subtypes. Although all have different dominants, there are a number of shared subdominants, and the environmental characteristics of all subtypes are similar. They are described below:

Artemisia tridentata dominates the *Artemisia* herb land. It is restricted to a small 4-acre (1.6-ha) area on deep granitic soil with a gentle, mostly S.-facing aspect. The main body is dense sagebrush with few understory species, but marginal areas support a diversity of herbs and subshrubs (23 species listed), including *Vicia americana*, *Linanthus lemmonii*, *Lupinus excubitus* var. *austromontanus*, *Eriogonum wrightii*, *Eriophyllum confertiflorum*, *Frasera parryi*, and *Solidago californica*. This vegetation appears stable, with little change from aerial photos taken in the 1940s.

Open herb land occurs adjacent to *Artemisia* herb land and in several other patches on W.- and SW.-facing slopes. All of the species associated with the *Artemisia tridentata* subtype also occur along with a number of others, including *Microseris lineariloba*, *Lotus strigosus*, *Camissonia bistorta*, *Lupinus bicolor*, *Penstemon centranthifolius*, *Eriastrum filifolium*, *Phacelia distans*, *Arabis sparsiflora* var. *californica*, and *Gilia capitata*. Grasses are uncommon in this subtype.

Salvia herb land is dominated by *Salvia apiana*. This subtype occurs in patches bordering open herb land and chaparral, on soils shallower than the open herb land but deeper than chaparral. Diversity and density of plants are less than in the previous open herb land subtype, but included are many of the same subdominants such as *Eriogonum wrightii*, *Galium angustifolium*, and *Penstemon centranthifolius*. The native grasses *Stipa coronata*, *Melica californica*, and *Koeleria macrantha* are conspicuous in some areas. Like the *Artemisia* herb land, this subtype is relatively stable. It is similar to the sage scrub communities described by Holland (1986) and other authors.

The herb land-grass subtype contains a significant mixture of grasses. These species vary from exposed xeric sites (with annual species such as *Bromus tectorum* and *Vulpia megalura*) through open W.-facing slopes with *Elymus condensatus*, *Koeleria macrantha*, *Sitanion longifolium*, and *Melica californica*, to relatively mesic depressions and swales dominated by *Muhlenbergia rigens*.

A rather sparsely vegetated variant, the *Chrysothamnus*-herb land, occurs on loose granitic soil in one area in the W. portion of the RNA. *Chrysothamnus teretifolius* and *Eriogonum wrightii* codominate with scattered *Frasera parryi*, *Penstemon centranthifolius*, *Arenaria douglasii*, *Nemacladus ramosissimus*, *Viola purpurea* ssp. *xerophyta*, *Linanthus ciliatus*, *L. dianthiflorus*, *Trichostema lanceolatum*, and *Cryptantha micrantha*.

Black Oak Savanna (71120, 81340): 41 acres (17 ha). This association is best developed in two patches adjacent to grassland in the NW. portion of the area where a savanna or a forest type may occur. Individual black oaks may be more than 3.3 ft (1 m) dbh (largest 5.3 ft, 1.6 m). The largest individuals are fire scarred. The understory of the oak savanna is dominated by herbs and grasses. This understory is taller and lusher (in spring) than adjacent, open herb land. Dominant species include *Bromus diandrus*, *B. tectorum*, *B. carinatus*, *Collinsia heterophylla*, *Galium aparine*, *Solidago californica*, *Artemisia ludoviciana*, *Montia perfoliata*, *Delphinium parishii*, and *Madia gracilis*. These savannas grade into the Coulter pine-black oak woodland on shallower soils. The few small areas of high-density black oak have dense and mesic understories dominated by such species as *Symphoricarpos mollis* and *Thalictrum fendleri*.

One small seep (Holland 45400) is associated with a dense black oak forest. It has several hydrophilic herbs including *Aquilegia formosa*, *Juncus textilis*, *Carex fracta*, and *Stachys rigida*.

Chamise Chaparral (37200): 31 acres (13 ha). This association occupies the steep, xeric, S.-facing slopes at the lowest elevations. It is dominated by *Adenostoma fasciculatum*, which often occurs in nearly pure stands. Other associated species are few and include *Yucca whipplei*, *Lotus scoparius*, and *Penstemon centranthifolius*. It is a low, dense chaparral with a very sparse understory.

Plant Diversity

One hundred fifty-eight taxa are listed in the establishment record.

Conflicting Impacts

The area will likely require prescribed burning to maintain the mixture of chaparral, Coulter pine, and black oak vegetation. The area receives moderate recreational use (principally day hiking), but there is little visible impact.

15. Cedar Basin (Keeler-Wolf 1982, 1989e)

Location

This recommended RNA (rRNA) is on the Shasta-Trinity National Forest. It is about 12 miles (19 km) SW. of the town of Mount Shasta. The area falls partly within sects. 30, 31 T39N, R5W and sects. 25, 36 T39N, R6W MDBM (41°12'N., 122°27'W.), USGS Seven Lakes Basin and Mumbo Basin quads (fig. 30). Ecological subsection – Upper Scott Mountains (M261Aj).

Target Element

Port Orford-Cedar (*Chamaecyparis lawsoniana*)

Distinctive Features

Port Orford-Cedar: The stands of Port Orford-cedar at this site are at the highest known elevation (up to 6400 ft, 1950 m). These make up part of the inland distribution of the species concentrated along the headwaters of the Trinity and Sacramento rivers. This inland distribution is geographically separate from the more coastal stands of NW. California and SW. Oregon which have suffered varying degrees of infection from the introduced and lethal root rot *Phytophthora lateralis*. This inland population may be genetically distinct from the coastal populations. The rRNA encompasses an entire basin and thus affords good protection from the waterborne fungus. A variety of vegetation types are associated with Port Orford-cedar (POC) in this area, including Shasta red fir (*Abies magnifica* var. *shastensis*), lodgepole pine (*Pinus contorta* ssp. *murrayana*), mixed conifer, and mountain hemlock (*Tsuga mertensiana*) forests.

Rare Plants: A new species of manzanita (*Arctostaphylos klamathensis*) was discovered at Cedar Basin as a result of field studies for this ecological survey (Edwards and others 1983). A member of CNPS List 1B, this species is also listed as sensitive species by Shasta-Trinity National Forests. Additional rare species include *Polystichum lonchitis* (CNPS List 3), *Darlingtonia californica* (CNPS List 4), *Lilium washingtonianum* var. *purpurascens* (CNPS List 4), and *Carex gigas* (CNPS List 4). There is also a distinctive population of *Penstemon rupicola* with purple-blue flowers (flowers are typically rose red), which may be an undescribed taxon.

Zoological Values: A number of uncommon vertebrate predators are known in the RNA. These include spotted owl (*Strix occidentalis*, California species of special concern), pine marten (*Martes americana*, Forest Service-listed sensitive species), mountain lion (*Felis concolor*), fisher (*Martes pennanti*, Forest Service-listed sensitive species), and wolverine (*Gulo gulo*, State-listed threatened species).

Paleoenvironment: A pollen core sample has been taken from Cedar Lake in the rRNA and represents a continuous record of more than 10,000 years (West 1986). Analysis has shown a shift from cool-moist climate through warm-dry, and back to cool-moist periods over the record.

Physical Characteristics

The ecological survey covers 972 acres (394 ha). Elevations range from 5420 ft (1652 m) along the upper Sacramento River to 7149 ft (2179 m) atop the ridge on the SW. edge of the area. The survey area lies at the head of the S. Fork of the Sacramento River. The basin is oriented to the NE. and has had all of its major features shaped by Pleistocene glaciation. The basin contains 10 permanent or

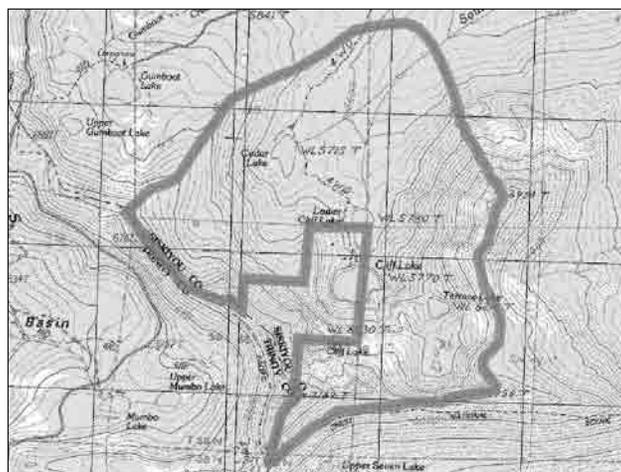


Figure 30—Cedar Basin rRNA

semipermanent lakes and ponds, several lateral moraines, polished gabbro bedrock, and peridotite morainal deposits (both rock types from the Trinity Ultramafic Pluton). Soils of six major mapping units occur in the area. These are Jumpe-Zeb families, Endlich-Typic Cryaquolls, Craggs family-rubbleland-Nanny complex, Toadlake-Hungary families, basic intrusive rock outcrop, and Inville-Jayar complex. Precipitation falls mostly as snow from November through March with a yearly average estimated at 60-80 inches (1524-2032 mm).

Association Types

Vegetation sampling was conducted in several of the forest associations. Ten 0.1-ha plots were sampled in relatively open coniferous vegetation, including five on serpentinite mixed conifer and five in red fir-mountain hemlock forest. Five additional 100-m² plots were sampled in Port Orford-cedar forest. The remaining associations are described qualitatively.

Mixed Conifer Forest (84180, 85420): 392 acres (159 ha). Two subtypes occur in this area: an open xeric subtype growing on SE.-facing serpentinite glacial moraine and a more mesic subtype growing on gabbro at the lower elevations of the basin. The serpentinite subtype was sampled, and results indicated basal areas ranging from 23.9 to 69.6 m²/ha and tree densities of 180-971 per hectare. Dominance is traded among Jeffrey pine (*Pinus jeffreyi*) on driest exposures, white fir (*Abies concolor*) and Douglas-fir on mesic low sites, and western white pine (*Pinus monticola*) on upper elevation sites. Incense-cedar (*Libocedrus decurrens*) is widely scattered throughout. The open understory is dominated by scattered clumps of *Quercus vaccinifolia*, *Arctostaphylos nevadensis*, and other mountain chaparral shrubs. Within the cRNA, two shrubs (*Rhamnus californicus* ssp. *occidentalis* and *Ribes roezlii*) appear locally restricted to this type.

The gabbro subtype differs by its high abundance of Shasta red fir and lodgepole pine. All other tree species from the serpentinite subtype also occur here, although Jeffrey pine and incense-cedar are less important in this subtype than in the serpentinite subtype. The moist aspect of this association and, perhaps, a more fertile substrate than the previous subtype combine to create a denser canopy and understory. Although the understory is dominated by mountain chaparral species, *Chrysolepis sempervirens* is often most important, and some mesophilic species such as *Leucothoe davisiae* and *Vaccinium arbuscula* are locally common.

Herbs and subshrubs are widely scattered in both subtypes, although a much higher diversity of species occurs on the gabbro subtype (21 species listed as characteristic). A few, such as *Lupinus croceus*, *Eriophyllum lanatum* var. *lanceolatum*, *Calystegia malacophylla*, *Lotus crassifolius*, *Angelica californica*, and *Cirsium andersonii*, seem locally restricted to the serpentinite subtype.

Mountain Chaparral (37510, 37542): 213 acres (86 ha). This association covers large areas of shallow, rocky soil, especially on the W.-facing slopes. Dominants are *Quercus vaccinifolia*, *Arctostaphylos nevadensis*, and *A. patula*. Other important shrubs are *Ceanothus prostratus*, *Amelanchier pallida*, and *Holodiscus boursieri*; the latter is particularly abundant on stabilized talus and rock outcrops. *Prunus emarginata*, *Ceanothus velutinus*, and *Chrysolepis sempervirens* are locally important. The endemic *Arctostaphylos klamathensis* dominates locally W. and SW. of Terrace Lake. A number of herbs (26 of the most common species are listed) occur in this association, many of which are shared with the xeric rock outcrop association. Large portions of the mountain chaparral are not rapidly succeeding to coniferous vegetation, probably as a result of the xeric exposure and poor, ultramafic, rocky soil.

Red Fir-Mountain Hemlock Forest (85310, 86210): 192 acres (78 ha). This association dominates on all N. exposures at higher elevations. Five plots were

sampled. Basal area ranges from 34.0 to 87.9 m²/ha, and density ranges from 561 to 2392 trees/ha. The forest ranges from dense, closed stands of primarily red fir on NE. and NW.-facing plots to stands dominated by mountain hemlock with some lodgepole pine in cold, mesic valley bottoms to open, senescent red fir forest and, finally, to very open forest codominated by red fir, western white pine, and lodgepole pine on very rocky soils. In the establishment record, this association is broken down into mountain hemlock (139 acres, 56 ha) and red fir (53 acres, 22 ha) forests. However, there is much overlap, and even at the highest, snowiest portions of the basin, mountain hemlock is not usually exclusively dominant.

The understory of open forests is dominated by mountain chaparral shrubs. The endemic *Arctostaphylos klamathensis* is locally important, covering up to 60 percent in some areas of the Terrace Lake subbasin. In closed-canopy, shady stands, the understory is sparse, with scattered herbaceous species such as *Chimaphila umbellata*, *Pyrola picta*, and *Corallorhiza maculata* predominating. *Leucothoe davisiae*, *Vaccinium arbuscula*, *V. scoparium*, *Anemone quinquefolia* var. *minor*, and *Pyrola secunda* occur in mesic stands. Stature of the dominant trees is somewhat smaller than other sampled red fir areas in the N. Sierra Nevada (e.g., Mount Pleasant RNA and Onion Creek ecological survey area). This may be the result of the relatively poor, rocky, gabbroic soil.

Port Orford-Cedar Forest (82500): 74 acres (30 ha). This is an edaphic association reliant upon permanent moisture. POC forest fringes all of the major lakes and streams in the basin. Two subtypes are distinguishable: a bottomland form occurring around Lower Cliff and Cedar lakes as well as around the slow-flowing portions of the Sacramento River at the lower elevations, and a rocky streamside and lakeshore type that occurs at the upper elevations along fast-flowing streams and around Cliff and Terrace lakes (fig. 31).

The bottomland type has the highest density stands of any forest in the area, averaging 4033 trees/ha (range 2900-5300 trees/ha). POC strongly dominates (total mean cover 80 m²/ha, of which POC comprises 73 percent). The trees are shallow rooted, and because of the saturated soil, they are often windthrown. The understory is usually littered with fallen trunks. Shallow, boggy, water-filled depressions left by uprooted trees are plentiful. Saplings and seedlings of POC are common in the understory. Understory shrubs and herbs form a dense cover in many areas. Hydrophilic, shade-tolerant species predominate, including *Ledum glandulosum*, *Gaultheria humifusa*, *Leucothoe davisiae*, *Physocarpus capitatus*, *Alnus tenuifolia*, *Cornus stolonifera*, *Darlingtonia californica*, *Linnaea borealis*, *Allium validum*, *Listera convallarioides*, *Caltha howellii*, and *Athyrium filix-femina* (20 species listed as characteristic). Much of this forest, despite its moist substrate, appears to have suffered a fire about 100 years ago.

The streamside rocky lakeshore type of POC forest has lower densities but higher basal area than the previous type. This subtype has the highest basal area of any forest in the cRNA, up to 226 m²/ha. The largest POC in this type is about 4 ft (1.2 m) dbh; it is estimated to be 400-500 years old. The understory species in this type includes *Leucothoe davisiae*, *Goodyera oblongifolia*, *Chimaphila umbellata*, *Pyrola picta*, *Vaccinium arbuscula*, *Pteridium aquilinum* var. *pubescens*, and *Pedicularis semibarbata*.

Figure 31—Cedar Basin,
steep streamside Port
Orford-cedar forest along
outlet to Terrace Lake with
saplings of mountain hemlock
and shasta red fir. (1987)



Rock Outcrop (91200): 76 acres (31 ha). A large portion of the upper elevation is open, rocky slopes and cliffs. This environment harbors a group of herbaceous or sub-shrubby plants growing in crevices and small hollows in the rocks. The species may be divided into mesic and xeric groups. Many of the xeric type also occur in mountain chaparral and include *Penstemon rupicola*, *Sitanion hystrix*, *Lewisia leana*, *Arenaria nuttallii* ssp. *gregaria*, *A. congesta*, *Eriogonum umbellatum*, *Sedum obtusatum* ssp. *boreale*, *Juncus parryi*, and many others (28 species listed as characteristic).

The mesic type includes such species as *Cryptogramma acrostichoides*, *Adiantum pedatum* var. *aleuticum*, *Polystichum lonchitis*, *P. lemmonii*, *Athyrium alpestre*, *Phyllodoce empetriformis*, *Casiope mertensiana*, *Romanzoffia sitchensis*, *Carex spectabilis*, *Saxifraga ferruginea*, and many others (30 species listed as characteristic).

Shallow Lakes and Ponds (52430): 25 acres (10 ha). With the exception of Cliff Lake and Terrace Lake, all 10 ponds and lakes in the basin have a zone of aquatic vegetation. Cedar Lake and Lower Cliff Lake have the best-developed aquatic associations. Characteristic species include *Isoetes occidentalis*, *I. bolanderi*, *Nuphar polysepalum*, *Menyanthes trifoliata*, *Potamogeton natans*, *Sparganium angustifolium*, *Scirpus validus*, *Heleocharis montevidensis* var. *parishii*, *Dulichium arundinaceum*, and *Carex rostrata*.

Bog and Meadow (51120, 45100): No acreage given. Well-developed bogs occur at Cedar and Lower Cliff lakes. These consist of both raised hummocky areas topped with ericaceous shrubs and lower mucky areas dominated by *Darlingtonia californica* and various members of the *Cyperaceae*. The raised areas support a near-continuous layer of the shrubs *Kalmia polifolia* var. *microphylla*, *Ledum glandulosum*, *Vaccinium occidentale*, and *Spiraea douglasii*. *Drosera rotundifolia*, *Tolfieldia glutinosa* ssp. *occidentalis*, *Narthecium californicum*, *Carex buxbaumii*, and *Carex aquatalis* are characteristic of the edges of the hummocks.

The low mucky bog is dominated by *Darlingtonia californica*, *Heleocharis montevidensis*, *Carex ormantha*, *C. integra*, *Aster alpigenus* ssp. *andersonii*, and *Hastingsia* (*Schoenolirion*) *alba*. A number of other species occur where more soil has developed such as near inlet streams and lakes. Fifty species are listed as characteristic of this association. Meadow vegetation is not well developed in the area and is grouped with bog vegetation in the ecological survey.

Plant Diversity

Two hundred sixty taxa of vascular plants are listed in the establishment record, an updated version of the list in the ecological survey.

Conflicting Impacts

The major impacts on the Cedar Basin cRNA include camping, woodcutting, and the threat of root rot disease.

16. Church Dome (Keeler-Wolf 1989g, 1991d)

Location

This established RNA is on the Sequoia National Forest and lies entirely within the Dome Land Wilderness, which is part of the Cannell Meadow Ranger District. It is located in the far S. end of Kern Plateau in the Sierra Nevada, bordering the Mojave Desert and the foothills of cismontane California. The trailhead is approximately 52 miles (84 km) from Kernville. The RNA is included in portions of sections 1, 2, 11, 12, and 13 T24S, R34E and sections 6, 7, and 18 T24S, R35E MDM (35°52'N., 118°15'W.), USGS White Dome and Cannell Peak quads (fig. 32). Ecological subsection – Kern Plateau (M261Eu).

Target Element

Jeffrey Pine (*Pinus jeffreyi*)

Distinctive Features

The Jeffrey pine forest of the RNA is the only one selected to represent this target element for the S. part of Sierra Nevada ecological section. Additionally, this RNA is distinct because, compared to the more clearly Great Basin flora of other Jeffrey pine forest areas (i.e., Indiana Summit RNA), the Jeffrey pine forest here is composed of more cismontane California flora with an infusion of S. Sierra Nevada and S. California endemics.

The RNA also supports a range of habitats for the Jeffrey pine. At low elevations, the Mojave Desert and California woodland elements intermingle with the Jeffrey pine vegetation. At upper elevations, other typically Sierran montane elements (white fir [*Abie concolor*] and sugar pine [*Pinus lambertiana*]), are present.

S. Sierra Nevada Endemics: *Ceanothus pinetorum*, *Gilia leptantha* ssp. *purpusii*, *Frasera tubulosa*, *Orochaenactis thysanocarpha*, *Cordylanthus ferrisianus*, *Ivesia campestris*, and *Linanthus oblanceolatus*.

S. Extents: A number of typical Sierran montane species are at or near their S. limits. These include *Chaenactis douglasii* var. *rubricaulis*, *Heuchera rubescens* var. *alpicola*, *Monardella odoratissima* spp. *parviflora*, *Silene bridgesii*, *Cynoglossum occidentale*, *Stipa pinetorum*, *Oreonana clematis*, *Arnica mollis*, *Erigeron peregrinus* ssp. *callianthemus*, and *Lupinus grayi*.

Fire History: The most recent fire occurred approximately 50 years ago. This is evident by small fire scars on some Jeffrey pine trees at mid-elevations. In another area, a small stand of mountain mahogany (*Cercocarpus* spp.) appears to have been rejuvenated by fire.

At the highest elevation, along the ecotone with Jeffrey pine-fir, occurs a small, even-aged stand of Jeffrey pine approximately 90 years old. This stand appears to have regenerated after a fire approximately 100 years ago.

Rare Plants: No Federally-listed endangered or rare plants are known to occur in the area; however, habitat for *Nemacladus twisselmannii* (CNPS List 1B) lies within the RNA.

Cultural: The RNA was part of the Tubatulabal group whose primary staple crops were acorns and pinyon nuts (Smith 1978).

Zoological: The Goshawk (*Accipiter gentilis*) is a Forest Service-listed sensitive species. The presence of several types of lower elevation species of birds (i.e., wren-underscores the area's affinity to desert and lowland cismontane habitat.

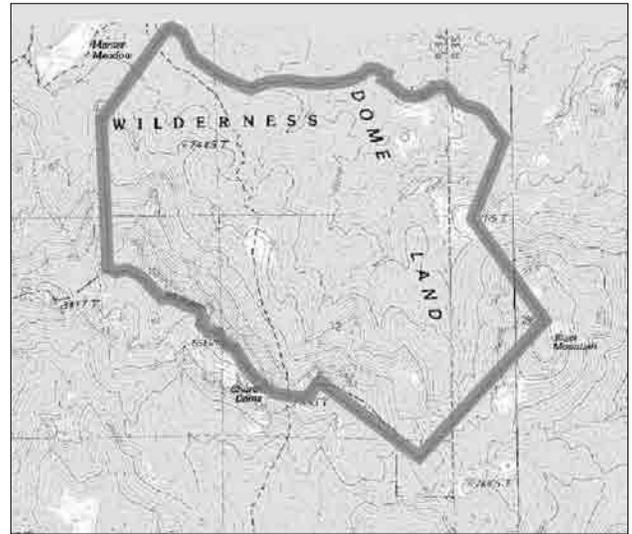


Figure 32—Church Dome RNA

Physical Characteristics

The area covers 1380 acres (558 ha) between 6640 and 8515 ft (2024-2595 m). The highest slopes are shear granite cliffs. Above 7600 ft (2317 m), the area is steep and NE.-facing. The RNA occupies a part of the SE.-flowing Manter Creek drainage. All streams within the RNA are ephemeral, drying typically by early summer, except for one perennial spring occurring near the N. boundary.

The RNA is underlain primarily by granitic basement rocks; it is part of the Sierra Nevada batholith (a huge area of Cretaceous granitic rock covering the majority of the S. Sierra Nevada). In general, the granitics of the RNA outcrops are coarse-textured with large porphyritic boulders and many phenocrysts of plagioclase and quartz.

Jointing planes of granitic rock play an important role in shaping the topography. A small area along the SE. boundary is Pleistocene basalt flow. It forms the top and sides of Black Mountain (approximately 50 m thick). The Jeffrey pine forest on the basalt here has substantially different understory than on the granitic substrate.

The order-three soil survey of Sequoia National Forest divides the soil into four mapping units: 1) Rock outcrop-Brader-Siskiyou families complex (20-60 percent slope, shallow) occupies the largest area at middle elevations. Also included in this unit are small areas of Dome, Chaix, and Chawanakee soils. 2) Chaix-Chawanakee-Rock complex (5-30 percent slope). Included in this unit are small areas of Dome and Holland soils. This soil unit has the largest Jeffrey pines and the fastest growth rate within the Jeffrey pine forest. 3) Rock outcrop consists of small to very large outcrops of granitic rocks; and 4) Rock outcrop-Xerotherms association (30-50 percent slope) occurs on the slopes and top of Black Mountain.

Temperatures are mild with highs of 80-85 °F (26.6-29.4 °C) in late July and lows of 20-25 °F (-6.6 to -3.9 °C) in the winter. Snowfall is light (10-25 inches [25.4-63.5 cm]). The SW. arm of the Sierra Nevada creates a rain shadow, so that the RNA receives only 20-25 inches (508-635 mm) of precipitation per year. This rain-shadow effect, augmented by the area's association with the Mojave Desert, contributes to the xeric aspects of the RNA.

Association Types

Jeffrey Pine Forest (85100): 1075 acres (435 ha). This association covers the majority (approx. 80 percent) of the area below 7600 ft (2317 m) elevation. The Jeffrey pine forest of the RNA is varied, ranging from mature, multi-age forests on gently-sloping flats and terraces to young, even-aged forests on steep slopes. The density of the forest also varies from open stands (shallow, rocky soils of S. exposure) to dense stands (stream courses).

The canopy is almost pure Jeffrey pine (89 percent cover); however, a few other trees also occur. At upper elevations, in a narrow belt of Jeffrey pine, individuals of California black oak (*Quercus kelloggii*) and occasional individuals of incense-cedar (*Libocedrus decurrens*) are found. A small Jeffrey pine forest atop Black Mountain represents a more mixed forest with species such as canyon oak (*Quercus chrysolepis*), single-leaf pinyon (*Pinus monophylla*), white fir, and western juniper (*Juniperus occidentalis* ssp. *australis*) (fig. 33).

The forest is open with scattered shrubs of montane chaparral species such as *Arctostaphylos patula* and *Ceanothus pinetorum* intermixed with Great Basin desert species such as *Purshia tridentata*, *Tetradymia canescens*, *Chrysothamnus nauseosus* spp. *albicaulis*, and *C. viscidiflorus*. The understory averages about 25 percent cover, although some areas have up to 50 percent cover (mostly *Arctostaphylos patula*). There are at least 39 species of herbs, but only a few, such as *Eriogonum umbellatum*, *Gilia leptantha* spp. *purpusii*, *Orochaenactis thysanocarpha*, and *Gayophytum diffusum* are relatively high in frequency. The average tree density is

231 trees/ha. The average basal area cover is 25.1 m²/ha. Seedling and sapling density are low (average is 92 saplings/ha, 5 seedlings/ha), 95 percent of which is Jeffrey pine. Most of the seedlings and saplings are found in deep, stream-bottom soils. The Jeffrey pines average 80 ft (24.4 m) tall and 30 inches (76.2 cm) dbh, but some can reach up to 110 ft (35.5 m) tall and 54 inches (132.3 cm) dbh.

Jeffrey Pine-Fir Forest (85210): 204 acres (83 ha). This association occurs on NE.-facing slopes at upper elevations. The forest is codominated by Jeffrey pine and white fir (white fir dominating at higher elevations), with a small percentage of sugar pine.

Compared to the Jeffrey pine forest association, this area has a higher density and basal area (310 trees/ha, 39.6 m²/ha). Total sapling density is 250/ha (72 percent white fir, 24 percent Jeffrey pine, 4 percent sugar pine), and seedling density is 40/ha (50 percent white fir, 25 percent Jeffrey pine, 25 percent sugar pine), which is 8 times the seedling density of the Jeffrey pine forest association. In general, the Jeffrey pine trees here are larger than in the Jeffrey pine forest association (35-40 inches [89-102 cm] dbh).

Great Basin Pinyon Woodland (72122): 52 acres (21 ha). This association is limited to the W. slopes and N. summit area of Black Mountain. It occurs primarily on basaltic flow or colluvium and is dominated by low trees (about 7-11 m tall) of single-leaf pinyon pine bordered by Jeffrey pine on less steep and rocky slopes. Some canyon oak also occur. Tree density is the highest in the RNA (1040 trees/ha). Basal area cover is 42.2 m²/ha. The understory vegetation is sparse with a mean cover of 9 percent, probably due to heavier duff and more shade. The two most common shrubs are Great Basin sagebrush (*Artemisia tridentata*) and bitterbrush (*Purshia tridentata*).



Freshwater Seep (45400): 3 acres (1.2 ha). This association is limited to the perennially moist spring in the N. part of the RNA. This habitat is also approximated along branches of S. Manter Creek. Surface water is absent here through most of the summer, but sufficient moisture exists to support a limited version of the spring and seep vegetation. Species associated with the spring and streambeds include *Arnica mollis*, *Artemisia ludoviciana*, *Juncus mexicanus*, *J. macrandrus*, *Carex nebrascensis*, *C. hassei*, *C. fracta*, *C. teneraeformis*, *Nasturtium officinale*, and *Madia elegans* ssp. *wheeleri*.

Alpine Talus and Scree (91200): 46 acres (19 ha). The area represented in the RNA is not technically alpine, but the cliffs and colluvial deposits around Church Dome support a small number of montane species typical of high-elevation, rocky situations. The association is divided into mesic and xeric subtypes. The mesic subtype occurs in crevices on NE.-facing slopes. It includes species such as *Potentilla saxosa* ssp. *sierrae*, *Heuchera rubescens* var. *alpicola*, *Senecio fremontii* var. *occidentalis*, *Silene bridgesii*, and *Stipa pinetorum*. The xeric subtype includes *Penstemon newberryi*, *Zauschneria latifolia*, *Eriogonum saxatile*, and *Haplopappus cuneatus*.

Plant Diversity

At least one hundred sixty-four species of vascular plants were collected for the area.

Figure 33—Church Dome, the upper northeast-facing slopes at the base of Church Dome. The forest is co-dominated by Jeffrey pine and white fir. Manter Meadow is in the middle distance with the Sierretta Peak highlands in the far distance across the upper Manter Creek drainage. (1988)

Conflicting Impacts

The area receives little recreational impact. The trail through the W. portion of the RNA has some light use. A small cement cap (dated 1931) is in place at the head of the spring, and the spring itself is scooped out and dammed at this spot to provide a basin for dipping water.

There is evidence of past grazing use, but no current grazing occurs, and there appears to be no habitat alteration as a result of past usage.

Forest litter is minimal, and the need for controlled burning is low.

17. Clark Fork (Keeler-Wolf 1991b)

Location

This candidate RNA is on the Stanislaus National Forest in Tuolumne County. The boundary includes all or portions of sects. 33 and 34, T7N, R20E, and sects. 3, 4, 5, 8, 9, 10, 15, 16, and 17 T6N, R20E MDBM (38°23'N., 119°48'W.), USGS Dardanelle and Dardanelle Cone quads (fig. 34). Ecological subsection – Upper Batholith and Volcanic Flows (M261Eh).



Figure 34—Clark Fork cRNA

Target Element

White Fir (*Abies concolor*)

Distinctive Features

White Fir Forest: The entire range of white fir dominance is present. Stands of white fir include dense, young, even-aged groves dating back to fires approximately 90 years ago, mature mesic and rocky N. slope stands, and highly productive mature bottomland stands on alluvium.

Red Fir Forest: The area also contains good examples of red fir (*Abies magnifica*) forest ranging throughout its entire local elevational distribution. Patches of mountain hemlock (*Tsuga mertensiana*), lodgepole pine (*Pinus contorta* ssp. *murrayana*), and whitebark pine (*P. albicaulis*) occur in the subalpine zone along with large areas of subalpine dry meadow scree and talus

communities.

Hydric Associations: These associations are well represented in the area, ranging from wet to dry subalpine and montane meadows and including mountain alder (*Alnus tenuifolia*) riparian thickets and patches of black cottonwood (*Populus trichocarpa*) and aspen (*P. tremuloides*) along the lower elevation creeks.

Ecological Diversity: Ecological diversity and integrity are high within the cRNA. Its value, beyond being a white fir study area, is substantial and is associated with its extension to the crests of the mountains within an area of low human impact.

Rare Flora: *Cryptantha crymophila*, a member of the CNPS List 4 (Skinner and Pavlik 1994), occurs on volcanic soils of the upper elevations in scree and open rocky meadows. This taxon is endemic to the mountains of Tuolumne and Alpine counties.

Physical Characteristics

The Clark Fork ecological survey area covers 2160 acres (874 ha); only 460 acres (186 ha) are proposed as a cRNA in the Forest Plan. The survey area occupies a portion of the N. slopes of the Bald Peak-Red Peak divide, separating the Clark Fork Drainage on the N. from the upper Middle Fork of the Stanislaus River Drainage to the S. All drainages in the cRNA empty into the W.-flowing Clark Fork. Overall topographic relief is substantial, ranging from about 6000 ft (1829 m) along the Clark Fork to 9836 ft (2998 m) atop the highest peak, a range of 3836 ft (1169.2 m).

The majority of the cRNA is underlain by Mesozoic granitics of the Sierra Nevada Batholith. Above 8500 ft (2591 m), the volcanic rocks of the Stanislaus formation dominate, forming a cap over the granitics. At Bald Peak the thickness of this formation is more than 1000 ft (305 m). There is little metamorphism or transition between the two principal rock types. Both types may exhibit steep topography, but the volcanics are frequently more spectacular, with glacially carved cirque headwalls and strangely eroded badlands.

The cRNA probably receives an average annual precipitation between 50 and 60 inches (1270-1524 mm). The mean annual temperature at 6600 ft (2012 m) is approximately 44-46 °F (6.7-7.8 °C). Snow loads on steep slopes at the upper elevations commonly reach critical mass, and most ravines and drainage ways show evidence of recent avalanche scouring.

Association Types

Ten 10- x 10-m plots were sampled along a transect at 75-m intervals in four of the five major phases in the Sierran white fir forest.

Sierran White Fir Forest (84240): 603 acres (244 ha).

Alluvial Phase: This phase is located along the valley floor of the Clark Fork. It is characterized by a productive forest strongly dominated by white fir, but with scattered old Jeffrey pine (*Pinus jeffreyi*). The density of fallen trunks and snags of large Jeffrey pine here suggest that this forest was codominated by Jeffrey pine and white fir about 200 years ago. The relative increase of white fir over the last century may relate to low fire frequency, increasing warmth, and high precipitation 50-100 years ago. Site conditions include relatively deep alluvial soil with widely scattered boulders, level-to-gently-sloping terrain, and mesic soil moisture conditions. The alluvial stands have the highest basal area cover of any forest type in the survey area and the highest density of trees, saplings, and seedlings of any of the sampled forest types.

Transitional Phase: A transitional zone between the alluvial stands and the upper slope successional stands is dominated by 65- to 80-year-old white fir within a matrix of montane chaparral. Soils are rocky with scattered boulders on mostly NW. exposures. Moisture conditions are more xeric and slopes steeper than in the alluvial type. The history of this transitional forest is different than that of the previous type, largely due to a fire that affected the area about 90 years ago. Monospecific stands of young white fir are in areas where the fire crowned extensively. Much of this forest also shows clear evidence of a seral stage of montane chaparral before the dominance of white fir. The steep, NW.-facing slopes still have a high percentage of *Quercus vaccinifolia*, *Arctostaphylos nevadensis*, and *Chrysolepis sempervirens* shrubs surviving in the understory (fig. 35), while the gently sloping

Figure 35—Clark Fork, successional white fir phase on WNW.-facing slope ca. 6900 ft (2103 m), NE 1/4 sec. 8. Note rocky patch of *Quercus vaccinifolia*-dominated montane chaparral surrounded by even-aged 80-year-old white fir. (1989)



areas have only skeletal remnants of the chaparral understory. Some of the largest, and probably oldest, trees in the white fir zone occur in this transitional forest, although they are widely scattered. These include white fir up to 72 inches (1.82 m) dbh, sugar pine (*Pinus lambertiana*) up to 60 inches (1.52 m) dbh, Jeffrey pine up to 50 inches (1.27 m) dbh, and incense-cedar (*Libocedrus decurrens*) up to 84 inches (2.13 m) dbh. Many of these larger trees show evidence of repeated ground fire, in contrast to the alluvial site, which has few fire-scarred trees. Understory species are sparse with very little cover, probably a result of the xeric, relatively shady understory with few openings and thick duff.

North Slope Phase: The steep N. aspect and rocky granitic soil of this phase tend to slow the growth of the dominant white fir. Sugar pine and Jeffrey pine are occasional members of the canopy, but they are less constant than in the transitional phase. Rare individuals of western white pine (*Pinus monticola*) and red fir occur, increasing in abundance above about 7000 ft (2156 m). Exposure and substrate probably account for the lower density and cover of trees here, while a high diversity of understory species relates to mesic understory conditions and light afforded by small rocky openings. The most common shrubs and herbs here include *Quercus vaccinifolia*, *Symphoricarpos acutus*, *Acer glabrum* var. *torreyi*, *Hieracium albiflorum*, *Ribes roezlii*, *Erigeron breweri*, *Osmorhiza chilensis*, *Gilia leptalea*, *Phacelia racemosa*, *Thalictrum fendleri*, *Kelloggi agalioides*, and *Deschampsia elongata*.

Mixed Conifer Phase: This upper-elevation mixed conifer forest is typically dominated by Jeffrey pine on W.-facing exposures while white fir dominates on the NW.-facing slopes. Sugar pine and incense-cedar are most important in the canopy at lower elevations (< 6600 ft, 2012 m). Slopes average between 20 percent and 45 percent, and the soil is largely rocky and 20-30 inches deep. On the lower slopes in the most highly mixed stands, dominant sugar pine and Jeffrey pine are regularly more than 180 ft (55 m), with the tallest reaching 200 ft (61 m). The understory cover is relatively high, with scattered clumps of montane chaparral species dominating. Shrub and herb diversity is moderately low. Understory species most commonly include *Quercus vaccinifolia*, *Arctostaphylos nevadensis*, *Chrysolepis sempervirens*, *Ribes roezlii*, *Chaenactis douglasii*, *Stipa columbiana*, *Ceanothus cordulatus*, *Symphoricarpos acutus*, and *Apocynum pumilum*.

Successional Phase: This phase is dominated by young poles of white fir emerging through a varying cover of mixed montane chaparral. It is the result of extensive crown fire on much of the W.- and NW.-facing slopes between 6400 and 8000 ft (1950-2438 m). Few older trees survived this fire, which occurred approximately 90 years ago. Densities are variable, with high density clumps separated by rocky open areas dominated by *Arctostaphylos nevadensis* and *Quercus vaccinifolia*. Semi-shaded understories are dominated by *Chrysolepis sempervirens*. Herbs are sparse and include such species as *Penstemon laetus*, *Allium campanulatum*, *Arabis platysperma*, *A. holboellii* var. *retrofracta*, *Gayophytum* sp., *Eriogonum nudum*, and *Monardella odoratissima* ssp. *pallida*. The effects of the past crown fire reach up into the red fir forests above 8000 ft (2438 m) on some W.-facing slopes.

Red Fir Forest (85310): 585 acres (237 ha). The red fir forest is well developed on both volcanic and granitic substrates from elevations as low as about 7000 ft (2134 m) on sheltered NE.-facing slopes to about 8800 ft (2682 m) on W.-facing ridges. White fir is a significant component of the lower-elevation red fir stands but quickly drops out within a few hundred vertical feet of the point where red fir canopy dominance begins. Western white pine is a constant low-density tree at low and mid-elevations, but it assumes greater importance at the upper elevations where small, nearly pure groves occur on both granitic and volcanic substrates between 8400 and 8800 ft (2560-2682 m). Both Jeffrey pine and Sierra

juniper (*Juniperus occidentalis* ssp. *australis*) are of low importance in the red fir forest and are associated with rocky, xeric sites. Mountain hemlocks are present in small quantities, usually as small understory trees on high-elevation N. slopes. In general, red fir forests on granitic soils tend to be more open, with a higher representation of understory species than those on volcanics. Understory components of the granitic stands include *Arctostaphylos nevadensis*, *Quercus vaccinifolia*, and *Chrysolepis sempervirens*. *Acer glabrum* var. *torreyi* is common on steep, rocky N.-facing slopes. Herbs include *Chrysopsis breweri*, *Erigeron breweri*, *Haplopappus whitneyi*, *Stipa occidentalis*, *Poa nervosa*, *Stephanomeria lactucina*, *Senecio integerrimus*, *Juncus parryi*, and *Ivesia lycopodioides*.

Rock Outcrop Communities (91200): 231 acres (94 ha). Much of the upper elevation terrain of the study area is very steep and composed of colluvial deposits or bedrock outcrops of granitic or volcanic rock. The flora of these cliff and talus areas is of relatively low diversity and includes *Sedum obtusatum* ssp. *boreale*, *Cheilanthes gracillima*, *Eriogonum umbellatum* ssp. *stellatum*, *Ipomopsis aggregata*, *Agastache urticifolia*, *Leptodactylon pungens*, *Arenaria kingii*, and *Eriogonum marifolium*. Species such as *Astragalus lentiginosus* var. *ineptus*, *Polemonium pulcherrimum*, *Eupatorium occidentale*, *Juncus parryi*, *Pellaea breweri*, *Melica stricta*, and *Erigeron compositus* appear to be strongly associated with volcanic outcrops.

Montane Chaparral (37510): 209 acres (85 ha). The montane chaparral may be either successional or edaphic climax. The successional types include those associated with white or red fir forests whose canopies were destroyed in the most recent extensive fires, about 90 years ago, and those associated with avalanche chutes. Edaphic climax chaparral occurs adjacent to granitic outcrops in small areas throughout the middle and lower elevations. Regardless of successional history, most montane chaparral in the area is similar in composition. *Quercus vaccinifolia* is the overall dominant, typically forming dense stands 3-5 ft (0.9-1.5 m) in height. Associated with this species are other shrubs such as *Ceanothus cordulatus*, *C. velutinus*, *Chrysolepis sempervirens*, and *Arctostaphylos nevadensis*. Other subordinate species include *Holodiscus boursieri*, *Prunus emarginata*, and *Ribes montigenum*. Herbaceous species are generally scarce.

Montane Riparian Scrub (63500): 206 acres (83 ha). Mountain alder and several species of willow (*Salix* spp.) form dense thickets associated with seeps, rivulets, and streams throughout the study area. Alder-dominated thickets are the most widespread; they are largely restricted to the granitic slopes of the lower and middle elevations. These alder runs typically line plunging ravines and narrow canyons that are frequently scoured by avalanches. Other shrubs associated with the mountain alder thickets include *Ribes nevadense*, *Cornus stolonifera*, and occasional *Salix ligulifolia*, *S. lutea*, and *S. scouleriana*. Beneath the canopy of 3- to 4-m tall shrubs is a lush layer of herbs and grasses. Mountain alder thickets are occasional at lower elevations on slopes not subjected to avalanches. Here they line low-gradient streams and seepy areas where they occasionally are joined by aspen and black cottonwood. At upper elevations, 8400-9000 ft (2560-2743 m), mountain alder is replaced by *Salix orestera*.

Dry Subalpine-Meadow (45220/91120): 135 acres (55 m). W.- and SW.-facing, moderately steep slopes on volcanic soil are dominated by a low-density herbaceous and subshrub cover. Herb density and diversity are greater than on adjacent granitic terrain or volcanic cliff and talus slopes, but because volcanics are at higher elevations than the granitics, it is difficult to separate the effects of climate and substrate on the vegetation. The subalpine steppe vegetation consists of the following herbs and subshrubs: *Anemone drummondii*, *Artemisia arbuscula*, *A. douglasiana*, *A. rothrockii*, *Castilleja breweri*, *Crepis acuminata*,

18. Cleghorn Canyon

Cryptantha crymophila, *Dicentra uniflora*, *Erigeron barbellatus*, *E. compositus*, *Erigonum ovalifolium* var. *nivale*, *E. umbellatum*, *E. wrightii* var. *subscaposum*, *Eriophyllum lanatum* var. *monoense*, *Geum canescens*, *Haplopappus acaulis*, *H. bloomeri*, *H. macronema*, *H. suffruticosus*, *Linum lewisii*, *Lomatium nevedense*, *Monardella odoratissima* ssp. *pallida*, *Orthocarpus copelandii*, *Penstemon bridgesii*, *Phacelia frigida*, *Phlox caespitosa* ssp. *ulvinata*, *Poa epilis*, *Ribes cereum*, *Senecio canus*, *Sitanion hystrix*, *Stipa occidentalis*, *Symphoricarpos vaccinoides*, *Thelypodium flexuosum*, and *Wyethia mollis*. Occasional trees of Sierra juniper (*Juniperus occidentalis* var. *australis*), western white pine, whitebark pine, mountain hemlock, red fir, and lodgepole pine also occur; most are stunted as a result of the highly exposed locations and shallow soils.

Wet Subalpine-Alpine Meadows (45210): 6 acres (2.4 ha). The only sizable areas of nonshrubby vegetation with permanently wet to moist soil occur on volcanic substrates at high elevations. Several well-developed meadows occur in the subalpine zone. Each is dominated by a different set of species largely depending upon moisture availability. The most extensive wet meadows occur along the drainage immediately to the N. of Bald Peak. Dominant species include *Allium vailidum*, *Delphinium glauca*, *Calamagrostis canadensis*, *Carex jonesii*, *C. nebrascensis*, *Cardamine breweri*, and *Veratrum californicum*. Other meadows on SW.-facing slopes contain such species as *Aster foliaceus* var. *parryi*, *Dodecatheon alpinum*, *Mimulus primuloides* var. *pilosellus*, *Helenium hoopesii*, *Gentiana calycosa*, *Arnica mollis*, *Veratrum californicum*, *Carex abrupta*, *C. gymnoclada*, *C. illota*, *Phleum alpinum*, *Sphenosciadium capitellatum*, and *Epilobium hornemannii*.

Plant Diversity

Two hundred twenty-seven taxa of vascular plants are listed.

Conflicting Impacts

Despite proximity to the Clark Fork campground and horse camp, little recreational use is made of the cRNA. Cattle grazing has occurred in the past, and there are indications of previous overgrazing. There is no significant impact from any logging operation.

18. Cleghorn Canyon (White 1994)

Location

This candidate RNA is on the Cajon Ranger District of the San Bernardino National Forest in San Bernardino County. It is approximately 20 miles (32 km) N. of San Bernardino. Its boundaries include portions of sections 4, 5, 6, 7, 8, 9, and 10 of T2N, R5W, and section 32 T3N, R5W SBBM (34°17'N., 117°25'30"W.), USGS Cajon quad (fig. 36). Ecological subsection – San Gorgonio Mountains (M262Bg).

Target Element

The cRNA was established to represent several plant communities in the Transverse Ranges (Southern California Mountains and Valleys ecological section). These communities include southern sycamore-alder riparian woodland (previously unrepresented in the RNA system), white alder riparian forest, and bigcone Douglas-fir-canyon oak forest.

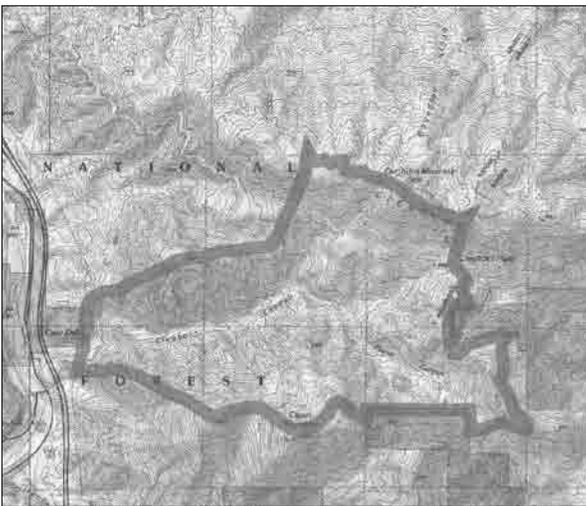


Figure 36—Cleghorn Canyon cRNA

Distinctive Features

The cRNA encompasses a nearly undisturbed watershed (Cleghorn Canyon). It contains a range of habitat types, all nearly contiguous to the canyon bottom (fig. 37). More than 90 percent of the 285 plant species in the cRNA are native to the area.

In addition to its diversity of plant communities, the cRNA plays an important role as the only suitable corridor for movement of large mammals between the San Gabriel and San Bernardino Mountain Ranges.

Rare Plants: No State- or Federally-listed threatened or endangered plant species are known to occur in the cRNA. The cRNA contains three CNPS listed species of known occurrence and five with a high probability of occurrence. The three species of known occurrence are *Boykenia rotundifolia* (CNPS List 4) above stream channels, *Calochortus plummerae* (CNPS List 1B) in chaparral and oak shrubland, and *Erigeron breweri* var. *bisanctus* (CNPS List 1B) on dry slopes and washes. The five additional species expected to occur but not observed are *Muhlenbergia californica* (CNPS List 1B), *Phacelia mohavensis* (CNPS List 4), *Rupertia rigida* (CNPS List 4), *Scutellaria bolanderi* ssp. *austromontana* (CNPS List 1B), and *Streptanthus campestris* (CNPS List 1B). Also, a cactus (*Opuntia basilaris* var. *brachyclada*), listed as sensitive species by the San Bernardino National Forest, is present 2 miles (3 km) to the N. of the cRNA. Suitable habitat for this cactus exists within the cRNA.

The three riparian communities in the cRNA are recognized by the California Department of Fish and Game as rare and of high priority for protection.

Rare Fauna: Spotted owls (*Strix occidentalis occidentalis*, California species of special concern) nest within the cRNA. Cleghorn Canyon likely serves as a connection to other suitable breeding habitats in the San Gabriel and San Bernardino Mountains.

Three native frogs are recognized by the San Bernardino National Forest as sensitive species and by state as species of special concern: California red-legged frog (*Rana aurora draytonii*, also a species proposed as an endangered species by the U.S. Fish and Wildlife Service), foothill yellow-legged frog (*R. boylei*), and mountain yellow-legged frog (*R. mucosa*). None have been recorded in the cRNA, but a small possibility exists that they could occur there. The speckled dace (*Rinichthys osculus*), a California species of special concern, occurs downstream in Cajon Wash, but it is predicted to seek refuge in Cleghorn Wash during high sediment loads. The San Diego horned lizard (*Phrynosoma coronatum blainvillei*) and the coast patch-nosed snake (*Salvadora hexalepis virgultea*), both listed as California species of special concern, occur in the cRNA.

Several California species of special concern and Forest Service-listed sensitive bird species nest in or migrate through the cRNA. These include Wilson's warbler (*Wilsonia pusilla*), purple martin (*Pogon subis*), yellow warbler (*Dendroica petechia brewsteri*), Cooper's hawk (*Accipiter cooperi*), sharp-skinned hawk (*Accipiter striatus*), and golden eagle (*Aquila chrysaetos*). Although not



Figure 37—Cleghorn Canyon,
view west from Cleghorn Pass,
elevation 4545 ft (1385 m).
(1993)

observed within the cRNA, the prairie falcon (*Falco peregrinus anatum*) and least Bell's vireo (*Vireo bellii pusillus*), both State- and Federally-listed as endangered, are known to nest near Cleghorn Canyon.

Four mammals listed as San Bernardino National Forest management special emphasis species occur in the cRNA: mountain lion (*Felis concolor*), mule deer (*Odocoileus hemionus*), western gray squirrel (*Sciurus griseus*), and black bear (*Ursus americanus*).

Fire History: Major fires in the watershed occurred in 1921 and 1964.

Cultural: A long-abandoned homesite with a cabin and a few pieces of concrete foundations can be found near the canyon floor. Remains of the foundations of several structures are found further upstream; the cabins probably washed away in the 1930s or 1940s.

Physical Characteristics

The area covers 1880 acres (761 ha) at an elevation of 2900-5300 ft (884-1615 m). The cRNA is on the W. slope of the San Bernardino Mountains and encompasses most of the Cleghorn watershed, the boundaries of which correspond to the cRNA boundaries. The San Gabriel Mountains lie to the W., and the Mojave Desert lies N. of the cRNA. A few miles S. is the urbanized San Bernardino Valley, an E. extension of the Los Angeles basin. Topography of the cRNA is dominated by steep mountain sides facing N. and S., divided by Cleghorn Creek and its tributaries, trending from E. to W. Vegetation varies greatly as one progresses down the slope.

Almost all bedrock in the cRNA is metamorphic (*quartz diorite gneiss*). Other areas are mapped as granodiorite, fanglomerate, "Crowder formation" sandstone and gravel, and surface gravel. Two fault lines cross the cRNA.

Soils are predominantly shallow and rocky with little horizon development and are dry throughout the profile for much of the year. Most are entisols in the Xerotherm great group. Other soils are from the Xerosamment and Xerofluvent great groups.

The cRNA has a Mediterranean type climate characterized by hot, dry summers and mild, rainy winters. Most precipitation falls as rain or snow (upper elevations) during the winter and spring months. Thunderstorms bring some summer precipitation. No permanent weather stations exist in the cRNA. Average annual precipitation is estimated between 34 and 41 inches (865-1043 mm), based on climate data of Lake Arrowhead (11 miles [18 km] E. with an elevation comparable to the cRNA's highest areas) and Lytle Creek Ranger Station (4 miles [6 km] SW. with an elevation comparable to the lowest point of the cRNA). Temperature at the cRNA is estimated to be 5 °F (summer) to 9 °F (winter) (3-5 °C) warmer than at Lake Arrowhead, where the average annual temperature is 51 °F (11 °C), average July temperature is 69 °F (21 °C), and average January temperature is 37 °F (3 °C). Fog often covers lower Cleghorn Canyon in spring and early summer; it may be responsible for Cleghorn Canyon's moderate temperatures and distinctly cismontane character even though it is near the Mojave Desert. Cajon Pass, approximately 3 miles (1.9 km) NW. of the cRNA, is one of the major funnel areas for Santa Ana winds, which increases the risk of wildfire spreading into the cRNA.

Association Types

Canyon Oak Forest-Bigcone Douglas-Fir (84150): This association is the dominant forest type in the cRNA. It occurs on N.- and E.-facing slopes above about 3800 ft (1158 m), and in steep, N.-facing drainages nearly to the canyon floor. The trees occur in both young and mature stands. The younger stands contain small canyon oak (*Quercus chrysolepis*), incense-cedar (*Libocedrus*

decurrens), and a few bigcone Douglas-fir (*Pseudotsuga macrocarpa*). The understory is sparse and contains scattered plants of *Toxicodendron diversilobum*, *Ribes roezlii*, *Bromus tectorum*, *B. diandrus*, *Agoseris* sp., *Elymus* sp., and various tree seedlings. There appear to be no bigcone Douglas-fir trees that predate the most recent fire. The more mature stand is composed of canyon oak and bigcone Douglas-fir in many size classes up to 30 inches (80 cm) dbh. Incense-cedar and bigleaf maple (*Acer macrophyllum*) (along the stream channel) also occur in the canopy. Understory resembles that of the younger stands.

Canyon Live Oak-Deerbrush Shrub Land (37530 in part): This association type develops after fire in the bigcone Douglas-fir-canyon oak forest. Dead deerbrush (*Ceanothus integerrimus*) stems are common. A few fire-scarred bigcone Douglas-fir trees live in the area and have begun reproducing.

Interior Live Oak-Chaparral Whitethorn Shrub Land (37A00 in part): This association type occurs in scattered patches within larger stands of chaparral or canyon oak forest and shrub land in the cRNA. It is usually found on S.-facing slopes and on E.- or W.-facing slopes of minor ridgelines. This shrub land can potentially develop into interior live oak forest (*Quercus wislizenii*), but no significant stands of interior live oak forest exist on the cRNA. The composition, structure, and development are similar to those of the montane *Ceanothus* chaparral and the bigcone Douglas-fir-canyon oak forest, except that interior live oak and chaparral whitethorn (*Ceanothus leucodermis*) replace canyon oak and deerbrush. Additional species include *Rhus trilobata*, *Bromus tectorum*, and *Prunus ilicifolia*.

Chamise-Eastwood Manzanita Chaparral (37110 in part): This association type is common on S.-facing sites above about 4000 ft (1219 m), often intermixed with interior live oak chaparral. Vegetation generally has a dense cover less than 6 ft (2 m) high. The dominant species are chamise (*Adenostoma fasciculatum*) and eastwood manzanita (*Arctostaphylos glandulosa*). The only other species is chaparral whitethorn.

Chamise-Hoaryleaf *Ceanothus* Chaparral (37120/37200): This association type is common on S.-facing slopes in the cRNA below about 4500 ft (1372 m). The vegetation is dense (66-96 percent cover) and relatively tall (20 percent over 6 ft [2 m]). Chamise and hoaryleaf *Ceanothus* (*C. crassifolius*) are the dominant species, but other species such as scrub oak (*Quercus berberidifolia*), chaparral whitethorn, mountain mahogany (*Cercocarpus betuloides*), Mexican elderberry (*Sambucus mexicanus*), bigberry manzanita (*Arctostaphylos glauca*), and interior live oak may occur as dominants in different areas. Additional shrubs common in this association type include California coffeeberry (*Rhamnus californica*), hollyleaf redberry (*Rhamnus ilicifolia*), toyon (*Heteromeles arbutifolia*), hollyleaf cherry (*Prunus ilicifolia*), flannel bush (*Fremontodendron californicum*), and eastwood manzanita (*Arctostaphylos glandulosa*).

Mountain Mahogany Chaparral (37400/37110): This association type is abundant on the steepest S.-facing slopes in the cRNA. Mountain mahogany is the dominant species. Other regularly occurring species include chamise, bush monkeyflower (*Mimulus aurantiacus*), and giant stipa (*Achnatherum coronatum*).

Scrub Oak Chaparral (37900): This association occurs in a belt near the canyon bottom, mostly on the N.-facing side of the canyon below about 4000 ft (1219 m). Scrub oak (*Quercus berberidifolia*) occurs with many other species including chamise, chaparral whitethorn, eastwood manzanita, bigberry manzanita, toyon, and hollyleaf cherry.

Non-Native Grassland (42200): A section of non-native grassland is present in the far W. corner of the cRNA. Dominant species are *Bromus tectorum*, *B. diandrus*, and *Avena barbata*. The only native plants with high cover are yerba

santa (*Eriodictyon trichocalyx*), chamise, and deerweed (*Lotus scoparius*). Other native shrubs and herbs include *Galium angustifolium*, *Ericameria linearifolia*, *E. pinifolia*, *Salvia apiana*, *Yucca whipplei*, and *Eriogonum fasciculatum*. The area was probably covered by chamise chaparral previously but has been converted to non-native grassland by frequent fire.

Riparian Mosaic (63320/61510/62400): Riparian vegetation occurs in a strip along Cleghorn Creek and falls into the three Holland classifications listed above. The three types occur in small stands, often intergrading into one another in a mosaic pattern. The mosaic pattern is likely a result of dynamic sediment deposition and scouring as flooding and bed alterations redirect stream flows.

Southern Willow Scrub (63320): is located in a small, intermittent drainage on an old bench above the canyon floor. It is atypical in the riparian sites of the cRNA. It is dominated by arroyo willow (*Salix lasiolepis*) and mugwort (*Artemisia douglasiana*). Vertical structure is dense, and overall height exceeds 9 ft (3 m) but does not approach heights of riparian trees. Additional species include deerweed, Mexican elderberry, cottonwood (*Populus fremontii*), *Galium* sp., *Salvia mellifera*, *Solanum xanti*, *Solidago californica*, *Toxicodendron diversilobum*, *Claytonia perfoliata*, and *Lonicera subspicata*.

White Alder Riparian Forest (61510): is dominated by white alder (*Alnus rhombifolia*), present in many size classes and usually forming a nearly closed canopy, with a sparse understory of mulefat (*Baccharis salicifolia*), mugwort, or willows. Forest heights are well over 9 ft (3 m). Other common species are mountain mahogany, California sycamore (*Platanus racemosa*), *Juncus xiphioides*, *Muhlenbergia rigens*, and *Bromus diandrus*.

Sycamore Alluvial Woodland (62400): has a relatively open canopy (28-44 percent cover above 9 ft [3 m]). California sycamore is nearly the only overstory species and occurs in many size classes. Shrub and understory species are diverse. They include mulefat, willow, mugwort, *Datisca glomerata*, *Eriogonum fasciculatum*, *Brickellia californica*, *Epilobium canum*, *Avena barbata*, *Bromus diandrus*, *Lepidospartum squamatum*, and *Melilotus alba*.

Plant Diversity

Two hundred eighty-five species of vascular plants are listed.

Conflicting Impacts

Air pollution and smog from the S. California basins reach Cleghorn Canyon and likely have an effect on vegetation (e.g., Miller 1984, Westman 1981).

The cRNA is within the Summit grazing allotment, although steep topography and dense vegetation probably prevent cattle from using it. No sign of livestock was observed during the field survey. The canyon also is used for deer and bear hunting.

A few roads exist along the boundaries of the cRNA. At the bottom of the canyon, a privately owned site is used for sand and gravel mining. The Southern California Gas natural gas pipeline and a buried PacBell telephone cable pass through the W. edge of the canyon.

19. Cone Peak Gradient (Limekiln Creek, South Fork of Devil's Canyon)

Location

This established RNA is on the Los Padres National Forest, near Lucia about 23 miles (37 km) SE. of the town of Big Sur, in Monterey County. It incorporates two ecological surveys, Limekiln Creek and South Fork of Devil's Canyon. The RNA includes portions of sects. 33, 34, and 35 T21S, R4E and all or portions of sects. 1, 2, 3, 10, 11, 12, 13, 14, 15, 22, and 23 T22S, R4E MDBM (36°01'N., 121°29'W.), USGS Cone Peak and Lopez Point quads (fig. 38). Ecological subsection – North Coastal Santa Lucia Range (261Aj).

Target Elements

This area falls in part under the category of unique ecosystem, resulting from the juxtaposition of many biogeographic elements. Santa Lucia fir (*Abies bracteata*) and disjunct stands of sugar pine (*Pinus lambertiana*) are perhaps the most significant special elements along with a set of isolated and endemic herbaceous species. The area also has been selected to represent the canyon live oak (*Quercus chrysolepis*) woodland, mixed evergreen forest, California coast live oak (*Quercus agrifolia*) woodland, redwood (*Sequoia sempervirens*), and chaparral target elements for the Central California Coast Ranges ecological section.

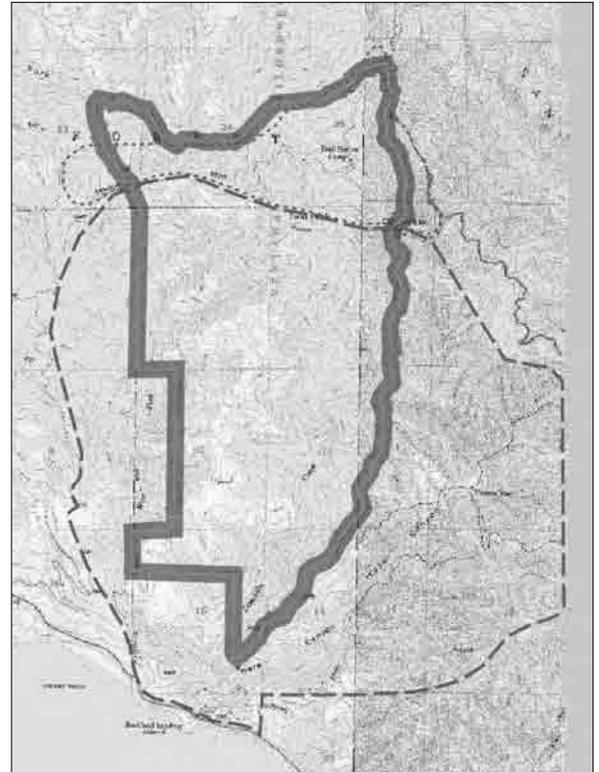


Figure 38—Cone Peak Gradient RNA

Dashed line = Limekiln Creek ecological study area
 Solid gray line = RNA Boundary
 Dotted line = South Fork of Devil's Canyon ecological study area

A. Limekiln Creek (Keeler-Wolf and Keeler-Wolf 1977, Borchert 1987)

Distinctive Features

Highly Varied Ecological Structure: A high number of plant associations exist in this small drainage. North coastal scrub, coastal sage scrub, redwood forest, coast live oak woodland, mixed evergreen forest, valley grassland, and several types of chaparral are well represented. The mixtures of such communities as coastal scrub and chaparral, valley grassland and coastal prairie, and north coastal scrub and south coastal scrub provide for some unique mixing of species. The unusual elevation cline of related associations such as mixed evergreen forest, coast live oak, and canyon live oak woodlands may provide answers to questions concerning the tolerance and requirements of the individual species comprising these associations.

Several closely related species that are typically segregated geographically such as *Eriophyllum confertiflorum* and *E. staechadifolium*, *Mimulus aurantiacus* and *M. bifidus* ssp. *fasciculatus*, and *Eriogonum parvifolium* and *E. fasciculatum* ssp. *foliolosum* co-occur here and may provide useful information on species relationships and environmental tolerances.

The area's complex group of plant associations has much to do with its varied climate, geology, and topography. The elevational difference of nearly one mile within a 3-mile (5-km) distance, a variety of slope exposures and rock types, the influence of the cool marine layer at the lower elevations, and the very steep gradient of precipitation from low to high elevations all combine to create a great diversity of environments within this relatively small area.

Biogeographical Significance: This area contains several biogeographically significant taxa, either reaching their distributional terminus in the area or representing isolated populations. The largest of these groups represents whole associations. For example, the local coast redwood forest contains several

characteristic plants such as *Oxalis oregana*, *Viola sempervirens*, *Whipplea modesta*, and *Hierochloe occidentalis*, among others, which all reach their S. limits within a few miles of the RNA. The north coastal scrub reaches its S. limits in the vicinity of the RNA. The south coastal sage scrub reaches its N. limits within the vicinity of the RNA with certain of its species such as *Salvia leucophylla* reaching its N. limits very near the RNA.

A group of species at the upper elevations of the RNA is characteristic montane California plants and may be more than 100 miles (161 km) from the nearest known populations. These include such species as sugar pine (*Pinus lambertiana*), *Cycladenia humilis* var. *venusta*, *Cheilanthes gracillima*, and *Lotus argophyllus* var. *fremontii*.

Another group of plants has a relatively continuous distribution but reaches its range limits within or near the RNA. Species at or near their N. limits include *Yucca whipplei* ssp. *percursa*, *Monardella villosa* var. *subglabra*, *Penstemon heterophyllus* ssp. *australis*, *Collinsia childii*, and *Mimulus subsecundus*. Species at or near their S. limits include *Arabis breweri*, *Calochortus albus* var. *rubellus*, *Penstemon corymbosus*, *Nemophylla parvifolia*, *Streptanthus tortuosus*, and *Erigeron petrophilus*.

The fauna of the region also has some biogeographical significance. Two species of slender salamanders (*Batrachoseps*) inhabit the Big Sur coast; the RNA is a meeting ground for the northern *Batrachoseps pacificus* and the southern *B. nigriventris*. The area may harbor a hybrid swarm and thus be of interest to evolutionary zoologists. Such species as the sagebrush lizard (*Sceloporus graciosus*) and mountain chickadee (*Parus gambeli*) have isolated occurrences near the summits of Cone and Twin peaks. A recent record of a night snake (*Hypsiglina torquata*) is the most coastward record for the species in central California.

Geological Significance: The geologic terrane (rock groups) within the RNA is varied, with outcrops of sedimentary, metamorphic (including marble and gneiss), and crystalline basement rocks. The area is geologically unique, containing the oldest (Pre-Cambrian) rocks known between the Transverse Ranges and the N. Cascades, a major thrust fault (the Sur-Nacimiento Fault), and the only charnockitic terrain described W. of the Continental Divide.

Rare Plants: Several rare species occur at the upper elevations. These are species shared with the Devil's Canyon portion of this RNA. They include Santa Lucia fir (*Abies bracteata*, CNPS List 4), *Galium californicum* ssp. *luciense* (CNPS List 1B), and *Galium clementis* (CNPS List 4).

Physical Characteristics

The area covered by the ecological survey includes the entire Limekiln Creek drainage (5478 acres, 2217 ha). The actual size of the established RNA is 2787 acres (1128 ha). The topography of the area is extremely rugged. The summit of Cone Peak is 5154 ft (1571 m); the mouth of Limekiln Creek, at sea level, is about 3.25 miles (5.2 km) from Cone Peak (the lowest point of the established RNA is 540 ft, 165 m). The drainage is oriented to the S. with the two highest points at its N. end. The deep canyons of the W. and main branches of Limekiln Creek divide the area. In general, the slopes are steepest at the upper reaches of canyons and at the foot of ridges. Numerous limestone outcrops add to the rugged nature at the upper elevations.

Rocks include the Pre-Cretaceous metamorphic Sur Series, Jurassic-Cretaceous Franciscan metasediments, and Mesozoic granitic rocks. The Sur Series covers more than 75 percent of the area. These rocks include limestone, quartzite, granofelses, and gneisses with many layers of amphibolites, schists, calcite marbles, and metadolomites (the latter two being broadly classified as

limestone). Soils include Cieneba-Rock outcrop, Cieneba-Sur-Rock Outcrop, Gamboa-Sur, Los Osos Clay loam, Pfeiffer-Rock outcrop, Rock outcrop, and Sur-Junipero complexes.

Climate is highly varied, with annual precipitation at the lower elevations about 28 inches (711 mm) to amounts in excess of 90 inches (2286 mm) on the lee side of Cone Peak. Less than 2 percent of the average annual precipitation falls between June and September. Snow is common in winter at the highest elevations, whereas the lower elevations rarely freeze. Temperature inversions resulting from the strong summer marine layer are very stable between May and October. Summer fog is common below about 2000 ft (610 m). Average winter temperatures vary as much as 19 °F (7.2 °C) between the highest and lowest elevations.

Association Types

Many of the plant associations in this area are complex and not easily separated into distinct types. No quantitative vegetation sampling was conducted for the ecological survey. Description and acreages of the types were based on the ecological survey.

Mixed Evergreen Forest (81100, 81400): 1200 acres (486 ha). This is the most diverse of the three sclerophyllous forests or woodlands present. It is dominated by varying mixtures of tanoak (*Lithocarpus densiflorus*), madrone (*Arbutus menziesii*), California bay (*Umbellularia californica*), bigleaf maple (*Acer macrophyllum*), coast live oak, interior live oak (*Quercus wislizenii*), canyon live oak (*Quercus chrysolepis*), and Coulter pine (*Pinus coulteri*).

Mesic lower N.-facing-slope stands have diverse understories of *Trientalis latifolia*, *Smilacina racemosa* var. *amplexicaulis*, *Osmorhiza chilensis*, *Dryopteris arguta*, *Symphoricarpos mollis*, *Adiantum jordanii*, *Rhamnus californicus*, and *Rosa gymnocarpa*, among others (28 typical understory species listed). The density of native grasses, including *Festuca californica*, *Melica hartfordii*, *M. imperfecta*, *Elymus glaucus*, *Calamagrostis rubescens*, and *Bromus grandis*, is frequently high.

Redwood Forest (82320, 82310, 61210): 800 acres (324 ha). This forest is restricted to mesic valley bottoms; it is difficult to separate from a true riparian element containing such trees as California sycamore (*Platanus racemosa*), white alder (*Alnus rhombifolia*), and the willow *Salix coulteri*. A number of other riparian or semi-riparian species are closely associated with redwood (*Sequoia sempervirens*), including bigleaf maple, California wax myrtle (*Myrica californica*), *Petasites palmatus*, *Boykinia elata*, *Aralia californica*, *Adiantum pedatum* var. *aleuticum*, and *Woodwardia fimbriata* (fig. 39).

The most well-developed redwood forests occur in the lower drainages and include characteristic understory species such as *Oxalis ore-gana*, *Viola sempervirens*, *Vaccinium ovatum*, and *Hierochloe occidentalis*. In the upper canyons redwood forest is patchier, nondiverse, and very closely tied to canyon bottoms. Redwood is generally the only dominant tree, but in some areas tanoak, California bay, and Douglas-fir (*Pseudotsuga menziesii*) may be



Figure 39—Cone Peak Gradient / Limekiln Creek, *Adiantum pedatum*, *Oxalis ore-gana*, and *Vaccinium ovatum* of the redwood riparian forest along W. Fork Limekiln Creek. (1976)

subdominants. Occasionally, Santa Lucia fir (*Abies bracteata*) occurs in redwood groves in the upper drainages. Most redwood forest in the RNA tends to form a mosaic with mixed evergreen forest.

Grassland (41100, 42110, 42200): 750 acres (304 ha). There is a gradual transition between coastal prairie grassland below the typical summer inversion layer to the more interior valley grassland at higher elevations. The coastal prairie type is not particularly well developed, with few species characteristic of the true coastal prairie of more N. locations. Such species as *Ranunculus californicus*, *Pteridium aquilinum*, *Zigadenus fremontii*, and *Dichelostemma (Brodiaea) pulchella* occur with the introduced annual *Bromus*, *Avena*, *Vulpia (Festuca)*, and *Erodium* species.

Upslope from this coastal grassland, *Stipa pulchra* becomes locally common, signifying the grassland of more interior affinities. Also in this more extensive upland grassland are such species as *Paeonia californica*, *Chlorogalum pomeridianum*, *Eremocarpus setigerus*, *Trichostema lanceolatum*, *Plagiobothrys nothofulvus*, *Phacelia imbricata*, *Linanthus ciliatus*, *L. androsaceus*, *L. linifolius*, *Lagophylla ramosissima*, *Poa howellii*, *P. scabrella*, *Sitanion jubatum*, *Festuca megalura*, and several annual species of the following genera: *Chorizanthe*, *Lotus*, *Trifolium*, and *Bromus*. These higher elevation grasslands have a more open habit than the lower-elevation coastal prairie type, with herbs often just as important as grasses.

Some areas of grassland are being replaced by transitional scrub, and much of this association may be maintained only by periodic fire. However, atop the central ridges on the clay-rich Los Osos soils, grassland exists in a relatively stable state. These areas are bordered by coast live oak woodland and contain a number of perennial grasses and native herbs characteristic of well-developed valley grassland.

Chaparral (37110, 37200): 690 acres (279 ha). This association is easily broken down into two subtypes, which are often treated as separate associations. The first is the chamise (*Adenostoma fasciculatum*) chaparral (450 acres, 182 ha). It dominates on xeric S.- or W.-facing steep slopes at mid- to upper elevations. Typically, chamise occurs as almost pure, dense stands with little understory cover and few associated herbs or shrubs. In some cases, such species as *Heteromeles arbutifolia*, *Ceanothus papillosus* var. *roweanus*, and *Arctostaphylos glandulosa* occur as important members.

The other subtype is mixed chaparral (240 acres, 97 ha). It occurs in various forms from about 1500 to 4800 ft (457-1463 m) elevation. Overall dominants are *Arctostaphylos glandulosa*, *Heteromeles arbutifolia*, *Adenostoma fasciculatum*, *Mimulus bifidus* ssp. *fasciculatus*, *Ceanothus integerrimus*, and *Yucca whipplei* ssp. *percursa*. This association occurs on all major rock types and is on S.-, W.-, or E.-facing exposures of more moderate steepness than most chamise stands. In rocky stands with low shrub density, numerous herbs may be present including *Selaginella bigelovii*, *Clarkia rhomboidea*, *Cordylanthus rigidus*, *Monardella villosa* var. *subserrata*, *Stephanomeria chicoriacea*, *Galium californicum*, *G. nuttallii*, and *Zauschneria californica*. Scrubby forms of canyon live oak, interior live oak, and tanoak also may occur as important members.

Sage Scrub (32300, 37G00): 550 acres (223 ha). This association occurs on S.-facing slopes away from the immediate coast between 200 and 2500 ft (61-762 m). Stands are generally lower with less crown overlap of shrubs than in the coastal scrub association. Dominants include *Artemisia californica*, *Salvia mellifera*, *Mimulus aurantiacus* (lower elevations), *M. bifidus* ssp. *fasciculatus* (upper elevations), *Eriogonum fasciculatum*, *Rhamnus crocea* ssp. *ilicifolia*, *Toxicodendron diversilobum*, *Lupinus albifrons*, and *Lotus scoparius*. This association is more xeric than the coastal scrub and intergrades with chaparral at higher elevations.

This association reaches its peak diversity on open, rocky, E.-facing exposures where numerous grasses and herbs occur with the shrubs. These additional species include *Castilleja affinis*, *Gnaphalium bicolor*, *G. microcephalum*, *Sitanion jubatum*, *Galium angustifolium*, *G. californicum*, *Clarkia rhomboidea*, *C. speciosa*, *Stephanomeria virgata*, *Lupinus hirsutissima*, *Chorizanthe douglasii*, *C. membrenacea*, *Eriogonum elongatum*, and *Stipa pulchra*. In contrast, xeric S.-facing stands frequently may be strongly dominated by *Artemisia californica* or *Salvia mellifera* with few associated species.

A subtype of this association, the transitional scrub, occurs in scattered, largely successional patches associated with sage scrub, chaparral, and grassland. This low scrub may develop into sage scrub, chaparral, or coast live oak woodland depending on site locations. The dominants are *Eriogonum fasciculatum*, *Lotus scoparius*, *Chrysopsis villosa* var. *sessiliflora*, *Penstemon breviflorus*, *Haplopappus squarrosus*, *Lupinus albifrons*, and *Yucca whipplei* ssp. *percursa*. At most of the sites where it occurs, this subtype is replacing grassland which was maintained by burning before the 1950s. This subtype is an important indicator of relatively rapid vegetational change in the drainage.

Coast Live Oak Woodland (71160, 81310, 81200): 520 acres (210 ha). This association occupies slopes and knolls of the main ridges. It normally is adjacent to and interdigitates with mixed evergreen forest, but it occurs on somewhat drier exposures. It is usually a more open association than the mixed evergreen forest with a more poorly developed understory. It is strongly dominated by coast live oak. *Rhamnus californica*, *Toxicodendron diversilobum*, and *Rubus vitifolius*, among other shrubs, are widely spaced with a sparse herb cover of *Collinsia heterophylla*, *Gnaphalium californicum*, *Madia elegans*, and *Sanicula crassicaulis*. A number of herbs and shrubs from chaparral, grassland, and sage scrub associations may occur where coast live oak woodland borders on those associations.

A California Bay subtype (Holland 81200) of this association often occurs around rock outcrops adjacent to grassland. These are generally small clonal stands interspersed within more extensive stands of coast live oak.

Canyon Live Oak Woodland (81320): 510 acres (206 ha). This association covers very steep upper slopes of the drainage on all major exposures. On the upper S. and W. slopes of Cone Peak it is typically composed of low, scrubby trees. The small size and high frequency of multiple stems of this association indicate past fire. This association is transitional between lower elevation, broad-leaved sclerophyll forests and the higher, more mesic conifer forests. A taller forest with scattered Coulter or ponderosa pine (*Pinus ponderosa*) occurs on gentler and less exposed slopes. On the ridgetops, this association may merge with mixed chaparral. The understory is sparse, but contains some interesting taxa including the three rare taxa, and several of the disjunct species listed under distinctive features.

Santa Lucia Mixed Conifer Forest (84120, 84131, 84140): 320 acres (130 ha). This association is best represented in the S. Fork of Devil's Canyon. Locally, this forest is divisible into three types. These include a mixed phase containing Santa Lucia fir, Coulter pine, canyon live oak, and occasional madrone and tanoak on NW.- or E.-facing slopes well protected from fire (90 acres, 36 ha); a ponderosa pine phase, occurring as an open woodland of coast live oak, madrone, and canyon live oak with a broken canopy of ponderosa pine (140 acres, 57 ha); and a Coulter pine phase (90 acres, 36 ha) that occurs in small stands on higher, xeric ridgetops and S.-facing slopes and has a sparse understory related to adjacent xeric, mixed evergreen and canyon live oak forests.

Bluebush Scrub (37820): 180 acres (73 ha). Closely associated with the coastal scrub and sage scrub, this scrub association is dominated by bluebush (*Ceanothus thyrsiflorus*) or the similar *Ceanothus griseus* (at lower elevations) or *C. soledadensis* (at higher elevations). This type of scrub is taller than coastal scrub and generally found on steeper, rockier slopes than the two related scrub associations. Holland considers it a form of chaparral.



Coastal Scrub (32200): 170 acres (69 ha). This association occurs along steep to moderate SW.- or E.-facing slopes directly above the ocean. Dominants include the shrubs *Artemisia californica*, *Toxicodendron diversilobum*, *Baccharis pilularis* var. *consanguinea*, *Eriophyllum staechadifolium*, *Rhamnus crocea*, and *Mimulus aurantiacus*. Herbs include *Achillea millefolium*, *Agrostis diegoensis*, *Astragalus nuttallii*, *Galium nuttallii*, *Eriogonum parvifolium*, *Phacelia malvifolia* var. *loasaefolia*, *Eucrypta chrysanthemifolia*, *Calystegia cyclostegius*, *Gnaphalium bicolor*, *G. californicum*, *G. ramosissimum*, and *Castilleja foliolosa*. Dominants vary from stand to stand, and a number of species more typical of the upper elevation scrub associations, such as *Salvia mellifera*, *Haplopappus squarrosus*, *Lotus scoparius*, *Yucca whipplei* var. *percursa*, may occur.

Figure 40—Cone Peak Gradient, South Fork of Devil's Canyon, the sugar pine dominated pine/oak woodland on the north slope of Twin Peak in South Fork of Devil's Canyon. (J. R. Griffin 1976)

B. South Fork of Devil's Canyon (Griffin 1976, Borchert 1987)

Distinctive Features

Disjunct and Unusual Vegetation: The Devil's Canyon vegetation encompasses a combination of plants in an unusual topographic setting including extensive groves of the Santa Lucia Mountains' endemic bristlecone fir, impressive disjunct old-growth sugar pine stands (fig. 40), interesting S. and N. montane disjuncts, three restricted endemic vascular plant species, and several types of mixed hardwood forest. The value of the area is not in its representation of typical or exemplary types of vegetation but in its unique plant communities.

Rare Flora: The following Devil's Canyon taxa are listed by CNPS: Santa Lucia fir (List 4), *Galium californicum* ssp. *lucianum* (List 1B), *Galium clementis* (List 4), *Arctostaphylos hooveri* (List 4), and *Lupinus cervinus* (List 4).

Disjunct Taxa: Several plant species including *Allium burlewii*, *Carex multicaulis*, *Chimaphila menziesii*, *Chrysothamnus nausiosus* ssp. *albicaulis*, *Cycladenia humilis* var. *venusta*, *Holodiscus microphyllus*, *Lotus argophyllus* var. *fremontii*, sugar pine, *Pleuricospora fimbriolata*, and *Streptanthus tortuosus* are disjunct for their main population centers in the higher, mountainous parts of California. The mountain chickadee (*Parus gambeli*) is also a disjunct bird (known from the Santa Lucia Range) in this area only.

Botanical Collecting History: A number of noted collectors including David Douglas, Thomas Coulter, Theodor Hartweg, Willis Jepson, and Alice Eastwood, among others, have collected in the area.

Physical Characteristics

The survey area covers 542 acres (219 ha). Elevations range from about 2800 ft (853 m) in the lower canyon bottom to 5155 ft (1571 m) atop Cone Peak. Topography is steep to extremely steep throughout, with N.- and S.-facing slope aspects predominating, but all aspects are represented.

The geology is predominantly pre-Cretaceous metasediments of the Sur series (primarily crystalline schist with local marble outcrops at the upper elevations of Twin and Cone peaks). Three soil units are known from the area. These are rock outcrops-xerotherms, Cieneba-Sur-rock outcrops complex, and Sur-Junipero complex. The best-developed forest vegetation occurs on Junipero sandy loam, whereas the most open hardwood forest occurs on Cieneba fine gravelly sandy loam.

Climate is varied, with occasional summer maritime influence at the lower elevations (temperature inversions relating to the cool maritime layer and associated fog generally occur below the lowest elevations in this area) and warm, dry interior climate in the summer above the inversion layer. Winter snows are common at the upper elevations. Annual average precipitation is estimated to range from 70 inches (1778 mm) across most of the area to 90 inches (2286 mm) on the E. flank of Cone Peak.

Association Types

Twelve 300-m² plots were sampled in the sugar pine/tanoak-canyon live oak/*Toxicodendron* forest. Twelve 250-m² plots were sampled in the sugar pine/tanoak-canyon live oak-madrone/*Toxicodendron* forest. Twelve 500-m² plots were sampled in pine/oak woodland. Descriptions and acreages are based on the ecological survey.

Pine/Mixed Hardwood Forest (84110): 260 acres (105 ha). This association has been broken into two phases.

The first is the sugar pine/tanoak-canyon live oak/*Toxicodendron* phase. This phase covers 92 acres (37 ha). Compared to the pine/oak woodland (see last association type on following page) tree cover is substantially greater (73 percent average). There is a pronounced increase (>10-fold) in tanoak density and cover relative to pine/oak woodland. Pacific madrone (*Arbutus menziesii*) is rare.

Sugar pine reaches its best development in the area in the first phase. Heights and dbh of sugar pine are significantly greater than in the pine/oak woodland (averaging 149 ft [45 m] tall and up to 70 inches [1.8 m] dbh). Most sugar pines (86 percent) have basal fire scars. Sugar pine reproduction is abundant in tree fall gaps and good elsewhere. Almost all hardwoods in this phase are sprouts with no old growth. Maximum canyon live oak dbh is 8 inches (20 cm), and 12 inches (31 cm) for tanoak. Both species of hardwoods are well represented in the reproduction layers. Average densities (trees/ha) and basal area (m²/ha), respectively, are given after the species in the following list: sugar pine (121, 64.5), canyon live oak (210, 1.8), tanoak (403, 7.3), Santa Lucia fir (5, trace), and total trees (741, 73.7).

Toxicodendron diversilobum is a conspicuous shrub (up to 25 percent cover). The rare or disjunct species *Allium burlewii*, *Cycladenia humilis* var. *venusta*, *Chimaphila menziesii*, and *Lupinus cervinus* occur as scattered individuals.

The second phase of this forest type is described as the sugar pine/tanoak-canyon live oak-Pacific madrone/*Toxicodendron* phase (168 acres, 68 ha). This phase occurs at lower elevations than the previous phase; it is characterized by a higher density and cover of hardwoods. Tanoak is ubiquitous, Pacific madrone is locally common, California bay (*Umbellularia californica*) is a minor component, and canyon live oak may be locally absent. Fire history is similar to that of the first phase with few older hardwood stems.

Maximum dbh for tanoak and madrone sprouts is about 14 inches (36 cm). Sugar pine tends to be smaller than in the previous phase, with a maximum recorded dbh of 61 inches (1.6 m). Trees also may be younger and shorter on average than sugar pines in previous stands. Only 29 percent of the mature trees have fire scars. Density of pines is similar to that of the woodland plots whereas basal area is intermediate between that of the woodland and the

previous phase. Pine seedlings and saplings are considerably less common than at the previous phase. Average densities (trees/ha) and basal area (m²/ha), respectively, are given after the following species: sugar pine (59, 46.8), *Quercus chrysolepis* (408, 7.3), Santa Lucia fir (7.4, trace), Pacific madrone (126, 3.4), California bay (54, trace), and total trees (1184, 67.3). Herbs are rare and mostly in rocky openings.

Toxicodendron is the most widespread and conspicuous understory plant. *Pleuricospora fimbriolata* was noted for the first time in the Santa Lucia Mountains in this phase.

Mixed Hardwood Forest (81100, 81320): 117 acres (47 ha). This forest also is broken into two phases.

The first is the tanoak-oak-Pacific madrone / *Toxicodendron* phase (66 acres, 27 ha). This is a typical mixed hardwood forest without significant presence of sugar pine. Tanoak is the most important species, with canyon live oak and Pacific madrone locally dominant. Interior live oaks (*Quercus wislizenii*) are scattered, but unimportant. A few Coulter pine and ponderosa pine (*Pinus ponderosa*) are present. *Toxicodendron diversilobum* remains the dominant understory plant. This phase is better represented in the adjacent Limekiln Creek drainage.

The second phase is dominated by canyon live oak (51 acres, 21 ha). It occurs on S. aspects. Compared to the previous type it has a low diversity with only widely scattered sugar or Coulter pine rising above the closed canyon-live-oak canopy. Fire history varies in this phase with some canyon live oak ranging up to 3 ft (1 m) dbh; other stands may be much smaller as a result of recent and frequent burns.

Santa Lucia Fir-Pine-Oak Woodland-Rock Land (84120): 92 acres (37 ha). This vegetation complex is divided into three landscape classes based on Talley (1974).

The first of these is the summit phase (65 acres, 26 ha). It is characterized by very steep (average 96 percent) rocky slopes with tree and shrub cover less than 25 percent. This phase is the best represented. Here scrubby sugar and Coulter pines are scattered with the firs. Stunted canyon live oaks are the principal hardwoods. Some colonies of *Arctostaphylos glandulosa* occur, but these are not extensive. Landscape features of this type almost preclude serious fires, thus the firs may be large and relatively old.

The cliff-outcrop-talus mosaic between the conifers and oaks has a rich flora including healthy populations of *Arabis breweri*, *Cheilanthes gracillima*, *Cheilanthes intertexta*, *Erigeron petrophilus*, *Eriogonum saxatile*, *Galium californicum* ssp. *luciense*, *G. clementis*, *Holodiscus microphyllus*, *Lotus argophyllus* var. *fremontii*, *Penstemon corymbosus*, *Stipa coronata*, and *Streptanthus tortuosus*.

The other two types are the transition phase, which occurs below the summits. One type is the steep (average 84 percent) rocky slopes without cliffs or sudden breaks in slope, with average tree cover of 40 percent and shrub cover of 25 percent. The other type is the ravine phase, with an average slope of 70 percent and tree cover of greater than 50 percent. These types are mapped together and are estimated to cover about 27 acres (11 ha).

Pine/Oak Woodland (no Holland equivalent): 51 acres (21 ha). Between the ridge crest at Twin Peak (4843 ft, 1476 m) and about 4400 ft (1341 m) on N.-facing slopes, a woodland with average tree cover of 45 percent occurs. It is dominated by widely spaced sugar pine up to 58 inches (1.5 m) dbh and 125 ft (38 m) tall. Sixty percent of these dominants have basal fire scars. Beneath the

pinus is a broken subcanopy of canyon live oak, many of which have been spared from fire for many years and have large boles. Average densities (trees/ha) and basal area (m²/ha), respectively, are given after the species name in the following list: sugar pine (59, 27), Coulter pine (*Pinus coulteri*) (47, 2), canyon live oak (136, 5), tanoak (40, 0.4), Santa Lucia fir (2, trace), and total trees (284, 33.5).

The shrub stratum is primarily composed of saplings of the oaks and pines. Herbs have a low cover-abundance value. Among the most conspicuous are *Galium californicum* ssp. *flacidum*, *Galium clementis*, *Lupinus cervinus*, and *Polystichum munitum* var. *curtum*.

Plant Diversity

More than 380 taxa of vascular plants have been identified from the RNA (Borchert 1987). The number listed in Limkilt Creek is 288; in South Fork of Devil's Canyon, 107.

Conflicting Impacts

The greatest recent influence in the area has been the 1985 Rat Fire, which burned virtually the entire RNA. Certainly much of the information on the structure and extent of a number of the associations described in this survey have changed dramatically after the fire. The prior amount of vegetation sampling will provide important baseline information for the monitoring of succession over the ensuing decades.

The area lies within the Federally-designated Ventana Wilderness. However, recreational use has traditionally been light.

Grazing, browsing (deer and cattle), and cattle wallowing within the coast live oak woodland appear to have affected the relatively poor seedling reproduction in this association. Seedlings are becoming established primarily in sheltered locations within transitional and other scrubs. Reproduction of coast live oaks within the grassland is virtually nil. Some areas of heavy disturbance from cattle congregation were noted in the lower grassland.

20. Craig's Creek (Imper 1991a)

Location

This recommended RNA is on the Six Rivers National Forest, Del Norte County. It is about 10 miles (16 km) E. of Crescent City and 13 miles (21 km) S. of the Oregon border, near the confluence of the Main and S. Forks of the Smith River. The area is included in portions of sects. 1, 2, 3, 10, 11, 12 T16N, R1E HBM (41°48'N., 124°03'W.), USGS Hiouchi quad (fig. 41). Ecological subsections – Western Jurassic (M261Aa) and Gasquet Mountain Ultramafics (M261Ab).

Target Element

Knobcone Pine (*Pinus attenuata*) Forest

Distinctive Features

Knobcone Pine: Knobcone pine occurs both in pure stands and mixed with Douglas-fir (*Pseudotsuga menziesii*) and hardwoods at Craig's Creek. These forests provide an interesting gradient in moisture availability, soil chemistry, and competitive abilities of the species present. They are representative of the Klamath Mountains ecological section.

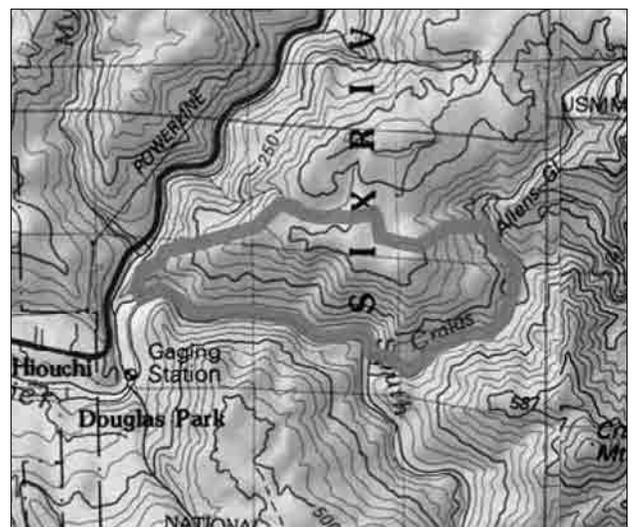


Figure 41—Craig's Creek rRNA

Habitat and Floral Diversity: Habitat diversity at the rRNA is impressive due to the broad range of soils, abundant water, and topographic/microsite variability. Species richness is characteristic of the Klamath Mountains, in part a function of its large endemic component and relictual status.

Rare Plants: *Arctostaphylos hispidula* and *Erigeron delicatus* (*E. cervinus* in Hickman [1993]) on CNPS List 4 are present in the rRNA.

Plant Species of Special Interest: Many species present are endemic to the Klamath Mountains. Local endemics include *Holodiscus discolor* var. *delnortensis* and *Arctostaphylos hispidula*. *Juniperus communis* var. *jackii*, *Galium ambiguum* var. *siskiyouense*, *Stenanthium occidentale*, *Tofieldia glutinosa*, *Tauschia glauca*, and *Lomatium howellii* are all endemic to the region. The carnivorous *Pinguicula vulgaris* grows on rock outcrops adjacent to the S. Fork.

Physical Characteristics

The survey area covers about 950 acres (385 ha), but the acreage proposed in the forest plan is 1150 acres (465 ha). The study area occupies the entire S.-facing slope of one continuous ridge, extending for about 2.25 miles (4.0 km) E. of the S. Fork Bridge. Elevation ranges from about 140 ft (43 m) at the S. boundary to 1750 ft (533 m) at the ridgetop. Aspects tend to be S., with slopes ranging from 50 to 100 percent.

The area is underlain by gabbro and related rocks with a complex of dike rocks intruding into the W. half. An area of Wimer formation is mapped on the ridgetop at the S. boundary. Soils are Hugo family, moderately deep-Maymen family complex 50-70 percent in the W. portion, and Maymen family-Rock outcrop, metaigneous complex 70-90 percent in the E. portion. Soils of the Clallam-Skalan-Goldridge families occur in the far E. portion and along Craig's Creek.

Due to proximity to the coast and the Siskiyou Mountains to the E., weather in the area is relatively mild year-round. A small portion of the abundant precipitation occurs in summer. Mean annual precipitation averages 80-90 inches (2036-2290 mm), although nearby locations occasionally receive more than 200 inches (5080 mm). Fog or low clouds are common. Snowfall is infrequent and light. The January mean minimum temperature is about 16 °F (-9 °C) and July's mean maximum is about 70 °F (21 °C). The average frost-free period extends from about April 1 to November 15.

Figure 42—Craig's Creek, looking southwest from lateral ridge (ca. 700 ft [213 m]) at west end of Craig's Creek rRNA, toward South Fork Bridge. The knobcone-tanoak forest is almost impenetrable, characterized by dense, stunted tanoak, and dense shrub layer of *Vaccinium ovatum*, *Arctostaphylos columbianum*, *Toxicodendron diversiloba*, *Rhododendron macrophyllum*, and *Gaultheria shallon*. (1990)



Association Types

Twenty-two 0.1-acre circular plots were sampled within representative stands for each of the vegetation types present. An additional three plots were sampled in a 4-acre area that burned in 1978.

Knobcone Pine Forest (83210): 151 acres (61 ha). The stunted vegetation, the presence of indicator species such as tanoak (*Lithocarpus densiflorus* var. *echinoides*) and *Juniperus communis* var. *jackii*, and the absence of species common to the other vegetation types are all due to the ultramafic nature of the parent material. The even-aged stands of knobcone pine approach pygmy stature

in this forest, with most individuals less than 4-5 inches (10-13 cm) dbh and 25 ft (8 m) tall at 50-65 years. Both Douglas-fir and sugar pine (*Pinus lambertiana*)

are present, and the Douglas-fir is often stunted in appearance. Other species restricted to this vegetation type include *Lotus crassifolius* and *Castilleja applegatei*. *Rhododendron macrophyllum*, *Vaccinium ovatum*, and *Arctostaphylos columbiana* are among the few species able to make the transition in soils from the other forest types. *Xerophyllum tenax*, as usual, is most common on the ultramafics but also occurs on adjacent soils. Additional species typical of the knobcone pine forest are *Gaultheria shallon*, *Chrysolepis chrysophylla*, *Quercus vaccinifolia*, and *Pteridium aquilinum*. No sign of disease or fire is obvious, and no regeneration of knobcone is occurring in this fire-suppressed forest.

Knobcone-Tanoak Forest (83210): 256 acres (104 ha). This entire forest dates to a fire in the 1920s and appears to be transitional between the knobcone pine forest and tanoak forest (fig. 42). Here, knobcone pine competes well and attains sizes somewhat larger and taller than in the knobcone pine forest. In some cases the type approaches chaparral in appearance, with only scattered knobcone pine and Douglas-fir. This forest mostly occurs on ridgetops and relatively steep slopes, on poor, rocky soils that are shallow and coarse.

Vegetation composition and structure distinguish this forest from the mixed evergreen forest. Canopies are more open, tree basal area is lower, and understory more diverse. Tanoak is almost invariably scrubby, normally less than 6 inches (15 cm) in diameter. The forest shares several species with the canyon live oak (*Quercus chrysolepis*) forest, including *Arctostaphylos columbianum*, *Mimulus aurantiacus*, *Whipplea modesta*, and others. *Rhododendron macrophyllum* is present in moister areas or sites exhibiting a stronger ultramafic influence. Occasional canyon live oak, madrone (*Arbutus menziesii*), and chinquapin (*Chrysolepis chrysophylla*) occur in this type. Other associated species are *Vaccinium ovatum*, *Gaultheria shallon*, poison oak (*Toxicodendron diversilobum*), *Eriodictyon californicum*, *Lonicera hispidula*, *Rubus vitifolius*, *Pteridium aquilinum*, *Trientalis latifolia*, and *Polystichum munitum* var. *imbricans*.

On a 4-acre patch in the W. portion of the forest, the 1978 fire burned sufficiently hot to stimulate knobcone pine regeneration. The lower portion and peripheral areas on either side of the core area burned only at the ground surface and suffered minimal dieback. Only an occasional knobcone pine seedling is seen in the marginal area compared to dense reproduction in the 4-acre core. Poor regeneration in these lightly burned areas is probably due to retention of much of the overstory and the thick litter layer. Vegetation composition in the core burn area differs significantly from that in the adjacent unburned area. It includes *Happlopappus arborescens*, *Ceanothus thrysiflorus*, *Baccharis pilularis*, and *Arctostaphylos hispidula*. Some level of fire-adaptation is implied in species found here but not encountered elsewhere in the rRNA.

Mixed Evergreen Forest (81100): 233 acres (94 ha). The mixed evergreen forest is characterized by a consistently dense overstory canopy of mostly tall tanoak and madrone. Here, the tanoak is much smaller in stature than in the knobcone-tanoak forest. Soils are deeper and moister, with a higher clay content. Douglas-fir is normally present in various size classes and ages (up to 400+ years), some dating to the 1920s fire. Occasional knobcone pines, up to 16 inches (41 cm) or more in diameter, occur close to the river, but most of the forest at lower elevations contains little or no knobcone pine. This forest in general tends to be dark, with a poorly developed understory. The drier-site forest may include *Vaccinium ovatum*, *Rhododendron macrophyllum*, *Gaultheria shallon*, *Toxicodendron diversilobum*, and *Pteridium aquilinum*. More open, moist stands support a diverse understory. The forest in the protected Craig's Creek canyon is quite lush and equivalent to Douglas-fir forest but with little or no Douglas-fir. Added species may include *Alnus rubra*, *Corylus cornuta* var. *californica*, *Polystichum munitum*, *Oxalis oregano*, and most of the species listed below for Douglas-fir forest.

Canyon Live Oak Forest (81320): 220 acres (89 ha). This type occurs in the rockiest, driest portion of the area (except actual rock outcrops). Soils are more closely related to the knobcone-tanoak forest than the better soils of the mixed evergreen forest. Canyon live oak forest is commonly associated with the upper headwalls of small watersheds and other sites probably associated with massive soil failure in the past. The largest contiguous area lies just above the S. Fork of the Smith River, near the sharp river bend, where surface exposure of gravel and cobbles is high. Except for the steep slopes (75-100 percent) and frequent poison oak, this forest is easier to walk through than either the knobcone pine forest or knobcone-tanoak forest. The tree layer is characterized by high cover of canyon live oak and dense shrubby tanoak, variable amounts of madrone, and scattered Douglas-fir. This is the only forest in the rRNA in which rhododendron is consistently absent. The moderately dense shrub layer is dominated by *Vaccinium ovatum*, *Arctostaphylos columbiana*, *A. canescens*, and, occasionally, *Quercus vaccinifolia*. *Gaultheria shallon*, *Garrya buxifolia*, *Lonicera hispidula*, and *Mimulus aurantiacus* are also present. The herbaceous layer is sparse and closely related to the rock outcrop community. It includes *Polystichum munitum* var. *imbricans*, *Polypodium californicum*, *Whipplea modesta*, *Trientalis latifolia*, *Eriophyllum lanatum*, *Galium ambiguum* var. *siskiyouense*, *Achillea borealis*, *Pteridium aquilinum*, *Hieracium albiflorum*, and *Maianthemum dilitatum*. Knobcone pine occurs only sporadically, probably due to moisture limitations.

Douglas-Fir Forest (82400): 16 acres (6 ha). Although it occupies only about 2 percent of the area, Douglas-fir forest is exceptionally well represented in old-growth stage and contributes significantly to the diversity of the rRNA. Little evidence of fire is present, and the stand appears to represent climax Douglas-fir forest. It is best developed on the low stream terrace and adjacent toeslope near the junction of Craig's Creek and the S. Fork of the Smith River. Douglas-fir ranges to 500+ years old, 6 ft (183 cm) dbh, and more than 200 ft (61 m) tall, although most trees are smaller than 4 ft (122 cm) dbh. Tanoak is the only hardwood generally present, in relatively low cover. Well-decayed logs are scattered throughout. The dense shrub and herb layers cover as much as 98 percent of the log and ground surface. In addition to the most common shrubs of the other forest types, the following occur here: *Corylus cornuta* var. *californica*, *Toxicodendron diversilobum*, *Rubus spectabilis*, *R. parviflorus*, *Aralia californica*, *Berberis nervosa*, *Rhamnus purshiana*, *Rosa gymnocarpa*, and *Acer circinatum*. Common herbs are *Polystichum munitum*, *Oxalis oregana*, *Rubus vitifolius*, *Trillium ovatum*, *Pteridium aquilinum*, *Hierochloe occidentalis*, *Achlys triphylla*, *Maianthemum racemosum*, and *Vancouveria planipetala*.

Redwood Forest (82320): 74 acres (30 ha). All of this type occurs adjacent to the S. Fork of the Smith River and along some of the drainages at lower elevation, on moderate slopes and several high benches. Redwoods (*Sequoia sempervirens*) vary in size, but range up to 7 ft (213 cm) dbh or more. Douglas-fir and Port Orford-cedar (*Chamaecyparis lawsoniana*) are subdominants; tanoak, occasional madrone, and, rarely, California bay (*Umbellularia californica*) form a hardwood mid-story. Patches of pure Douglas-fir forest are interspersed within the area. The understory is usually dark, rather sparse, and includes the following species: *Vaccinium ovatum*, *Rhododendron macrophyllum*, *Gaultheria shallon*, *Myrica californica*, *Rubus parviflorus*, *Corylus cornuta* var. *californica*, *Rubus vitifolius*, *Rosa gymnocarpa*, *Polystichum munitum*, *Trientalis latifolia*, *Viola sempervirens*, *Pteridium aquilinum*, and *Festuca subuliflora*. There is abundant evidence of fire in this forest, ranging from char to large fire scars.

Riparian Zone (Red Alder Forest, 81A00): No acreage available. Lush riparian corridors follow each of the numerous creeks that flow across the lower slope of the area. Hardwoods grow somewhat larger in these corridors than in adjacent forest. Understories are dark and include a diverse complement of shade-tolerant

species. The greatest diversity occurs along streams and seeps in the E. portion of the area, above Craig's Creek. Plants of the riparian corridor include *Alnus rubra*, *Rhamnus purshiana*, *Lithocarpus densiflorus*, *Acer macrophyllum*, *Umbellularia californica*, *Chamaecyparis lawsoniana*, *Sequoia sempervirens*, *Arbutus menziesii*, *Rhododendron macrophyllum*, *Berberis nervosa*, *Adiantum pedatum*, *Rubus parviflorus*, *Vaccinium ovatum*, *Polystichum munitum*, *Aralia californica*, *Aquilegia formosa*, and a host of herbaceous species. The riparian corridors along the S. Fork of the Smith River and Craig's Creek are well developed and contain unique elements. Dense vegetation is interspersed with rock outcrops with their own unique assemblage of plants. Some of the species generally restricted to or more common in those areas include *Cornus nuttallii*, *Stenanthium occidentale*, *Trifolium longipes*, *Petasites palmatus*, *Mimulus cardinalis*, *Juncus orthophyllus*, *Ligusticum apiifolium*, *Acer circinatum*, *Philadelphus lewisii*, and *Physocarpus capitatus*.

Rock Outcrops: No acreage available. Rock outcrops are commonly surrounded by canyon live oak forest, but they are floristically distinct. Exposed rocks are usually fine grained, and some are nearly covered by *Quercus vaccinifolia*. Most support open communities, including species such as *Garrya buxifolia*, *Mimulus aurantiacus*, *Selaginella oregana*, *Luina hypoleuca*, *Calochortus tolmiei*, *Eriodictyon californicum*, *Whipplea modesta*, *Sedum spathulifolium*, *Holodiscus discolor* var. *delnortensis*, *Madia minima*, *Calystegia polymorpha*, *Lonicera hispidula*, *Achillea borealis*, *Arctostaphylos canescens*, *A. columbiana*, and *Pinguicula vulgaris*.

Plant Diversity

One hundred seventy-three taxa are listed.

Conflicting Impacts

Recreational use may increase now that the National Recreation Area is established. Presence of the fatal *Phytophthora lateralis* root rot in stands of Port Orford-cedar may continue to affect the structural diversity of the forests in the lower portion of the area, but not where knobcone pine is present. Vegetation management by fire may be important in the near future in many of the vegetation types.

21. Crater Creek (Keeler-Wolf 1987b)

Location

This candidate RNA is on the Klamath National Forest, Siskiyou County. It is about 16 miles (26 km) NW. of Mount Shasta City. It occupies portions of sections 18 T41N, R6W and 13 T41N, R7W MDBM (41°24'N., 122°35'W.), USGS China Mtn. quad (fig. 43). Ecological subsection – Upper Scott Mountains (M261Aj).

Target Elements

Curl-Leaf Mountain Mahogany (*Cercocarpus ledifolius*) and California Mixed Subalpine Forest

Distinctive Features

Dense and Diverse Subalpine Forest: The high density and basal area cover of the Crater Creek subalpine forest are exceptional. Other measurements of subalpine forests in California over relatively large areas have not approached these figures (e.g., Sugar Creek candidate RNA and Whippoorwill Flat RNA). These may be the most productive subalpine forests in the State. Trees are typically not only dense but also relatively tall and well-formed. In addition, these subalpine forests may be the most diverse in the State, with seven regularly occurring tree

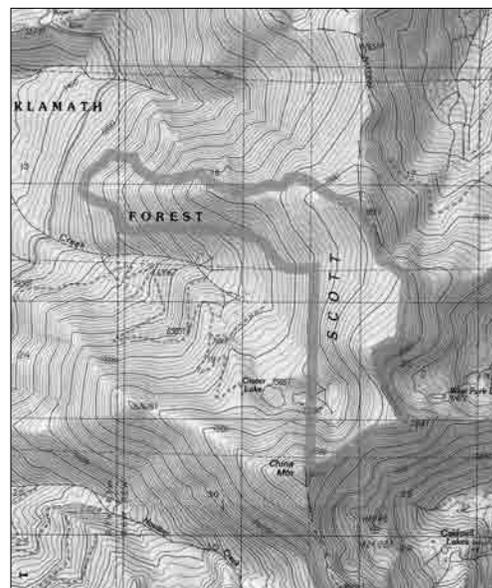


Figure 43—Crater Creek cRNA

species. These forests contain mixtures of all the important subalpine trees of E. Klamath Mountains. The codominance of foxtail pine (*Pinus balfouriana*), whitebark pine (*P. albicaulis*), and mountain hemlock (*Tsuga mertensiana*) in certain stands is unique.

Curl-Leaf Mountain Mahogany Vegetation: This area displays an excellent array of curl-leaf mountain mahogany (further known as, simply, mountain mahogany) vegetation types with respect to variations in slope exposure, steepness, parent material, and elevation. Although mountain mahogany associations are widespread in the W. United States, little is known about their successional relationships and ecological position relative to adjacent vegetation types. Many gaps in the knowledge of the species could be answered at this site.

Rare Flora: Three members of CNPS List 4 (*Allium siskiyouense*, *Lomatium engelmannii*, and *Eriogonum siskiyouense*) occur in the area. Because of the early date of survey (late May), several other rare species known from the vicinity may have been overlooked.

Physical Characteristics

The study area covers about 550 acres (223 ha). Elevations within the area surveyed range from approximately 5760 to 8420 ft (1756-2566 m). The site occupies the S.-facing slopes of a major spur ridge of the Scott Mountains crest as well as the W. side of a portion of the main crest itself, stretching for about 1.5 miles (2.4 km) N. of China Mountain. In addition to the predominantly S.-facing exposures on the spur ridge, areas of N., NW., W., and SE. exposures also occur on the 300-acre (121-ha) addition. Slopes are moderate to steep throughout. The principal rock type is gabbro of the Trinity ultramafic pluton, with the W. portion of the area underlain by serpentized peridotite. Soils are typically shallow, rocky, and poorly developed. However, soil derived from the peridotite tends to be less rocky, less fertile, and more clay-rich than the gabbroic soils. Precipitation is estimated at 40-60 inches (1016-1525 mm) annually, with estimated mean January minima of -10 °F (-23 °C) at the upper elevations and mean July maxima about 90 °F (32 °C) at the lowest elevations.

Association Types

Ten 100-m² plots each were sampled in the mountain mahogany and subalpine forest associations.

Subalpine Forest (86210, 86220, 86300, 86600): 305 acres (123 ha). The diverse subalpine forest above 7600 ft (2317 m) shows clinal variation with respect to exposure. Four main subtypes are identifiable.

Subtype 1. The foxtail pine subalpine forest (46 acres, 19 ha) is the most highly insolated subtype, occurring on S.- to SW.-facing exposures at lowest elevations. It is dominated by foxtail pine with lesser numbers of mountain mahogany, red fir, and lodgepole, western white, and whitebark pines. It is an open forest with relatively deep, rocky soil. Reproduction is scattered in openings and dominated by foxtail pine and red fir. The understory is similar to the adjacent mountain mahogany woodland (subtype 3). As with other subalpine trees at Crater Creek, the foxtail

Figure 44—Crater Creek, dense mixed subalpine forest with foxtail pine, whitebark pine and mountain hemlock. (1986)



pinus are not particularly old. Five trees 27-35 inches (69-89 cm) dbh were between 370 and 435 years old. The largest foxtail pines in this type are 44-48 inches (1.1-1.2 m) dbh and are probably 600-700 years old.

Subtype 2. The mixed subalpine forest (108 acres, 44 ha) lies on mostly W.-facing exposures above the previous subtype. It is denser than subtype 1, with the deletion of mountain mahogany and many of its associated understory species. Foxtail and whitebark pines are codominants with western white pine, lodgepole pine, and red fir as relatively minor components. Heights of dominant whitebark and foxtail pines are typically between 66 and 82 ft (20-25 m). The tall whitebark pines are particularly noteworthy (fig. 44).

Subtype 3. The mountain hemlock subalpine forest (117 acres, 47 ha) occurs at higher elevations and on more NW.-facing slopes than the previous subtypes. This is the densest form of subalpine forest, characterized by the addition and regular dominance of mountain hemlock. Whitebark pine remains an important subdominant and occasional codominant, but foxtail pine becomes rare, as do the other tree species associated with previous subtypes.

Subtype 4. The whitebark pine subalpine forest (34 acres, 14 ha) is the highest and most exposed of the subalpine types. It occurs on the summit ridge above 8200 ft (2500 m) and is dominated by semikrummholz whitebark pine. Mountain mahogany again becomes the most important subdominant, as it is in the open forests of subtype 1. Foxtail pine is scattered on deeper soil within this ridgetop type.

The sample plots are concentrated within the first two subtypes. Of the seven tree species in the sample, whitebark pine dominates (basal area cover 37 m²/ha, density 660/ha, frequency 90 percent), followed by foxtail pine (basal area cover 32 m²/ha, density 130/ha, frequency 70 percent). The other species in order of importance are red fir, mountain mahogany, mountain hemlock, western white pine, and lodgepole pine. Total basal area cover is about 80 m²/ha, and total density is 1150/ha.

Mountain Mahogany (no Holland equivalent): 240 acres (97 ha). This type may be broken into three subtypes considered as a gradient ranging from open shrub-steppe on the lowest, driest, most highly serpentinized areas, through a taller dwarf woodland or scrub in rocky gabbroic areas at mid-elevations, to a woodland on deeper gabbroic soil with scattered trees of several species of conifers at high elevations.

Subtype 1. The serpentinite shrub-steppe (82 acres, 33 ha) has the lowest cover of the three types. It is restricted to the serpentinite belt on the W. side of the area, ranging from 5760 to 6880 ft (1756-2097 m). Slopes are relatively steep (30-45°) with xeric W. to SW. exposures. The area is dominated by low (4- to 6-ft, 1.2- to 1.8-m) mountain mahogany with large grass- and herb-dominated patches intervening. Average shrub density on two 100-m² plots is 900/ha, and average shrub cover is 27 percent. Density of mountain mahogany saplings and seedlings averages 130/ha. The dominant herbs and grasses include *Festuca idahoensis*, *Elymus glaucus*, *Phlox diffusa*, and *Poa pringlei*. Species apparently restricted to this subtype include *Sedum lanceolatum*, *Arenaria congesta*, *Allium siskiyouensis*, *Cryptantha affinis*, *Phacelia linearis*, and *Eriogonum siskiyouensis*.

Subtype 2. The rocky gabbro scrub (98 acres, 40 ha) occurs at elevations between 6800 and 7500 ft (2073-2286 m). Stature of mountain mahogany increases, grass cover decreases, and additional small shrubs increase compared to the previous subtype. Gabbro boulders cover 40-50 percent of the ground. On four 100-m² plots, the stem cover for mountain mahogany averages 9 m²/ha whereas shrub density (not stem density) averages 575/ha. Other shrubs on the four plots include *Symphoricarpos vaccinoides*, *Berberis pumila*, *Amelanchier pallida*, *Ceanothus prostratus*, *Prunus virginiana* var. *demissa*, *P. emarginata*, and *Arctostaphylos patula*. Herbs and grasses are sparse in cover, but they are

represented by 25 species on the four sample plots. These include *Viola purpurea*, *Achillea lanulosa*, *Monardella odoratissima* ssp. *pallida*, *Hackelia jessicae*, and *Senecio integerrimus*.

Subtype 3. The mixed mountain mahogany woodland (60 acres, 24 ha) occurs on gentle S. to SW. exposures with deep, relatively unrocky soil. Mountain mahogany attains its greatest size in this type, which ranges between 7200 and 7760 ft (2195-2365 m) in the SE. quarter of section 18 and the adjacent part of sect. 19. Tree-size individuals of mountain mahogany up to 20 inches (51 cm) dbh and 25 ft (7.6 m) tall are interspersed with scattered trees of foxtail pine, whitebark pine, western white pine (*Pinus monticola*), Jeffrey pine (*P. jeffreyi*), lodgepole pine (*P. contorta* ssp. *murrayana*), white fir (*Abies concolor*), and Shasta red fir (*A. magnifica* var. *shastensis*).

Only one of the four 100-m² plots is clearly dominated by mountain mahogany, whereas two are marginally dominated by foxtail pine with mountain mahogany as the major subdominant, and the other plot is dominated by Jeffrey pine. On all four plots, mountain mahogany stems outnumber all trees, with an average density of 1300/ha (range 300-2600/ha). Some mountain mahogonies are single-stemmed, but most have 3-6 basal stems. Reproduction of mountain mahogany is better than in other subtypes, with seedlings or saplings occurring on 75 percent of the plots and averaging 1000/ha.

Artemisia tridentata is characteristic and conspicuous in many areas as the major low shrub (12-25 percent cover). Eight other species of shrubs occur in this subtype, including *Ceanothus prostratus* (12-35 percent cover), *Symphoricarpos vaccinoides* (2-10 percent cover), and *Ribes binominatum*. Herbs and grasses are more conspicuous (26 species) on this type than the rocky gabbro subtype. This subtype is clearly ecotonal with subalpine forest and shows that mountain mahogany is limited by competition to poorer sites where conifers cannot dominate.

Plant Diversity

One hundred two taxa are listed.

Conflicting Impacts

A recent selective logging operation encroaches on the lower elevations of the proposed area, although it does not appear to have affected any of the major vegetation types within the proposed boundaries.

22. Cub Creek (Lassen National Forest 1981, Taylor and Randall 1978)

Location

This established RNA is on the Lassen National Forest. It lies about 12 miles (19 km) S. of Mineral, occurring in portions of sects. 13, 14, 15, 23, 24, and 25 T27N, R4E and sects. 18, 19, 20, 29, and 31 T27N, R5E MDBM (40°10'N., 121°9'W.), USGS Butte Meadows and Jonesville 15' quads (*fig. 45*). Ecological subsections – Lassen-Almanor (M261Dm) and Shingletown-Paradise (M261D1).

Target Element

Mixed Conifer Forest

Distinctive Features

Successional Trends in Mixed Conifer Forest: Throughout the elevational range of forest in the drainage, only white fir (*Abies concolor*) shows an abundance of individuals of smaller size classes (*fig. 46*). At present there are no data suggesting white fir mortality patterns change with age. Thus, barring fire intervention,

forest composition may change towards strong white fir dominance and reduced diversity of associated canopy species. The Cub Creek watershed shows a wide variety of possible study sites for investigations of long-term successional trends within the mixed conifer and adjacent zones.

Large Size and Ecological Integrity: The preservation of the area as an entire watershed will be useful for ecosystem-wide studies, and the large area of the RNA will enable many studies to take place within its boundaries without the need to select additional locations.

Physical Characteristics

The area covers 3922 acres (1587 ha) that include the majority of the Cub Creek watershed. Cub Creek is a low-order tributary of Deer Creek, draining the W. slope of the S. Cascades. Elevations range from 3725 to 6703 ft (1136-2044 m). Gross topography is moderately steep (25-40°). However, because of many small cliffs less than 66 ft (20 m) high, the microtopography is more rugged than indicated on topographic maps. The stream runs in a NW. direction, making NE. and SW. slopes the predominant aspect in the area.

Rocks are entirely Pliocene volcanics. Vertical cliffs are primarily breccia and often capped by resistant andesite. Soil depth is greatest on NE.-facing slopes, but no detailed account of soils was available at the time of the survey. Climate is typical summer-dry, winter-wet with total annual precipitation at Mineral averaging 51.5 inches (1309 mm). Mineral's average annual temperature is 46 °F (7.6 °C) with a January average of 30.6 °F (-0.8 °C) and a July average of 63.0 °F (17.2 °C).

Association Types

Seven plots were sampled in the mixed conifer forest and four in the red fir zone.

***Arctostaphylos patula-Quercus vaccinifolia* (37510):** 974 acres (397 ha). This is a seral brush association that is trending toward forest in most sites. *A. patula*, *Ceanothus integerrimus*, and *Q. vaccinifolia* dominate the vegetation, forming a closed canopy 1-1.5 m tall. Herbs are sparse. On very rocky sites at lower elevations within the drainage this may be a climax type.

Ponderosa Pine/Douglas-Fir/Incense-Cedar (*Pinus ponderosa-Pseudotsuga menziesii-Libocedrus decurrens*) (84230): 901 acres (365 ha). This association shows the typical variation in dominance between the five principal dominants of the Sierran mixed conifer forest: ponderosa pine, Douglas-fir, sugar pine (*Pinus lambertiana*), incense-cedar, and white fir. Incense-cedar has the highest frequency of occurrence, followed by Douglas-fir, ponderosa pine, and sugar pine. Basal area ranges from 89 to 124 m²/ha, and density ranges from 808 to 1050 trees/ha. Shrubs are not indicated on the samples. Herbs are represented by *Bromus marginatus*, *Polygala cornuta*, *Viola lobata*, *Pedicularis densiflora*, *Iris hartwegii*, *Carex multicaulis*, *Arceuthobium campylopodum*, *Hieracium albiflorum*, and *Galium bolanderi*, most of which are less than one percent cover.

***Sitanion hystrix-Chrysothamnus nausiosus* (35400):** 481 acres (191 ha). This association occupies rocky or shallow soil sites at the highest elevations within

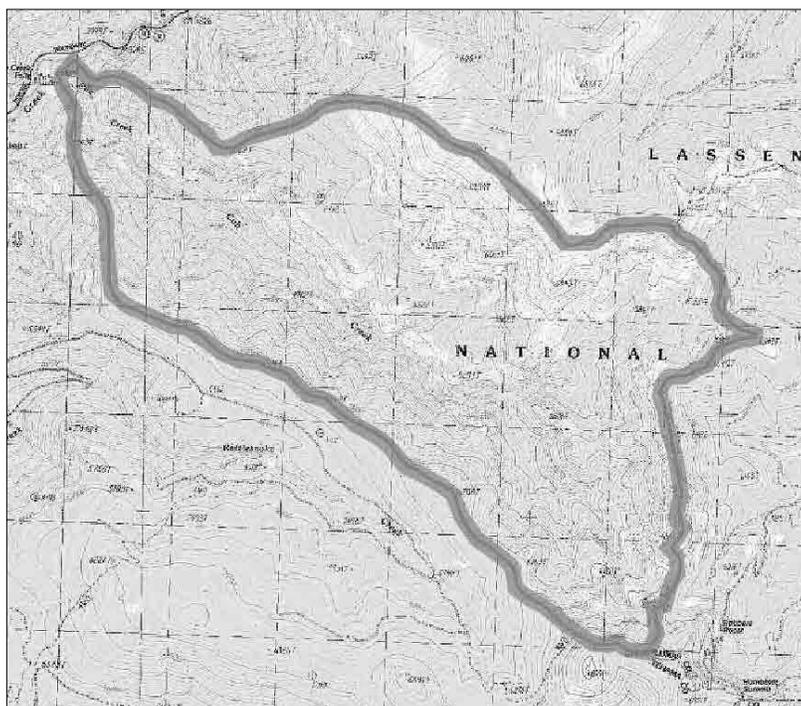


Figure 45—Cub Creek RNA

the Cub Creek basin. These sites are dry and well-drained with little snow cover in winter because of wind exposure. The vegetation is composed of cold-desert type species. Other species beside the two definitives include *Penstemon laetus*, *Phacelia frigida* ssp. *dasyphylla*, *Calyptridium umbellatum*, *Eriophyllum lanatum* ssp. *integrifolium*, *Artemisia arbuscula*, *Leptodactylon pungens* ssp. *hookeri*, *Calochortus leichtlinii*, *Sanicula tuberosa*, *Phlox diffusa*, *Pteryxia terebinthina* var. *californica*, *Allium plauticaule*, *Galium hypotrichium*, *Eriogonum microthecum*, *Penstemon deustus*, *Collomia tinctoria*, and *Eriogonum ursinum*.

Red Fir (*Abies magnifica*)-White Fir-Western White Pine (*Pinus monticola*) (84240, 85310): 1366 acres (552 ha). The four plots yield basal area cover of 56-123 m²/ha, with white fir, red fir, and western white pine dominating the canopy. Densities range from 301 to 1902 trees/ha. This forest shares some species of shrubs and herbs with the montane chaparral, and it appears that most of the montane chaparral in the drainage will succeed to this type of forest. Shrub and herb species include *Quercus vaccinifolia*, *Smilacina racemosa amplexicaulis*, *Penstemon gracilentus*, *Monardella odoratissima* ssp. *pallida*, *Arctostaphylos nevadensis*, *Ribes viscosum* ssp. *hallii*, *Chrysopsis breweri*, *Acer glabrum*, *Pyrola picta*, and *Chimaphila menziesii*.

Douglas-Fir-Pacific Dogwood (*Cornus nuttallii*) (84110): 160 acres (64 ha). Douglas-fir is the dominant canopy species and occurs with white fir, incense-cedar, Pacific dogwood, California black oak (*Quercus kelloggii*), and bigleaf maple (*Acer macrophyllum*). This type occurs on only the lower NE.-facing slopes of the area. One plot sampled in this type indicates a near-equal importance of Douglas-fir and incense-cedar, with much lower importance of other tree species. Shrubs are apparently very sparse (none listed), and herbs include *Goodyera oblongifolia*, *Pteridium aquilinum pubescens*, *Disporum hookeri* var. *trachyandrum*, *Corallorhiza maculata*, *Trientalis latifolia*, *Asarum hartwegii*, and *Chimaphila umbellata* ssp. *occidentalis*.

Carex microptera-Glyceria striata (45100): 40 acres (16 ha). Meadows are few in number and small. Among the species included in this association are *Veratrum californicum*, *Muhlenbergia filiformis*, *Deschampsia elongata*, *Mimulus primuloides* ssp. *pilosellus*, *Sagina saginoides* ssp. *hesperia*, *Hypericum anagalloides*, *Taraxacum officinale*, *Epilobium oregonense*, *Mimulus guttatus*, *Trifolium longipes*, *Veronica americana*, and *Viola adunca*.

Figure 46—Cub Creek, view of the southwest-facing slopes at the head of Cub Creek. Montane chaparral alternates with patches of *Abies concolor-Abies magnifica* reproduction. *Arctostaphylos patula* and *Ceanothus integerrimus* dominate the chaparral. Cliffs are formed from resistant volcanic rocks. Barren areas within the chaparral are vegetated by the *Sitanion hystrix-Chrysothamnus nauseosus* association. (1976)



Plant Diversity

Two hundred thirty-one plant taxa are listed.

Conflicting Impacts

No conflicts of major importance are indicated. Access to the lower reaches of the drainage is somewhat difficult. Slopes are steep and rugged, limiting to some degree the ease of scientific study.

23. Devil's Basin (Martin 1995, Newton 1987)

Location

This established RNA is on the Mendocino National Forest and is located about 10 miles (16 km) SW. of the town of Paskenta in Tehama County. It includes parts of sects. 11, 12, 13, and 14 T23N, R8W MDBM (39°50'N., 122°43'W.), USGS Hall Ridge quad (fig. 47). Ecological subsection – Eastern Franciscan (M261Ba).

Target Element

California Black Oak (*Quercus kelloggii*)

Distinguishing Features

Diversity of Black Oak Types: The presence of relatively young and mature California black oak stands in addition to mixed stands with Douglas-fir (*Pseudotsuga menziesii*) and ponderosa pine (*Pinus ponderosa*) provides a varied background for an array of ecological studies on the California black oak target element. The Devil's Basin California black oak stands are within the range of optimum development of the forest type in California.

Wildlife Values: California black oak is an important source of food for a variety of acorn-consuming vertebrates including black-tailed deer (*Odocoileus hemionus columbianus*), mountain quail (*Oreortyx pictus*), California quail (*Callipepla californica*), band-tailed pigeon (*Columba fasciata*), and gray squirrel (*Sciurus griseus*). The older stands of black oak in the area are probably near peak acorn-producing capability and thus serve as important resources to a large number of animals.

Rare Plant: California black walnut (*Juglans hindsii*) is a member of CNPS list 1B. The local individuals may be naturalized from planted trees.

Physical Characteristics

The area covers 671 acres (272 ha). Elevations range from 1400 to 3660 ft (427-1116 m). Topography is rugged, with steep N.- to NE.-facing slopes predominating (fig. 48). The area is centered on the toe of an ancient slope failure and includes surrounding steep to moderately steep slopes and ridgelines. Slope instability is prevalent throughout much of the steeper areas.

Rocks are entirely Franciscan assemblage and are locally schistose metasediments. Soil series are of two main types: Tyson (poorest sites, with canyon live oak) and Sheetiron (better sites; with California black oak and Douglas-fir). Small portions of Laughlin series (blue oak savanna) and Hulls series occur, as well as small areas of rock-land and colluvial soils. Climate is mild, with estimated mean annual precipitation of 30+ inches (762+ mm). Mean summer temperature maxima are slightly over 100 °F (38 °C), whereas mean winter minima are 28 to 30 °F (-2 to -1 °C) at lower elevations.

Association Types

The size of the associations and the numbers and sizes of plots and relevés are not given.

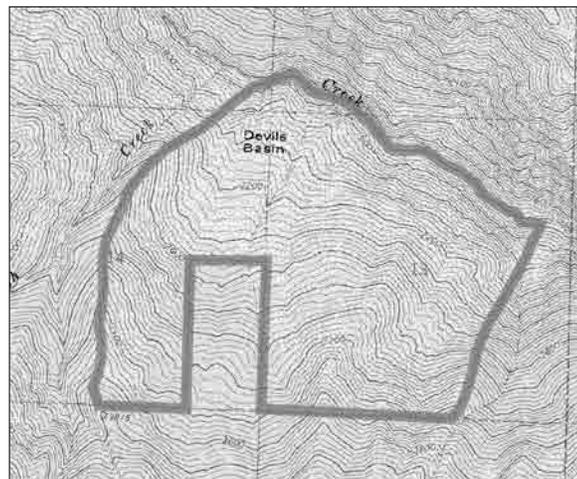


Figure 47—Devil's Basin RNA

California Black Oak/*Festuca californica* (71120): The California black oak-dominated forest at the site is composed of both persistent subclimax stands and seral stages, successional to Douglas-fir-dominated forest. These forests may be divided into young and old stands.

The young stands have 60 percent canopy cover dominated by California black oak, with occasional Douglas-fir and canyon live oak (*Quercus chrysolepis*). California black oak reproduction is low, but widespread. This is primarily a young black oak forest, showing little evidence of succession to Douglas-fir dominance. Most oaks are 60-70 years old (4-8 inches, 10-20 cm dbh) with 23-30 m²/ha basal area. Shrubs in the young stands are dominated by *Toxicodendron diversilobum*, with *Rhus trilobata* and *Cercis occidentalis* as secondary species. The herb layer (15-30 percent cover) is dominated by *Festuca californica* with *Galium triflorum*, *Lathyrus nevadensis*, *Silene californica*, and *Chlorogalum pomeridianum*.

The more mature stands are variable in canopy cover (50-90 percent) and dominated by California black oak, with some ponderosa pine and Douglas-fir. Reproduction of all canopy species is present with black oak saplings and seedlings covering up to 20 percent. Basal area cover ranges from 14.5 to 82.6 m²/ha, and trees range from 70 to 120+ years (8-30 inches, 20-76 cm dbh). The

shrub layer (5-20 percent cover) is more diverse than in younger stands. In addition to the previously mentioned shrubs, *Cercocarpus betuloides* and *Ribes roezlii* also occur. The herb layer is much more diverse than in young stands (with often 60 percent cover). It is dominated by *Festuca californica* but also includes *Trientalis latifolia*, *Osmorhiza chilensis*, *Bromus mollis*, *Collinsia sparsiflora*, *Galium bolanderi*, *Monardella villosa*, *Wyethia angustifolia*, *Viola sheltonii*, *Asclepias cordifolia*, *Delphinium nudicaule*, *Dichelostemma (Brodiaea) multiflora*, and *D. pulchella*.

Douglas-Fir/*Mahonia (Berberis) dictyota* (84110): The upper canopy of this forest is open (20 percent cover) and dominated by Douglas-fir, with smaller amounts of ponderosa and knobcone pine (*Pinus attenuata*). The subcanopy averages 70 percent cover; it is 50-70 ft (15-21 m) tall and dominated by California black oak. Reproduction of both major trees is low. Basal area averages 50.5 m²/ha, with trees averaging 150-200 years old. Shrub and herb layers are low in cover (10 percent). *Berberis dictyota*, *Cynoglossum grande*, *Osmorhiza chilensis*, *Galium triflorum*, *Viola sheltonii*, and *Symphoricarpos mollis* are the principal understory species.

Blue Oak (*Quercus douglasii*)/*Stipa lemmonii* (71140): This blue oak savanna has an open canopy (5 percent cover) dominated by blue oak about 50 ft (15 m) tall and 100 years old, with some Oregon white oak (*Quercus garryana*) interspersed. Basal cover averages about 9.2 m²/ha. No shrubs occur, and the herb layer (100 percent cover) is dominated by a mixture of native and introduced species including *Stipa lemmonii*, *Aira caryophylla*, *Avena barbata*, *Bromus mollis*, *B. rubens*, *Melica hartfordii*, *Vulpia (Festuca) microstachys* var. *ciliata*, *V. myuros* var.

hirsuta, *Eriogonum nudum*, *Delphinium hesperium*, *Torilis arvensis*, *Thysanocarpus curvipes*, *Trifolium albopurpureum*, and *T. ciliolatum*.

Canyon Live Oak/*Sedum* sp. (81320): This forest occurs on the poorest sites (steep, rocky slopes). Canopy height averages 60 ft (18 m); it is dominated by multiple-trunked canyon live oak. California buckeye (*Aesculus californica*) and a few California bay (*Umbellularia californica*) are also present. Reproduction of canyon live oak is occasional. Shrub and herb layers are variable (10-90 percent)

Figure 48—Devil's Basin, view east down Thomes Creek gorge, canyon live oak forest in middleground, mixed California black oak and buckeye brush in foreground. (1986)



depending on canopy openness and slope characteristics. Shrubs range from 5 to 30 ft (1.5-9.1 m) tall and include *Toxicodendron diversilobum*, *Cercocarpus betuloides*, and shrubby California black walnut. Herbs include *Sedum* sp., *Galium bolanderi*, *Dichelostemma (Brodiaea) volubilis*, and, in some areas with better soil development, grasses similar to those of the blue oak savanna.

***Quercus dumosa*/California buckeye (37110):** This brushy woodland type has a very low canopy cover (<5 percent). Canopy species include sparse foothill pine (*Pinus sabiniana*) up to 50 ft (15 m) tall with occasional black oak and canyon live oak. Shrubby trees of the two canopy oaks and of California buckeye are fairly common. Shrubs are dense (90 percent cover) and dominated by *Quercus dumosa*, along with *Cercocarpus betuloides*, *Toxicodendron diversilobum*, *Rhus trilobata*, *Adenostoma fasciculatum*, *Ceanothus integerrimus*, and *Heteromeles arbutifolia*. Herbs are generally low in cover and include *Festuca californica*, *Trientalis latifolia*, and *Dichelostemma volubilis*.

Plant Diversity

One hundred forty-five species are listed.

Conflicting Impacts

Controlled burning may be necessary to maintain black oak stands on better sites where succession may lead to conifer dominance. The area is within the Thomes Creek Roadless Area, and little human impact is apparent.

24. Devil's Garden (Keeler-Wolf 1984a)

Location

This established RNA is on the Modoc National Forest. It lies 23 miles (36 km) NNW. of Alturas, occurring in portions of sects. 28, 29, 32, and 33 T46N, R12E MDBM (41°48'N., 120°36'W.), USGS South Mtn. 15' quad (fig. 49). Ecological subsection – Devil's Garden (M261Gb).

Target Element

Western Juniper (*Juniperus occidentalis* ssp. *occidentalis*)

Distinctive Features

Western Juniper Woodland: The Devil's Garden RNA contains the only specifically designated scientific reserve of this major plant association in NE. California. The RNA is positioned within the most extensive single stand of western juniper anywhere, and it is within its zone of optimal development (fig. 50).

Artemisia Shrub-Steppe: This widespread transmontane vegetation, characterized by a mixture of shrubs and grasses, is not well represented in the California RNA system (see Babbitt Peak, Cahuilla Mountain, Indiana Summit, McAfee, Mud Lake, Sentinel Meadow, Whippoorwill Flat, and White Mountain), but it is extensive in this RNA. The low grazing pressure in this type locally has preserved a diversity of native grasses and herbs frequently reduced in other sagebrush communities in the region.

High Plant Diversity in a Stressful Environment: The Devil's Garden RNA has a substantially higher diversity of vascular plants (up to 52 species/0.1 ha) than

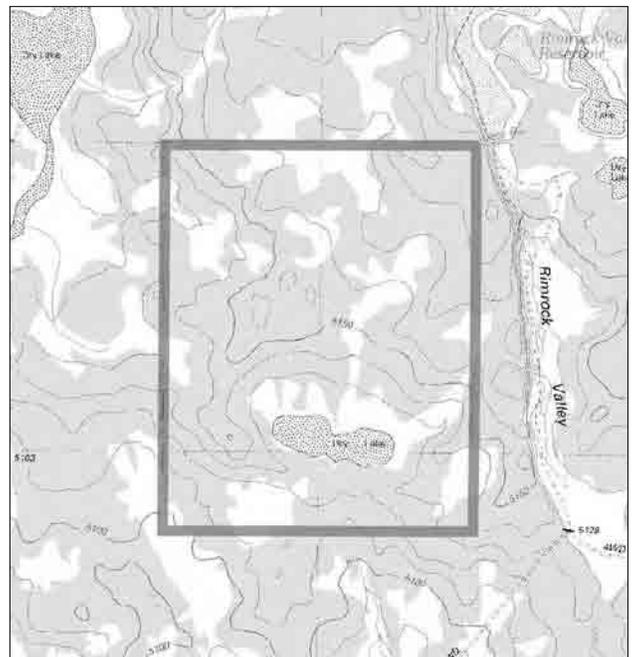


Figure 49—Devil's Garden RNA

has been listed for other western juniper and sagebrush-steppe associations (West 1988). This raises questions about the origins of this diversity within an area of such habitat uniformity, yet high environmental stress.

Succession on the 1959 Burn: Little is known about succession in western juniper woodland. Twenty-four years after a fire in the SE. part of the area, there was a surprisingly high density of juniper saplings as well as young shrubs of *Artemisia tridentata* and *Purshia tridentata*. Comparisons with descriptive accounts of the vegetation from 10 years after the burn indicate distinct trends such as replacement of once extensive ruderal vegetation (e.g., *Verbascum*, *Cirsium*) by later successional native species.

Patterned Ground: Frost mounds and frost lines occur in several places within and adjacent to the RNA. These features are usually associated with periglacial activity, and these NE. California examples are among the lowest elevation of any known in the state. The cold, dry, continental climate of the area and the predominantly heavy clay soil, subject to much expansion and contraction during freezing and thawing, may be responsible for their presence.

Rare Flora: *Erigeron elegantulus* (List 4), *Hackelia cusickii* (List 4), *Penstemon cinereus* (List 4), *Poa fibrata* (List 3), and *Polygonum polygaloides* ssp. *esotericum* (List 1B, type locality, Devil's Garden) are considered rare by CNPS.

Physical Characteristics

The area covers 800 acres (324 ha). Elevations range from 5100 ft to 5190 ft (1555-1582 m). Topography is very gradual and gently-rolling, with one shallow, vernaly flooded depression located in the S.-central portion. A small area of fault-raised rimrock escarpment occurs on the NE. corner. Patterned ground related to frost heaving occurs in portions of the area.

Rocks are entirely late Pliocene to early Pleistocene volcanics (Devil's Garden Basalt). Soils vary from haplargids to haploxerolls and vertisols. Climate is relatively harsh. Annual precipitation is estimated between 15 and 20 inches (380-500 mm). It is mostly snow, which is often blown clear over large areas. Temperatures range from January minima of about 14 °F (-10 °C) to July maxima of about 86 °F (30 °C).

Association Types

Two 0.1-ha plots were sampled in the western juniper woodland.

Western Juniper Woodland (72110): 592 acres (240 ha). This major association may be broken down into three phases locally: rimrock juniper, open juniper, and successional juniper. Rimrock juniper covers 7 acres (3 ha); this phase has the highest density of western juniper and other large woody species such as *Cercocarpus ledifolius* and *Prunus virginiana* var. *melanocarpa* (average stem density, 600/ha). Other representative shrubs and herbs include *Artemisia tridentata*, *Amelanchier pallida*, *Chrysothamnus viscidiflorus*, *C. nauseosus* ssp. *albicaulis*, *Ribes cereum*, *Sambucus caerulea*, *Cirsium utahense*, *Elymus triticoides*, and *Scrophularia lanceolata*.

Open juniper covers 505 acres (204 ha). On 0.2 ha of sampled area, juniper densities are 200-340 trees/ha. Shrub layer is dominated by *Artemisia arbuscula* with occasional *Ribes velutinum*. A surprising diversity of herbs and grasses are encountered on the sample plots, including 11 species of grasses and 40 species of herbs. The majority of these species are shared with *Artemisia arbuscula* shrub-steppe, but several shade and duff-tolerant species characteristic beneath junipers include *Senecio integerrimus*, *Fritillaria pudica*, *Hackelia cusickii*, *Lithophragma tenellum*, *Plectritis macrocera* var. *grayi*, and *Collinsia parviflora*. The



Figure 50—Devil's Garden, open western juniper woodland looking west from northeast corner of Devil's Garden RNA. (1983)

openings are generally rockier than true *Artemisia arbuscula* shrub-steppe and contain certain species that are less common on the open, treeless *A. arbuscula* flats, including *Agropyron spicatum*, *Arabis holboellii* var. *retrofracta*, *Cordylanthus ramosus*, *Crepis modocensis*, *Erigeron elegantulus*, *Eriogonum douglasii*, *Penstemon laetus*, and *Thelypodium flexuosum*.

Successional juniper occupies about 80 acres (32 ha) that burned in 1959. Although this association type is not presently dominated by juniper, the density of stumps and snags indicates that it once had a heavy juniper cover. Several herbaceous species appear restricted to this area, including *Geum ciliatum*, *Cirsium vulgare*, *Achillea millefolium*, *Crepis acuminata*, *Phacelia imbricata*, *Madia citriodora*, and *Arenaria nuttallii* ssp. *fragilis*. Regeneration of juniper is better here than on typical undisturbed open woodland (about 70 vs. 30 saplings and seedlings/ha). Also characteristic of the burned area is a lower diversity of grasses and herbs than in adjacent undisturbed juniper woodland.

Artemisia Shrub-Steppe (35300, 35400, 44131): 208 acres (84 ha). This association generally occurs on less rocky and more poorly drained sites than the juniper woodland. It may also be divided into three phases: rocky scabland, upland, and closed basin.

The rocky scabland type covers 5 acres (2 ha) and has the lowest cover of *A. arbuscula* and other species, including *Eriogonum umbellatum*, *E. douglasii*, *Arenaria congesta*, *Festuca idahoensis*, and *Sitanion hystrix*. These species are scattered among nearly continuous outcroppings of basalt, with only small pockets of soil.

The upland phase is the most diverse and extensive, covering 160 acres (65 ha). *Artemisia arbuscula* is the dominant woody species. However, cover is often exceeded by perennial grasses, including *Festuca idahoensis*, *Koeleria macrantha*, *Poa juncifolia*, *Stipa columbiana*, *Danthonia unispicata*, and *Sitanion hystrix*. This phase may be flooded briefly in spring. Scattered rocks pepper the surface of the soil, which is intermediate in depth between the other two phases of shrub-steppe. Drainage channels leading into the small basin contain several vernal hydrophilic species such as *Perideridia bolanderi*, *Polygonum polygaloides* ssp. *esotericum*, and *Navarretia minima*. Other typical species of this modal *A. arbuscula* type include *Penstemon speciosus*, *Lomatium triternatum*, *L. nudicaule*, *Zigadenus paniculatus*, *Blepharipappus scaber*, *Poa fibrata*, *Phlox douglasii* ssp. *rigida*, *Antennaria luzuloides*, *Plagiobothrys cusickii*, *Gilia leptalea*, and *Erigeron linearis*.

The closed basin type is dominated by *Artemisia arbuscula* and *Chrysothamnus viscidiflorus* ssp. *pumilus* (43 acres, 17 ha). Grasses are substantially less important than in other *A. arbuscula* types. Diversity is low with *Lomatium leptocarpum*, *Polygonum polygaloides* ssp. *esotericum*, *P. douglasii*, *Gayophytum* sp., *Poa juncifolia*, *Blepharipappus scaber*, and *Perideridia bolanderi* among the few species. Parts of this basin are almost devoid of vegetation. The summer-dry, deeply cracked vertisol is probably flooded and saturated with water for at least a month in spring and remains moist for perhaps two additional months in most years.

Plant Diversity

One hundred and four taxa are listed.

Conflicting Impacts

Cattle grazing has some impact, particularly on the NE. corner and E.-central part of the RNA. The size of the RNA has been reduced by half since originally established in 1933. Bulldozers were used to fight the 1959 fire on the RNA, and resulting trails were still obvious in 1984.

Note: for Devil's Rock, see Devil's Rock-Hosselkus, #25

25. Devil's Rock-Hosselkus (Devil's Rock, Hosselkus Limestone) (Keeler-Wolf and Keeler-Wolf 1975, Keeler-Wolf 1989h, Cheng 1997b)

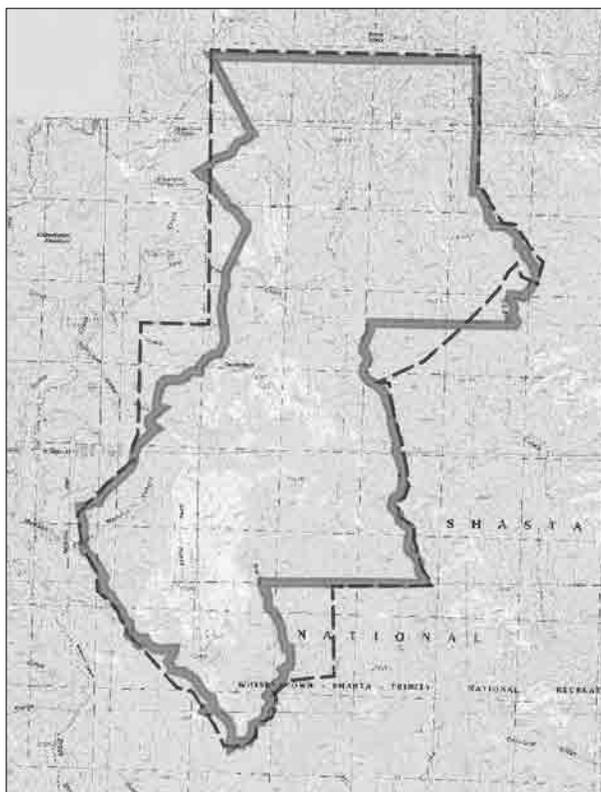


Figure 51—Devil's Rock-Hosselkus RNA

Dashed line = Ecological study area;
Solid gray line = RNA Boundary

Location

This established RNA is on the Shasta-Trinity National Forest. It is centered approximately 24 miles (39 km) NE of Redding. The area includes all or portions of sects. 21, 22, 23, 26, 27, 28, 32, 33, 34 T35N, R2W and sects. 3, 4, 5, 8, 9, and 16 T34N, R2W MDBM (40°51'N., 122°06'W.), USGS Devil's Rock, Goose Gap, and Minnesota Mtn. quads (fig. 51). Ecological subsection – Eastern Klamath Mountains (M261Ai).

Target Elements

Limestone Ecosystem (unique element), California Black Oak (*Quercus kelloggii*), and Canyon Live Oak (*Quercus chrysolepis*)

Distinctive Features

Limestone Values: A variety of important values can be attributed to the presence of extensive beds of Triassic limestone in the area (fig. 52). These include the localized endemic plant *Eupatorium shastensis*, wider ranging plants endemic to limestone substrates (e.g., *Cheilanthes cooperae*, *Adiantum capillaris-veneris*), localized endemic land snails (Shasta sideband snail [*Monodenia troglodytes*], a category 2

candidate for listing by the U.S. Fish and Wildlife Service, which means existing information indicates taxa may warrant listing, but substantial biological information necessary to support a proposed rule is lacking), a localized endemic salamander (Shasta salamander [*Hydromantes shastae*], a State-listed threatened species), a rich assemblage of Triassic invertebrate fossils (including ammonites, brachiopods, corals, in all more than 200 species of invertebrates), the best representation of N. American Triassic marine reptiles (including five species and three genera of ichthyosaurs and the only known remains of the order Thalatosauria in the W. Hemisphere), and more recent Pleistocene vertebrate fossils in cave deposits (including at least one representative of every vertebrate class). These combined values cannot be duplicated in any other area.

California Black Oak: This is the only designee for this fire-adapted target element in the Klamath Mountains ecological section. The extensive forests dominated by California black oak in the E. portion of the area (the former Devil's Rock candidate RNA) cover a larger area on more varied slope exposures and a greater diversity of stocking densities and subtypes than can be found on the other RNAs currently designated for this target element in California (fig. 53). The variety of successional states, including Douglas-fir (*Pseudotsuga menziesii*) invasion on mesic exposures and ponderosa pine (*Pinus ponderosa*) and foothill pine (*P. sabiniana*) on more xeric exposures, is of particular interest. On steeper slopes, California black oak merges with and gives way to canyon live oak forest.

Biogeographic Significance: This area, at the junction of the Klamath Mountains and Great Valley ecological sections, is the meeting place for a number of plants and animals at or near their distributional limits. Nineteen species of vascular

plants are thought to be at or near their N. range limits (including *Salvia sonomensis*, *Collinsia tinctoria*, *Aesculus californica*, *Dendromecon rigida*, *Fraxinus dipetala*, *Styrax officinalis* var. *californica*, and *Calycanthus occidentalis*), while 10 species are at or near their most inland occurrences (including *Whipplea modesta*, *Viola ocellata*, *Acer circinatum*, *Aruncus vulgaris*, and *Cacaliopsis nardosmia*). Several animals such as California newt (*Taricha torosa*), striped racer (*Masticophis lateralis*), and Nuttall's woodpecker (*Picoides nuttallii*) are near their N. limits. Species such as black salamander (*Aniades flavipunctatus*), tailed frog (*Ascaphus truei*), and Pacific giant salamander (*Dicamptodon ensatus*) are near their most inland locations in California.

Archeological Values: This RNA is adjacent to a significant multilevel cultural deposit dating back at least 6500 years. Although no excavations or thorough searches for artifacts have been conducted in the RNA, sites occupied by American Indians have been discovered in caves in the S. of the area.

Rare Plants: The endemic *Eupatorium shastensis* is considered a member of List 4 by CNPS. Shasta snowwreath (*Neviusia cliftonii*), CNPS List 1B, is a species discovered in 1992. This species is thought to be relict from the Arcto-tertiary period; its closest relative occurs in SE. United States.

Rare Animals: The Shasta salamander (*Hyromantes shastae*) is listed by California State as threatened, and it is considered sensitive species by the Shasta-Trinity National Forests. The land snail (*Monodenia troglodytes*) is a candidate for State listing.

Physical Characteristics

The survey area covers 6439 acres (2608 ha) with elevations from 1100 to 3272 ft (335 to 997 m). The established RNA is 5550 acres (2246 ha). This area occupies the upper Brock Mountain peninsula between the Squaw Creek and Pit River arms of Lake Shasta. It is bisected by a prominent N.-S. trending ridge of rugged, resistant gray limestone, which stretches for about 5 miles (8 km). This limestone rises above 3000 ft (914 m) in several locations but is deeply cut by the canyon of Low Pass Creek in the N. portion of the area. The area E. of the limestone is gentler topography, dominated by the valleys of S.-flowing Flat and Ripgut creeks. Slopes of all aspects are well represented.

Rocks include the previously discussed Hosselkus Limestone, Brock Shale (which underlies the majority of the E. portion), and the Pit formation (shaley-siltstone, metadacite, and limestone, underlying a small portion of the NW. side of the area). Soils within the area are relatively complex and have been divided into 12 mapping units. The families represented include Neuns, Marpa, Kidig, Goulding, Boomer, and Speaker, with extensive areas of limestone rock outcrop. Precipitation is estimated at 60-70 inches (1524-1778 mm) annually. Highest and lowest annual temperatures are estimated to be 109 °F (42.8 °C) and 24 °F (-4.4 °C).

Association Types

The associations are described qualitatively; no vegetation sampling was conducted.

California Black Oak Forest (81340, 81320, 71110, 71120): 3246 acres (1315 ha). Oak-dominated vegetation in the RNA is a result of past widespread fires.

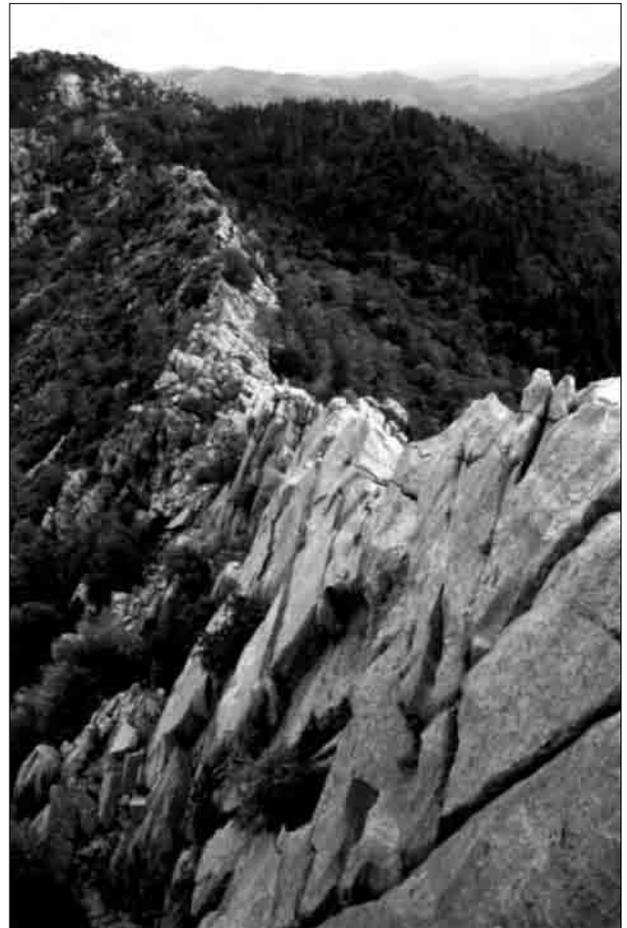


Figure 52—Devil's Rock-Hosselkus Limestone, sharp-edged outcrop of Hosselkus limestone at Gray Rocks, looking north. (1988)



Figure 53—Devil's Rock-Hosselkus Limestone, open ridgetop stand of California black oak in Devil's Rock – Hosselkus RNA. (1988)

Typical-ly, the upper S., W., and E. exposures with relatively deep soil and slope angles of <45 percent are clothed in black oak. The majority of these forests are younger than 100 years (mean age is 74 years). Growth rates and understory composition depend primarily on slope exposure. Several types are present. The following are brief descriptions of the variants:

W.-facing slope with black oak dominant over an understory of *Elymus glaucus* with *Toxicodendron diversilobum*, *Corylus cornuta* var. *californica*, *Symphoricarpos mollis*, *Galium aparine*, *Trillium chloropetalum*, *Osmorhiza chilensis*, and *Aristolochia californica*, among others. There may be saplings of

ponderosa pine and Douglas-fir. Some of the larger black oaks occur here (0.6 m dbh and 21 m tall).

SE.-facing slopes on W. side of RNA with high percentage of ponderosa pine and sparse understory including *Iris tenuissima*, *Brodiaea lutea* var. *analina*, *Hypericum concinnum*, *Collomia heterophylla*, *Viola lobata*, *Silene campanulata*, and *Brodiaea multiflora*. This type is transitional to the ponderosa pine phase of the low-elevation mixed conifer forest discussed in a following section.

SW.-facing slopes at high elevations on E. side of RNA. This is a spindly woodland with black oak 15-51 cm dbh and an understory of *Styrax officinalis* var. *californica*, *Melica californica*, *Carex multicaulis*, *Toxicodendron diversilobum*, and reproduction by Douglas-fir and foothill pine.

SE.-facing slopes on E. side of RNA with black oak 31-46 cm dbh and 15-17 m tall with a shrubby understory of *Styrax officinalis* var. *californica*, *Philadelphus lewisii* ssp. *californicus*, *Toxicodendron diversilobum*, *Cercis occidentalis*, and *Ceanothus integerrimus*. There are scattered grassy patches dominated by *Melica californica* and *Elymus glaucus*.

Highest elevation ridgetop stands where black oak dominates over a well-developed grassy understory with *Festuca californica*, *Elymus glaucus*, *Microseris nutans*, *Senecio aronicoides*, *Silene lemmonii*, *Agoseris grandiflora*, *Daucus pusillus*, *Cynosurus echinatus*, *Hydrophyllum occidentale*, and *Claytonia perfoliata* (among others).

On gentle NW.-facing slopes with deep soil, black oak dominates along with bigleaf maple (*Acer macrophyllum*) and canyon live oak with a dense understory dominated by *Corylus cornuta* var. *californica*.

Steep E.-facing slopes with shallow soils have spindly black oak co-dominant with canyon live oak and a sparse understory.

At highest elevations with steep S. exposures or on rocky slopes of shale or limestone, black oak gives way to stands of Oregon white oak (*Quercus garryana*). These stands (similar to Holland 71110) are typically stunted and compact (5-13 cm dbh, 2.4-3.7 m tall).

On very steep slopes of virtually any exposure, canyon live oak tends to dominate in dense stands with little understory except scattered *Toxicodendron*

diversilobum and *Corylus cornuta* var. *californica* (Holland 81320). These steep locales may be spared from fire for long periods, and thus some canyon live oak may attain dbh of more than 3 ft (1 m) and heights above 70 ft (21 m).

Limestone Scrub (37110, 37541, 71420): 1631 acres (661 ha). This vegetation resembles mixed chaparral in its principal constituents except for Brewer oak (typical of montane chaparral). It is more open than most chaparrals as a result of the abundant jagged limestone outcrops. *Cercocarpus betuloides* dominates most xeric rocky sites along with such herbs as *Arabis breweri*. Other dominants on less xeric sites include Brewer oak, *Philadelphus lewisii* ssp. *californicus*, California buckeye (*Aesculus californica*), *Rhamnus crocea* ssp. *ilicifolia*, *Garrya fremontii*, *Fraxinus dipetala*, *Cercis occidentalis*, *Holodiscus discolor*, *Clematis lasiantha*, and foothill pine. The most mesic N.-facing cliffs have a scattering of canyon live oak and such characteristic species as *Eupatorium shastensis*. The primary factor determining the distribution of limestone scrub is the substrate, whether on limestone or shale, this vegetation type occurs generally on the poorest rocky slopes and outcrops.

Low-Elevation Mixed Conifer Forest (84110, 81100, 84131): 1562 acres (633 ha). This association occupies the ravine bottoms and sheltered exposures. It is divisible into two subtypes. One bears a resemblance to the coastal mesic Douglas-fir-mixed evergreen forests, and the other is more similar to xeric ponderosa pine-Douglas-fir type (Society of American Foresters [SAF] type 244, Eyre 1980).

The Douglas-fir canyon-bottom subtype is well-protected from crown fire, and the largest dominants are 150 ft (46 m) tall and 5-6 ft (1.5-1.8 m) dbh. Typical Douglas-fir dominants are 2-4 ft (0.6-1.2 m) dbh and are associated with large individuals of canyon live oak, bigleaf maple, Pacific madrone (*Arbutus menziesii*), and California black oak (up to 4 ft, 1.2 m dbh). Beneath the taller trees is an understory of woody species including Pacific dogwood (*Cornus nuttallii*), *Corylus cornuta* ssp. *californica*, *Holodiscus discolor*, *Physocarpus capitatus*, *Toxicodendron diversilobum*, *Rosa gymnocarpa*, and *Ribes sanguineum*. The herb layer, which is diverse and variable in cover, includes *Viola ocellata*, *Trientalis latifolia*, *Asarum hartwegii*, *Smilacina racemosa* var. *amplexicaulis*, *Campanula prenanthoides*, *Dryopteris arguta*, *Polystichum munitum*, *Adiantum jordanii*, and *Heuchera micrantha* var. *pacifica*.

The ponderosa pine-dominated subtype occurs on N.-facing slopes and on relatively sheltered W.- and E.-facing slopes. California black oak is also a common component of the tree strata, and occasional sugar pines (*Pinus lambertiana*) may occur at upper elevations. Shrub and herb cover is sparser than in the Douglas-fir type and includes the shrubs *Arctostaphylos viscida*, *Ceanothus prostratus*, *C. lemmonii*, and *Lupinus albifrons* over a scattered low herbaceous cover of *Balsamorhiza deltoidea*, *Hieracium albiflorum*, *Apocynum pumilum*, *Lotus stipularis* ssp. *balsamifera*, *Lupinus albicaulis*, *Carex multicaulis*, *Festuca californica*, and *Horkelia tridentata* (among others).

Canyon Riparian Forest (61510): Acreage small (<100 acres or 40 ha). This association lines the deeper canyon bottoms, surrounds springs, and follows trickles up shady N. slopes. The association is best developed along Low Pass, Flat, and Riggut creeks. Dominant trees and shrubs include white alder (*Alnus rhombifolia*), Oregon ash (*Fraxinus latifolia*), bigleaf maple, *Cornus sessilis*, *Calycanthus occidentalis*, and *Prunus virginiana* var. *demissa*. In sunny locations *Vitis californica*, *Rubus ursinus*, and *Smilax californica* climb over trees and shrubs. In deep, shady canyons Pacific yew (*Taxus brevifolia*) and vine maple (*Acer circinatum*) may be locally common, and *Cornus sessilis* tends to dominate. The

herb understory varies depending on shade and water availability. Typical species include *Woodwardia fimbriata*, *Aralia californica*, *Peltiphyllum peltatum*, *Mimulus guttatus*, and *Luzula divaricata*.

Plant Diversity

A total of two hundred fifty-seven taxa are listed in the establishment record, an updated version of the list in the ecological survey.

Conflicting Impacts

Despite the fact that the S. end of the area is within the Whiskeytown-Shasta-Trinity National Recreation Area, this RNA is relatively remote and receives little visitation except from hunters and spelunkers visiting the caves in the Low Pass region. Some cave vandalism has occurred in the past. A jeep road enters Low Pass Canyon, traversing the limestone in a sensitive area (containing caves, associated flora and fauna, and fossil deposits).

26. Doll Basin (Keeler-Wolf 1986b, 1990g)

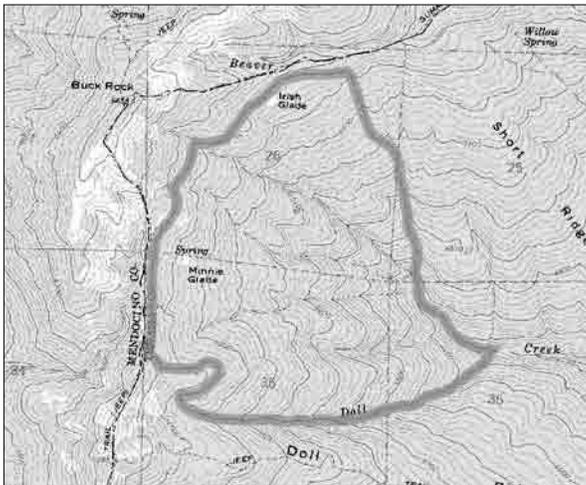


Figure 54—Doll Basin RNA

Location

This established RNA is on the Mendocino National Forest. It is about 17 miles (27 km) NE. of Covelo, occurring in portions of sects. 25, 26, 35, and 36 T24N, R10E MDBM (39°54'N., 122°30'W.), USGS Buck Rock quad (fig. 54). Ecological subsection – Eastern Franciscan (M261Ba).

Target Elements

Mixed Conifer Forest

Distinctive Features

Mixed Conifer Forest: Doll Basin was selected for its excellent representation of Sierran mixed conifer forest. This forest is extensive and economically important in California. This and Ruth RNA are the only two RNAs in the N. Coast Ranges (Northern California Coast Ranges ecological

section) having this vegetation. The Doll Basin mixed conifer forest is similar to many areas of this vegetation type throughout N. California; it exhibits the standard distribution of dominants and subdominants over such an elevational gradient as the Doll Basin RNA. Its relatively pristine nature is indicated by typically uneven-aged stands, not overly crowded with recent saplings.

Undisturbed Habitat for Large Vertebrates: Although the Doll Basin RNA is a relatively small island of unaltered habitat surrounded by selectively logged and clear-cut forests, it retains its complement of large montane animals (at least for the present). Sensitive species such as spotted owl (*Strix occidentalis*) and goshawk (*Accipiter gentilis*), both listed as California species of special concern, have been sighted within the area, as has the Federally-listed endangered peregrine falcon (*Falco peregrinus*). Many other large vertebrates such as black bear (*Ursus americanus*), blue grouse (*Dendragapus obscurus*), black-tailed deer (*Odocoileus hemionus columbianus*), and pileated woodpecker (*Dryocopus piliatus*) have been seen in the area. These vertebrates include 8 of the 12 species listed in the Mendocino National Forest's management plan (Mendocino National Forest 1987) as management indicator species.

Archeological Value: Two of the meadows in the white fir zone, Minnie and Irish glades, are significant archeological sites. These sites are important, particularly as windows on past climate. Because of continuous use of these and

nearby sites for more than 8,000 years, a good record of vegetational change (indicated by differing types of artifacts) may occur. No thorough excavation of these sites has been made. However, midden deposits to a depth of about 3.5 ft (1 m) have been unearthed by stream erosion.

Transition Forests: With an elevational span of more than 2000 ft (610 m), the transition between the mixed conifer and Douglas-fir (*Pseudotsuga menziesii*)-dominated forest at lower elevations and white fir (*Abies concolor*)-dominated forest at higher elevations is well marked. This transition is important in the understanding of the mixed conifer type in relation to adjacent forest types; it also affords research possibilities in the additional adjacent forest types.

Rare Plants: *Penstemon purpusii* is a CNPS List 4 species known from the area.

Physical Characteristics

The area covers 895 acres (403 ha) on the E. side of the inner N. Coast Ranges crest. Elevations range from 4100 to 6200 ft (1250-1890 m). Topography is relatively rugged. The area is dissected by six small drainageways that converge into Doll Creek on the E. side of the RNA. All slopes are moderately to very steep (30-60°).

Rocks are all of the Franciscan assemblage with two- to three-rock units within the area. These are the Hellhole Graywacke Faces, the Williams Chaos Faces, and possibly the Taliaferro Metamorphic complex. All are Upper Jurassic in age. Soils are divided into two major units, the Sheetiron and the Yolla Bolly series. Sheetiron soils, derived from graywacke and metasediments, are the most extensive. Precipitation is estimated between 45 inches (1143 mm) at the lowest E. portion of the area and 65 inches (1651 mm) near the summit area along the W. boundary. Temperatures are relatively mild, with average estimated January lows between 15 and 26 °F (-9.4 to -3.3 °C) and average July highs between 80 and 87 °F (26.6-30.5 °C), depending on elevation.

Association Types

Thirty 100-m² plots were sampled in the area.

The Sierran Mixed Coniferous Forest (84230): 485 acres (196 ha). In this zone all five major coniferous species (Douglas-fir [*Pseudotsuga menziesii*], ponderosa pine [*Pinus ponderosa*], sugar pine [*P. lambertiana*], white fir [*Abies concolor*], and incense-cedar [*Libocedrus decurrens*]) may dominate individual stands. Of the eleven 100-m² plots sampled in this zone, the most important species are, in order: white fir, incense-cedar, ponderosa pine, Douglas-fir, sugar pine, and California black oak (*Quercus kelloggii*). Tree density is 1420/ha, and basal area cover is 160 m²/ha. Many mature dominants approach 200 ft (61 m) tall and 5-6 ft (1.5-1.8 m) dbh. The relatively young and small white firs are responsible for the largest percentage of stems (40 percent).

Fire history of Doll Basin mixed conifer forest has changed dramatically in the past 100 years. Analyses of cut stems adjacent to the RNA indicate fire frequencies before 1900 of 9-53 years (mean 14.5, n=24). Saplings and seedlings are mostly white fir, but other major species are well represented and indicate that under present conditions (despite the reduction of fire frequency), the mixed nature of the species composition should continue.

Figure 55—Doll Basin, north-facing white fir forest at ca. 6100 ft (1859 m) with significant admixture of several age classes of red fir. (1985)



Densities of saplings are highest on the SE. slopes where occasional overly dense thickets are encountered. However, much of the NE.-facing slope understories are relatively open. Shrubs and herbs are poorly represented, with *Symphoricarpos acutus*, *Galium ambiguum*, and *Hieracium albiflorum* the only species occurring on more than 5 percent of the plots. On S. exposures ponderosa pine and California black oak increase relative to other tree species, and in such situations the large tufted bunchgrass *Festuca californica* may cover up to 50 percent of the ground.

White Fir Forest (84240, 85310): 320 acres (130 ha). At elevations over about 5800 ft (1768 m) on E.-facing slopes and about 5600 ft (1707 m) on N.-facing slopes tree diversity decreases. Ponderosa pine, California black oak, and Douglas-fir become uniformly scarce and incense-cedar becomes more localized along drainage channels. On eight 100-m² plots white fir is the uniform dominant of the tree (relative cover 72 percent, basal area cover 92 m²/ha, importance value 222.5) and reproduction (combined sapling and seedling density 780/ha, frequency 88 percent, relative density 62 percent, relative frequency 64 percent) layers. Age and size of the white firs are generally young and small (80-100 yr, 45-65 ft [14-20 m] tall). This is a result of a major crown fire about 100 years ago. Shasta red fir (*Abies magnifica* var. *shastensis*) occurs on sheltered N.-facing slopes at the higher elevations (approaching Holland 85310) (fig. 55). Occasional surviving patches of more mature forest with trees up to 4 ft (1.2 m) dbh and 160 ft (49 m) tall occur on steeper slopes and ridges. Total tree density is 1040/ha, and total basal area is 128 m²/ha. Understory vegetation is very sparse because of shade and duff accumulation.

Douglas-Fir Canyon Bottom Forest (84110): 155 acres (63 ha). This forest occurs in the lower reaches of the RNA on relatively mesic, N.-facing slopes. It is dominated by Douglas-fir (70 percent relative cover, basal area cover of 167 m²/ha, and importance value of 122 on ten 100-m² plots). White fir, sugar pine, ponderosa pine, Pacific dogwood (*Cornus nuttallii*), canyon live oak (*Quercus chrysolepis*), incense-cedar, and bigleaf maple (*Acer macrophyllum*) also occur in this type. Total basal area cover for trees is very high (241 m²/ha), and total stem density is 1200/ha. Douglas-fir is consistently the largest tree, up to 6.5 ft (2 m) dbh and 200 ft (61 m) tall. White fir dominates the sapling and seedling layers but, in general, does not form an overcrowded understory. Understory herbs and shrubs form a sparse cover (10-15 percent). Although 29 taxa of understory species are noted on the sample plots, only 4 species (*Symphoricarpos acutus*, *Rosa gymnocarpa*, *Hieracium albiflorum*, and *Chimaphila menziesii*) occur on 50 percent or more of the plots. Ground fire has played a regular role in this forest, with most of the mature trees fire-scarred.

Stream Riparian (61510): 12 acres (5 ha). This association is scattered along the main branches of Doll Creek below about 4600 ft (1402 m). It is a simple community dominated by white alder (*Alnus rhombifolia*), with very few other indicator species, except occasional individuals of *Salix scouleriana* and *Epilobium adenocaulon* var. *holosericeum*. This type is best developed along the branch of Doll Creek forming the E. boundary. The stream has a relatively sunny S. exposure and is characterized in summer by intermittently flowing water and pools interspersed with large outcrops, log jams, and dry cobble beds. The S. branch of Doll Creek is a shadier stream in a narrow gulch, with low cover of alder and higher cover of such species as bigleaf maple and *Aralia californica*.

Meadow-Riparian (45100, 45400, 63500): 14 acres (6 ha). This is the major hydric association in the RNA. The meadow portion is well developed at several small, springy areas within the white fir zone of the upper elevations. Diversity of species is higher than for any other local vegetation type, with 23 species listed as typical for the moist meadow border subtype. Inward from the meadow

fringe areas lies a zone of permanent moisture where soil is dark and organically rich. Thirty herbaceous species are listed as typical for the wet subtype. The riparian thicket subtype is relatively poorly developed locally. A few patches of *Alnus tenuifolia*, *Salix caudata* var. *bryantiana*, and *S. ligulifolia* are widely scattered along the rivulets issuing from the springy meadows. A larger area bordering these rivulets is dominated by herbaceous species such as *Athyrium felix-femina*, *Carex amplifolia*, *Circaea alpina* var. *pacifica*, *Lilium pardalinum*, *Scirpus criniger*, and *Senecio triangularis*.

Canyon Live Oak Woodland (81320): 9 acres (4 ha). On steep, rocky SE.-facing slopes at the lower elevations, canyon live oak may locally dominate without a coniferous overstory. These areas are usually no larger than 1-2 acres (0.5-1 ha) and have a low species diversity. Douglas-fir and ponderosa pine occur as scattered individuals, and the shrub layer is represented by patches of *Arctostaphylos canescens* and *A. patula*. Few herbs are present.

Douglas-Fir-Pine-Oak Woodland (84110): 7 acres (3 ha). This is the less steeply-sloped analog to the canyon live oak woodland. In the establishment record this type is included within the S.-facing phase of the Sierran mixed conifer forest. It is characterized by an open canopy of Douglas-fir, sugar pine, and ponderosa pine over a denser subcanopy of canyon live oak and California black oak. The understory is sparse, with occasional patches of *Arctostaphylos canescens*, *A. patula*, and *Ceanothus integerrimus*. Tree regeneration is patchy. Some areas contain overly dense thickets of conifer saplings.

Incense-Cedar Gully Forest (no Holland equivalent): 5 acres (2 ha). This minor association occurs along rills and gullies and around the edges of meadows at the upper elevations of the RNA, largely within the white fir zone. It is dominated by incense-cedar up to 5 ft (1.5 m) dbh and 145 ft (44 m) tall, with scattered sugar pine and white fir. Incense-cedar may dominate here because of its tolerance of the high water table and because of the protection against crown fires offered by the mesic, semi-riparian or meadowside locations.

Openings (no Holland equivalent): 5 acres (2 ha). Small open areas between stands of white fir occur on relatively steep E.- and SE.-facing exposures throughout the upper elevations of the survey area. On Yolla Bolly rocky loam, these areas are covered sparsely by *Lomatium ciliolatum*, *Haplopappus greenei*, *Crepis monticola*, *Stipa columbiana*, *Calyptridium umbellatum*, *Penstemon purpusii*, *Chrysothamnus nausiosus* var. *albicaulis*, *Eriogonum nudum*, *E. spergulinum* var. *reddingianum*, *Sitanion hystrix*, *Arabis platysperma*, and *Monardella odoratissima* ssp. *pallida*. Some openings have small clumps of Brewer oak (*Quercus garryana* var. *breweri*) and may be considered shin oak brush (Holland 37541). Successionally, these openings are enigmatic; some appear very stable while others are being slowly colonized by white fir.

Plant Diversity

One hundred ninety taxa are listed.

Conflicting Impacts

Cattle grazing has had heavy impact on some of the meadows, particularly Irish Glade. Portions of Irish Glade are eroding at unnaturally fast rates. The patches of dense conifer reproduction in the mixed conifer and Douglas-fir-dominated forests may require prescription burns. There may be some increased gullying within the area as a result of the construction (around 1975) of road 24N02 up-slope from the W. boundary.

Note: for Eagle Crag, see Agua Tibia, #2

27. Falls Canyon (Phillips 1998b, Sproul 1981)

Location

This established RNA is on the Angeles National Forest. It is only 8 air miles (13 km) NE. of Pasadena and lies in portions of sects. 18, 19, 20, 29, and 30 T2N, R11W and sects. 13 and 24 T2N, R12W SBBM (34°04'N., 118°06'W.), USGS Mt. Wilson quad (fig. 56). Ecological subsection – San Gabriel Mountains (M262Bd).



Figure 56—Falls Canyon RNA

Target Elements

Bigcone Douglas-Fir (*Pseudotsuga macrocarpa*) and Canyon Live Oak (*Quercus chrysolepis*)

Distinctive Features

Bigcone Douglas-Fir and Fire: Bigcone Douglas-fir (BDF) is scattered throughout the Transverse and Peninsular Ranges of S. California. Its modern distribution has been altered by the frequency and severity of fires. In many places it appears to be dwindling as a result of very intense modern fires. Although the species is known to resprout and to have thick, fire-resistant bark, it cannot survive extremely hot fires. The relatively extensive, dense stands at Falls Canyon are less likely to suffer from fires than the sparse phases because of lighter understory fuel loads. Reproduction of BDF occurs in both dense and sparse stands.

Canyon Live Oak: This species is the most widely distributed oak in California (Griffin and Critchfield 1976). In S. California it is the dominant member of the southward extension of the mixed evergreen forest (Sawyer and others 1977, Thorne 1976). Canyon live oak occurs in typical fashion for the region in Falls Canyon, dominating on several slope exposures and codominating with BDF on mesic N. slopes.

Rare Plants: Two species are listed by CNPS (both List 4). They are *Heuchera elegans*, a locally important member of the ridge flora, and *Boykinia rotundifolia*, a fairly widely distributed species of the riparian subcommunity of the S. mixed evergreen forest.

Physical Characteristics

The RNA covers 1165 acres (472 ha). Falls Canyon is a tributary of the West Fork of the San Gabriel River. Strayns Canyon and Rush Creek are also tributaries of the West Fork and partially occur within the area. Slopes are steep (60-100 percent) throughout, and are generally N.-facing. However, because of the greatly dissected N. slope of the Mount Wilson-San Gabriel Peak Ridge, significant areas of W. and E. exposures also occur. Elevations range from 3200 to 5440 ft (975-1658 m).

The rocks of the area are entirely Mesozoic granitics. Soils are of one family, the Stukel, Sur-Winthrop complex. These are recent soils with a very high erosion hazard, although they may be relatively deep with a rich humus layer. The area receives average annual precipitation of 30+ inches (762+ mm).

Association Types

Accurate estimates of acreages for each association type were not given. Point-centered quarter samples were taken in three stands of BDF.

Southern California Mixed Evergreen Forest (61510, 84150, 61330, 81320): 885 acres (359 ha). A mixed forest of canyon live oak (*Quercus chrysolepis*) and BDF covers 80-87 percent of the three boundary proposals discussed. This type is described following Thorne (1976). However, the BDF stands are treated separately in the vegetation analysis. All 21 major species listed by Thorne for the southern California mixed evergreen forest are present locally, except two. The densest stands of BDF are intricately mixed with canyon live oak and, to a lesser extent, incense-cedar (*Libocedrus decurrens*) and sugar pine (*Pinus lambertiana*).



Figure 57—Falls Canyon, southern California mixed evergreen forest dominated by big-cone Douglas-fir in Strayns Canyon.

The southern California mixed evergreen forest grades into a riparian community along the major streams of the area. Here, such hydrophilic species as bigleaf maple (*Acer macrophyllum*), white alder (*Alnus rhombifolia*), California sycamore (*Platanus racemosa*), Fremont cottonwood (*Populus fremontii*), *Aralia californica*, *Boykinia rotundifolia*, and *Salix lasiolepis* occur along with California bay (*Umbellularia californica*), coast live oak (*Quercus agrifolia*), and the other previously mentioned species.

In the Mount Disappointment and Valley Forge campgrounds area (20 sample points), BDF averages 16 m²/ha (all species 21 m²/ha) basal area, with an average density of 52 trees/ha. BDF averages 14-m spacing (average for all trees: 6.4 m), 66 cm dbh (all tree species: 41 cm dbh), and 20 m tall (all tree species: 12 m). Canyon live oak is the most abundant species in this sparse phase, with often twice the density of BDF. Most canyon live oaks are multi-stemmed, reflecting past fire history. This sparse phase is typical of the smaller stands of BDF in the San Gabriel Mountains.

Stands sampled (20 points) in Strayns and Rush Creek canyons comprise a less common, but denser phase of BDF (fig. 57). At these sites, BDF represents 48 percent of all trees. Mean BDF density is 131/ha (total trees: 272/ha), while mean basal area cover is 34.4 m²/ha (total average: 31.0 m²/ha). The average heights and diameters for BDF are somewhat smaller than for the sparse phase (17 m and 58 cm dbh, respectively), and spacing is substantially less (8.8 m).

Twenty increment cores were taken from BDF. In general, there is great variation in growth rates, with some approximately 2-ft (61-cm) dbh individuals as much as twice as old (200 vs. 100 yr) as others the same size. The oldest sampled tree is 384 years old and 40 inches (102 cm) dbh. The largest of any measured trees is 54 inches (137 cm) dbh. There seems to be no major difference in growth rates between sparse and dense phases.

Although diameter does not necessarily reflect age, diameter classes indicate that more small trees are in the sparse than in the dense phases. Whether this indicates an expansion of young trees in the former phase is unclear from the data. Many seedlings of BDF and canyon live oak are present in both sparse

and dense phases. BDF seedlings are abundant in shaded forest, openings, stabilized road cuts, and slides. This diversity of regeneration sites suggests perpetuity of BDF.

Regeneration following two major fires around 1890 and 1900 accounts for only a small percentage of all BDF in the area. Many of the older trees either survived the fires by resprouting from the burned trunks and larger branches, or they were passed over completely by the fires.

Transitional or High-Altitude Southern California Mixed Evergreen Forest (84230): 100 acres (40 ha). Above about 5500 ft (1676 m), near the summit of Mount Wilson, the canyon live oak-dominated forest becomes more heavily infused with ponderosa pine (*Pinus ponderosa*), sugar pine, and incense-cedar to a point where these conifers become codominant with canyon live oak.

Mountain Talus (no Holland equivalent): 105 acres (42 ha). This type has also been described as "Ridge Flora" on the vegetation map of Falls Canyon RNA. It corresponds well to Thorne's (1976) mountain talus community. It covers a small area along the uppermost ridges and outcrops. Among the members of this largely shrub- and herb-dominated association are *Arabis sparsiflora* var. *arcuata*, *Brickellia californica*, *Castilleja martinii* var. *ewanii*, *Diplacus (Mimulus) longiflorus* ssp. *calycinus*, *Dudleya cymosa* ssp. *minor*, *Eriogonum saxatile*, *Haplopappus cuneatus*, *Heuchera elegans*, *Hulsea heterochroma*, *Leptodactylon californicum* ssp. *glandulosum*, *Poa scabrella*, *Turricula parryi*, and *Zauschneria californica* ssp. *latifolia*.

Chaparral (37510): 175 acres (71 ha). The chaparral at Falls Canyon is described as mixed chaparral; however, there are small monospecific stands of *Arctostaphylos glauca*, *Cercocarpus betuloides*, *Quercus wislizenii* var. *frutescens*, and *Adenostoma fasciculatum*. Other plants of this association are much lower in relative dominance, and do not form pure stands. *Arctostaphylos glauca* and *C. betuloides* may occur as small trees up to 20 ft (6 m) tall. The generally large quantity of dead wood in all chaparral indicates its relatively senescent nature. All chaparral types are confined to island-like enclaves surrounded by canyon live oak-dominated associations rather than by BDF. However, some individuals of BDF are scattered in some steep, sparse chaparral.

Plant Diversity

One hundred twenty taxa are listed.

Conflicting Impacts

The area is heavily used by recreationists on the N. and S. peripheries. However, the uniqueness of the BDF stands is not easily duplicated, and it largely overrides the recreational impact. Other impacts include the unnatural slides along the Mount Wilson Road and the introduced plantings of both native and non-native species along the roads and campgrounds. In general, steep topography and dense vegetation will limit the study of BDF to the vicinity of trails.

28. Fern Canyon (Meier 1979)

Location

This established RNA is on the San Dimas Experimental Forest, within the Angeles National Forest. It is approximately 6 miles (10 km) N. of the city of Claremont. It occupies portions of seven sects. in T1N, R8W SBBM (34°12'N., 117°43'W.), USGS Mt. Baldy quad (fig. 58). Ecological subsection – San Gabriel Mountains (M261Bd).

Target Elements

Chamise Chaparral (*Adenostoma fasciculatum*) and Canyon Live Oak (*Quercus chrysolepis*)

Distinctive Features

Well-Monitored Site: The RNA is located within an experimental forest. There is a good record of the impact and extent of fires in the area dating back to 1914 (six major fires have occurred). This record extends to the relative volume of pre- and post-fire stream flow in the three subdrainages within the RNA. Stream flow has changed appreciably among the three drainages since a major fire in 1938.

Low-Elevation Ponderosa Pine: Brown's Flat, a shallow 80-acre (32-ha) bowl created by an ancient land slump, contains the lowest elevation stand of *Pinus ponderosa* in S. California (about 3900 ft, 1189 m). This relictual stand of 81 individuals is well-isolated from other ponderosa pine stands in the San Gabriel Mountains and strongly affected by air pollution. There is almost no recent reproduction.

Chaparral: This extensive vegetation formation occurs as chamise (*Adenostoma fasciculatum*) and *Ceanothus*-dominated types. It was extensively burned in 1975 and, thus, is vigorous (fig. 59).

Oak Woodlands: The area covered by this vegetation is extensive and varied. It occurs primarily on N.-facing exposures and in canyon bottoms. Much of the woodland was burned in 1975. The bottomland stands are dominated by coast live oak (*Quercus agrifolia*) with a significant mixture of riparian trees. Many of the upper-slope oaks are apparent hybrids between coast live oak and scrub oak (*Quercus dumosa*). At high, sheltered sites canyon live oak is dominant. On exposed sites at lower elevations, interior live oak (*Quercus wislizenii*) dominates a scrubby woodland with many chaparral shrubs. Hybrids between California black oak (*Quercus kelloggii*) and interior live oak, the so-called oracle oak (*Q. x morehus*), also occur at low elevations.

Bigcone Douglas-Fir (*Pseudotsuga macrocarpa*): The stands of bigcone Douglas-fir (BDF) at Fern Canyon have burned recently (1975). Poor reproduction suggests that the fire had a negative effect on seedling and sapling establishment. However, many of the larger trees, although scarred, survived the fire. The local stands should provide interesting comparisons with other stands in Millard Canyon and Falls Canyon RNAs, which have not been affected by fire for many years.

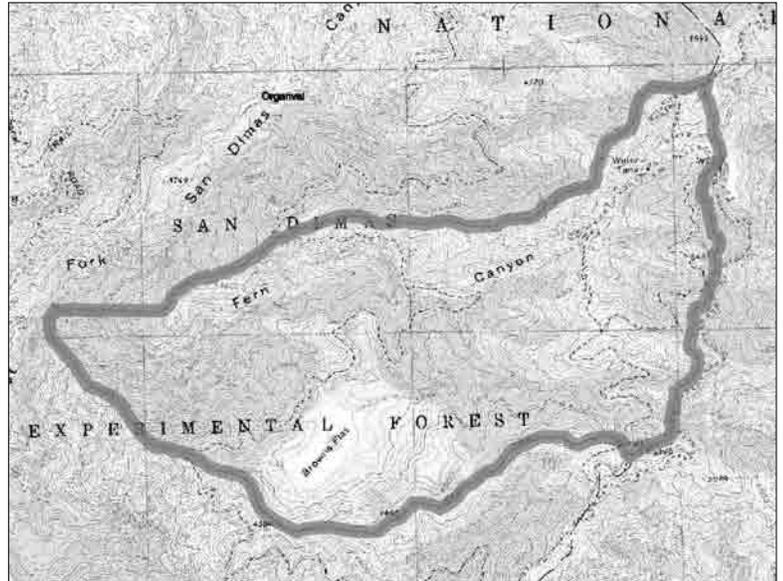


Figure 58—Fern Canyon RNA

Physical Characteristics

The RNA covers 1460 acres (591 ha). Elevations range from 2592 to 5512 ft (790-1680 m). Fern Canyon drains E.-W. and is a tributary to San Dimas Canyon. The RNA contains the entire drainage of Fern Canyon. Slopes are primarily N.- and S.-facing, but some W.- and E.-facing slopes occur at the head of the drainage. Average slopes are steep (approximately 68 percent). The three previously mentioned subdrainages occupy the head of the main drainage below Sunset Peak. Rapids and falls occur along the main canyon. The distinctive Brown's Flat occupies a bench created by a massive landslide S. of the main canyon.

Geology is relative complex and includes schists and gneisses (derived from diorite), aplite, pegmatite dikes, and unaltered diorites. Soils are varied; five principal types occur in the RNA. Most are relatively fine textured and well drained. One type has much clay with high water retention. Climate is well monitored using recording stations close to the RNA. At the highest elevations, mean temperatures range from 41.9 °F (5.5 °C) in February to 73.9 °F (23.3 °C) in August. Low-elevation temperatures vary from 46 °F (7.8 °C) in January to 72 °F (22.2 °C) in August. Annual precipitation averages 34.3 inches (871 mm) at the upper elevations and 26.8 inches (680 mm) at the lower elevations. About 92

percent of the precipitation falls from November through April, with much as snow at the upper elevations.

Association Types

The line-intercept method was used to sample most of the vegetation of the area. In addition, diameters were taken of all individuals of ponderosa pine at Brown's Flat and a number of BDF. Acreage of the vegetation associations is not given.

Chaparral (37200, 37110, 37530): This extensive vegetation is represented by

both *Adenostoma fasciculatum* and *Ceanothus*-dominated types. The *Adenostoma* (chamise) type dominates the xeric S.-facing slopes where it may occur as dense monospecific stands on steepest slopes or as a dominant on relatively gradual slopes. Transect data for *Adenostoma* include frequency, 100 percent; relative density, 54 percent; and relative cover, 76 percent. Associated species with their relative densities and covers include *Ceanothus leucodermis* (9 percent, 9 percent), *Salvia mellifera* (9 percent, 2.4 percent), *Salvia leucophylla* (18 percent, 14 percent), *Garrya veatchii* (3 percent, 4 percent), *Arctostaphylos glandulosa* (3 percent, 5 percent), *Yucca whipplei* (3 percent, 4 percent), and the post-fire invader *Turricula parryi* (3 percent, 1.8 percent). Eight other species are listed for this type.

Most of the chamise chaparral burned in 1975. However, taller stands (2.5 m) at the lower reaches of the canyon have not burned since 1960. Certain species such as *Toxicodendron diversilobum*, *Marah macrocarpus*, and *Pycnanthemum californicum* are characteristic of the understory. At the lowest elevations this vegetation grades into coast live oak woodland.

Ceanothus species dominate the chaparral on the exposed N.-facing slopes. This vegetation grows to 13 ft (4 m) tall, and much of it has not burned within the past century. The dominants include *Ceanothus integerrimus*, *C. leucodermis*, *C. tomentosus*, *C. oliganthus*, and a possibly hybrid *C. integerrimus* x *cordulatus*. Other shrubs include *Rhamnus crocea*, *Garrya fremontii*, *Arctostaphylos glauca*, *A. glandulosa*, *Cercocarpus betuloides*, *Prunus ilicifolia*, *Leptodactylon californicum*,



Figure 59—Fern Canyon, view of Brown's Flat from 5100 ft (1554 m) contour trail on the south side of Fern Canyon. Notice the big cone Douglas-fir in the foreground. Also notice how Brown's Flat is formed by sediment deposition in the hollow created by a landslide that slipped toward the right and off of the picture. (D. Cheatham, around 1970/71)

California bay (*Umbellularia californica*), and *Quercus x morehus*. In openings, the mesophytic species *Solanum douglasii*, *Achillea millefolium*, *Cystopteris fragilis*, and *Polystichum munitum* occur.

Oak Woodland (71150, 71160, 81310, 81320, 81330, 37A00, 61310, 61330): Several subtypes occur in the drainage. On N.-facing slopes at the head of the canyon the putative hybrid between coast live and scrub oak dominates (relative cover 56 percent). Other species with their relative covers include *Turricula parryi*, 4 percent; *Lupinus adsurgens*, 27 percent; *Penstemon* spp., 8 percent; *Ceanothus leucodermis*, 2 percent; *Ceanothus integerrimus* x *C. cordulatus*, 12 percent; *Garrya veatchii*, 7 percent; *Arctostaphylos glandulosa*, 4 percent; *Lonicera subspicata*, 7 percent; and *Ribes amarum* (unspecified).

Canyon live oak dominates on upper N.-facing slopes forming dense stands with virtually complete canopy cover in some areas. This type does not appear to have been affected strongly by the 1975 fire (about 25 percent suffered critical stem damage). Average relative cover is 43 percent for canyon live oak; relative frequency is 19 percent. Other species (with percent relative frequency and percent relative cover, respectively) include *Turricula parryi* (15, 14), *Ceanothus integerrimus* x *cordulatus* (28, 29), *Ribes amarum* (22, 13), *Ceanothus leucodermis* (10, 2), *Ribes speciosum* (4, 1), and *Solanum xantii* (2, 1). Typically this vegetation occurs at sufficiently high and sheltered sites to receive winter snow. However, it may also occur in low gullies associated with bigcone Douglas-fir.

A dense scrubby woodland of interior live oak surrounds much of the Brown's Flat area. *Ceanothus integerrimus* x *cordulatus*, *Ribes amarum*, *Lupinus longifolius*, *Rhamnus crocea*, California bay, and *Prunus ilicifolia* are associated with this species. *Toxicodendron diversilobum* is common at the lower elevations of this type (<4200 ft, 1280 m). This type was largely spared from the 1975 fire.

Between 3510 and 3937 ft (1070-1200 m) on the S. boundary ridge, *Quercus x morehus* dominates a scrubby woodland with many of the same species as the interior live oak woodland.

Along the canyon bottom, coast live oak dominates with riparian species such as bigleaf maple (*Acer macrophyllum*) and white alder (*Alnus rhombifolia*) and moisture-tolerant species such as California bay and bigcone Douglas-fir (Holland 61310). Beneath these trees, a mesophytic understory of such species as *Adiantum jordanii*, *Cystopteris fragilis*, *Dryopteris arguta*, *Ribes speciosum*, *Holodiscus discolor*, *Marah macrocarpus*, *Arabis glabra*, *Delphinium parryi*, and *Heuchera elegans* occurs.

Mixed Conifer Association (84150): This association is dominated by BDF and includes rare individuals of white fir (*Abies concolor*) and sugar pine (*Pinus lambertiana*) at the uppermost elevations. BDF occurs principally on N.-facing slopes at the upper elevations or in sheltered canyon bottoms. At the upper elevations BDF forms an overstory (65-82 ft, 20-25 m) over canyon live oak and *Quercus agrifolia* x *dumosa*. Many trees have suffered fire damage. The paucity of young BDF in this forest also reflects the effect of the recent 1975 fire. The larger BDF (3.2-8.2 ft, 1-2.5 m dbh) are well represented and, although scarred, survived the fire. Associated species are similar to the understory of the canyon live oak forest.

Ponderosa Pine (84210, 42110): This type is restricted to the area of Brown's Flat and is an open stand of ponderosa pine up to 164 ft (50 m) tall over a grassy understory dominated by *Agropyron elongatum*, *A. intermedium*, *Elymus condensatus*, *Festuca megalura*, and *Poa scabrella*. There has been poor reproduction in recent years, but the size-class structure of more mature trees (>16 inches, 40 cm dbh) suggests that this stand has been reproducing normally up until recently. Air pollution combined with marginal habitat and possibly high seed predation may have caused the recent decline in reproduction.

Plant Diversity

One hundred eighty-nine taxa are listed.

Conflicting Impacts

Air pollution has a strong effect on the ponderosa pine stand at Brown's Flat. The frequency of natural fire appears high enough to maintain chaparral and oak woodland associations without intervention for several years.

29. Fisherman's Camp (Burke 1992b, Phillips 1998c)

Location

This established RNA is located on the San Bernardino National Forest, San Bernardino County. It is approximately 4.5 miles (7.2 km) due E. of the town of Lake Arrowhead and 1.5 miles (2.4 km) N. of Running Springs. The RNA lies within the Arrowhead Ranger District. Its boundaries include portions of sections 20 and 29 of T2N, R2W (34°14'N., 117°06'W.), USGS Keeler Peak quad (fig. 60). Ecological subsection – Upper San Gorgonio Mountains (M262Bh).

Target Element

Coulter Pine (*Pinus coulteri*)

Distinctive Features

This RNA contains an unusual Coulter pine forest with a large number of associated tree species. Coulter pine is typically found in association with chaparral throughout the San Bernardino Mountains, but here it codominates with either canyon live oak (*Quercus chrysolepis*) or California black oak (*Quercus kelloggii*). In addition to the *Pinus coulteri*-*Quercus chrysolepis*-*Quercus kelloggii* forest, species common to ponderosa pine (*Pinus ponderosa*) forest (fig. 61) are also present throughout the RNA, particularly at the N. end.

Rare Plants: *Streptanthus bernardinus* (CNPS List 1B) is found among the sparse herbaceous vegetation on dry, powdery slopes in the Coulter pine-westside ponderosa pine forest association. *Castilleja montigena* and *Lilium humboldtii* (both CNPS List 4) were tentatively identified at the site.

Rare Fauna: The RNA includes spotted owl (*Strix occidentalis* ssp. *occidentalis*, California species of special concern) territory. It also harbors the southern rubber boa (*Charina bottae umbratica*, State-listed threatened species, Forest Service-listed sensitive species) and the San Diego horned lizard (*Phrynosoma coronatum blainvillei*, California species of special concern). Additional rare species may be found in the RNA if a formal wildlife survey is conducted.

Fire History: A policy of fire suppression has been in place in the San Bernardino Mountains since the early 1900s. No fire within the boundaries of the RNA has been recorded since 1980. Long-time residents in the area recall a fire on the ridge in the late 1950s. Coulter pines are considered a fire-adapted species, and although possessing closed cones, they do not require fire to open them. The cones, requiring 2 years to mature, open in late winter (January-February), which may help protect seeds from summer and autumn fires.

Physical Characteristics

The area covers 431 acres (172 ha) with an elevation of 5020-6036 ft (1530-1841 m). The area consists generally of a N.-S. trending ridge and the E. exposure slopes

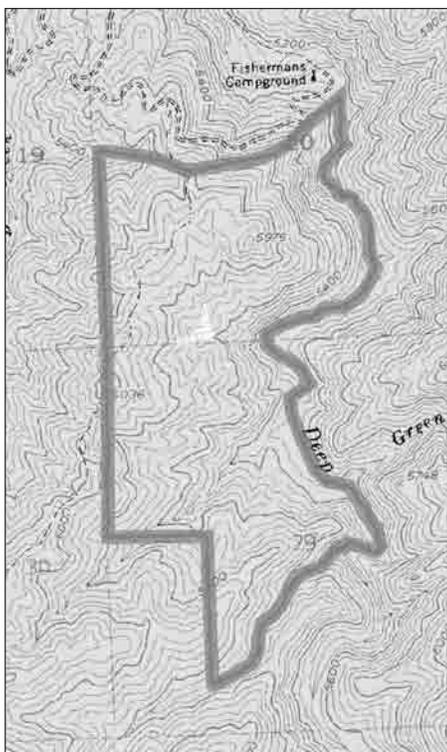


Figure 60—Fisherman's Camp RNA

extending to the adjoining stream. The topography can be quite rugged where streams cut steep-sided canyons through the upland surface. The slopes range from 5° (9 percent) (portions of ridgetop) to 38° (78 percent) (above Deep Creek).

The RNA is mapped as a single quartz monzonite (Mesozoic plutonic rock known as the Pleasant View Ridge quartz monzonite) of Cretaceous or Jurassic age. Detailed soil inventories of RNA are not available. A reconnaissance inventory was compiled using photointerpretation; however, the resolution of the mapping is low (minimum mapping area is about 100 acres [40 ha]). Based on this information, the RNA is mapped as a single soil type: the Wapi-Pacifico families-Rock outcrop complex. This complex occurs on 50-75 percent (27-37°) slopes and is a soft, shallow, sandy loam with a fine to very fine granular structure. The surface soils are 0-7 inches (0-18 cm) deep. Danger of erosion is very high. Rock outcrops comprise about 15 percent of the complex and are found intermixed with the soft, powdery loam.

General climate in the region is Mediterranean. The year-round weather station nearest the RNA is the Lake Arrowhead fire station (34°15'N., 117°11'W. at 5210 ft [1585 m]). The average annual precipitation at Lake Arrowhead is 40.17 inches (1022 mm). Snowfall averages 61 inches (155 cm) per year. Average temperatures range from 38 to 68 °F (3-20 °C), with extremes ranging from a winter low of 8 °F (-13 °C) to a summer high temperature of 106 °F (41 °C). High elevations and cool temperatures result in a short growing season between mid-June and mid-September – about 100 frostfree days per year.

Association Types

Coulter Pine Forest/Westside Ponderosa Pine Forest (84140/84210): 365 acres (147 ha). The pine forest types overlap here to such a degree that it is difficult to map them as separate communities with discrete boundaries. They are, therefore, mapped as a single forest complex. The steep slopes of the RNA support a complex Coulter pine forest where codominance in the tree layer varies with slope and exposure. Coulter pine is present along the ridge and on the E. slopes, especially those with a S.-facing exposure. Other coniferous species sharing dominance with Coulter pine include white fir (*Abies concolor*) and sugar pine (*Pinus lambertiana*) on N.-facing slopes and ponderosa pine and Jeffrey pine (*Pinus jeffreyi*) on warmer, S.-facing slopes. Canyon live oak and black oak are also important components of this forest, occurring throughout the site but predominantly on the N. end.

Tree cover varies between 65 and 80 percent. Reproduction of all tree species appears good, and all age classes are present. Throughout much of the site, the forest has an open understory. Shrubs and herbaceous plants are few and scattered. They include *Arctostaphylos pringleii* var. *drupacea*, *Eriogonum saxatile*, *Lotus nevadensis*, *L. crassifolius*, and *Carex multicaulis*. Where the forest is particularly open and soils are dry, *Pteridium aquilinum* var. *pubescens* occurs in dense patches along with grass associates, including *Bromus ciliatus*, *B. tectorum*, and *Acnatherum latiglumis*. In particularly mesic areas, such as canyon bottoms, incense-cedar (*Libocedrus decurrens*) and mountain dogwood (*Cornus nuttallii*) – a rare riparian associate in the San Bernardino Mountains – occur among the other forest trees. Thimbleberry (*Rubus parviflorus*) is a common shrub on these cool, shady slopes.

White Alder Riparian Forest (61510): 66 acres (27 ha). A dense riparian forest occurs along the edges of Deep Creek and in the narrow canyons of intermittent

Figure 61—Fisherman's Camp, open park-like Coulter pine forest – westside ponderosa pine forest complex covers much of the Fisherman's Camp RNA. Bare ground and boulder-filled canyons are common. (1989)



tributaries. This vegetation adds greatly to the diversity of plants at the site and provides valuable habitat for many wildlife species. This association type is dominated by white alder (*Alnus rhombifolia*). The shrubby understory includes *Cornus sericea* ssp. *sericea*, *Rosa woodsii*, *Rhamnus californica*, *Rhubus parviflorus*, and *Salix lasiolepis* amidst a dense herbaceous layer of annuals, perennials, and vines. These include *Clematis ligusticifolia*, *Aquilegia formosa*, *Artemisia douglasiana*, *Barbarea orthoceras*, *Erodium* spp., *Galium angustifolium*, *Geum macrophyllum*, *Gilia splendens*, *Lepidium virginicum* var. *pubescens*, *Juncus* spp., *Claytonia perfoliata* var. *perfoliata*, and *Urtica holosericea*. Grasses include *Agropyron parishii*, *Bromus carinatus*, and *B. tectorum*.

Plant Diversity

One hundred ten species of vascular plants are listed.

Conflicting Impacts

The San Bernardino Mountains are one of the more heavily visited mountain areas in the United States. However, the only current use and activity noted in the RNA is day hiking on the trail through the NW. corner, and this appears to have had little impact on the site. Logging was an important industry in this area in the mid 1800s, and physical evidence of this exists at the RNA in the form of old cables and logging chutes. Pine and fir were the most common trees logged in this area at that time.

Air pollution from the valley floor continues to be a significant hazard to coniferous species in this area.

30. Frenzel Creek (Keeler-Wolf 1983)

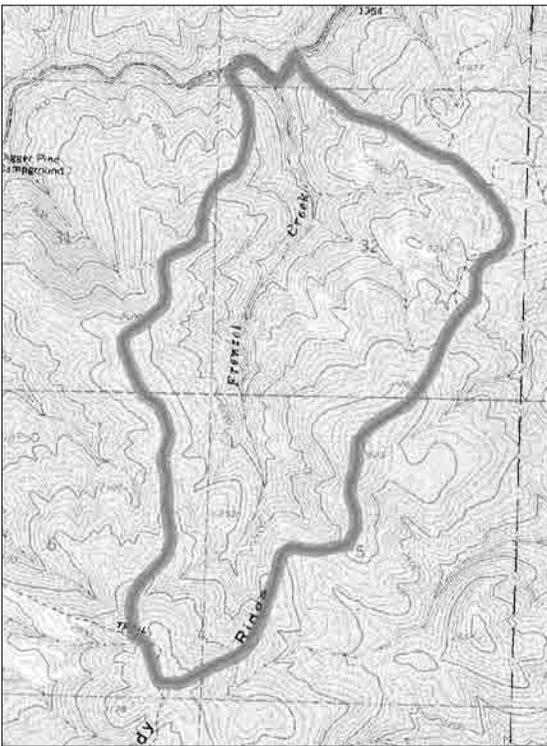


Figure 62—Frenzel Creek RNA

Location

This established RNA is on the Mendocino National Forest. The N. end of the area (39°17'N., 122°32'W.) lies 6 miles (10 km) SSW. of the town of Stonyford, Colusa County. It includes portions of sects. 31 and 32 T17N, R6W and sects. 5 and 6 T16N, R6W MDBM, USGS Gilmore Peak quad (fig. 62). Ecological subsection – Stony Creek Serpentine (M261Bc) and Western Foothills (M261Ca).

Target Elements

Serpentine Chaparral, Sargent Cypress (*Cupressus sargentii*), and MacNab Cypress (*Cupressus macnabiana*)

Distinctive Features

Distribution and Regeneration of Sargent and MacNab Cypress: These are the only two sympatric species of cypress in California. MacNab cypress is an interior, xerophilic cypress, occurring on ridgetops, never overlapping with Sargent cypress in the drainage. Sargent cypress is a mesophilic coastal type near its most inland distribution here (fig. 63). Hybridization was not seen in the RNA and is rare elsewhere (Griffin and Critchfield 1976). Sargent is apparently less fire-dependent than MacNab, regularly reseeding in riparian areas of drainage, without fire. In contrast, MacNab cypress rarely reseeds without fire. Sargent cypress is

relatively shade-tolerant in the seedling stage.

Numbers and Types of Serpentinite Endemics: About 36 taxa in the RNA are generally considered serpentinite endemics or indicators (Kruckeberg 1984). Most are herbaceous neo-endemics; five are likely to be paleo-endemics (Raven and Axelrod 1978).

Rare Flora: Eight taxa found in the drainage are listed by CNPS, including *Astragalus cleveandii* (List 4), *Antirrhinum subcordatum* (List 1B), *Hesperolinum drymarioides* (List 1B), *Mimulus brachiatus* (List 3), *Mimulus glaucescens* (List 4), *Senecio cleveandii* (List 4), and *Streptanthus morrisonii* (List 1B).

New and Undetermined Taxa: Two plant taxa, *Castilleja miniata* ssp. nov. and *Allium cratericola* ssp. nov., have been collected in the RNA. The *Castilleja* was collected for the first time during the fieldwork for the RNA ecological survey. It is a serpentine riparian species locally common at Frenzel Creek and along portions of Little Stony Creek. It also was seen at Cook's Springs, about 2 miles (3 km) E. of the RNA. L. Heckard of the Jepson Herbarium believes this is a distinctive subspecies of the widespread *C. miniata* complex. The *Allium* occurs on serpentinite barrens and has previously been collected in the inner N. Coast Ranges by Dale McNeal and his students at University of the Pacific, but it is still undescribed.



Figure 63—Frenzel Creek, looking up the Frenzel Creek drainage. Taken from about half way up the east slope and about 200 yards (183 m) from the mouth. Sargent cypress can be seen in the valley bottom, foothill pine in the foreground, and chaparral in the background. (1970)

Physical Characteristics

The area covers 935 acres (378 ha). Elevations range from 1390 to 3090 ft (424-942 m). The entire drainage of Frenzel Creek, a small N.-flowing, permanent tributary of Little Stony Creek, is included. Slopes are predominantly E.- and W.-facing and steep, except for the majority of the two main ridgetops. Rocks are primarily serpentinized peridotite, with a small area of Lower Cretaceous Franciscan sediments and metasediments at the head of the drainage. Climate is typical for this elevation in N.-central California. Mean annual precipitation is about 32-38 inches (813-965 mm); more than 90 percent is rain.

Association Types

Vegetation sampling consisted of five 100-m² plots in the Sargent cypress dominated area, and six 100-m² plots in the MacNab cypress stands. Acreage of each type is based on the ecological survey (Keeler-Wolf 1983), and the sum does not match the total area.

Serpentinite Chaparral (37600, 71321, 83220): 580 acres (235 ha). Two subtypes are divided into four phases.

The mixed subtype 1 is most extensive, dominated by *Arctostaphylos viscida* and *Quercus durata*, with *Ceanothus jepsonii* var. *albiflorus*, *Garrya congdoni*, *Heteromeles arbutifolia*, and *Eriodictyon californicum*. It includes the *A. viscida* phase on most xeric exposures; the *Q. durata* phase dominates on E., NE., and NW. exposures. Foothill pine (*Pinus sabiniana*) forms a very open canopy in some places. Thirty-five species of herbs are listed as typical for this subtype, including the serpentine endemics *Allium falcifolium*, *Clarkia gracilis* ssp. *albicaulis*, *Claytonia gypsophylloides*, *Calystegia subacaulis*, *Nemacladus montanus*, *Senecio greenii*, *Silene campanulata* ssp. *glandulosa*, and *Streptanthus breweri*.

Subtype 2 is dominated by MacNab cypress (51 acres, 21 ha). Two phases occur: exposed and sheltered. The exposed phase on ridgetops is most extensive, with subdominant serpentine chaparral shrubs and relatively high cover of *Adenostoma fasciculatum*. Stands are of uniform height (3-4 m) and age (mostly 60-80 years). Herbs are similar to mixed serpentinite chaparral. The sheltered phase is restricted to N. slopes and heads of ravines. MacNab Cypress is more

often a tree up to 7 m tall and 64 cm dbh. Density of woody plant stems varies from 2400 to 9600/ha. Basal area of MacNab cypress ranges from 2.7 m²/ha on the 1950 burn to 86 m²/ha on the sheltered phase.

Serpentinite Barrens (no Holland equivalent): 81 acres (33 ha). Vegetation is very sparse and herb dominated. Species include *Streptanthus morrisonii*, *S. breweri*, *Allium cratericola* ssp. nov., *Asclepias cordifolia*, *A. solanoana*, *Eriogonum vimineum*, *E. nudum*, *E. dasycarpum*, and *E. ursinum* var. *nervulosum*.

Non-Serpentinite Chaparral (37110, 37E00): 66 acres (27 ha). Two subtypes (mesic and xeric) occur. The mesic subtype occurs on NE.-facing slopes and is dominated by tall shrubs of *Cercocarpus betuloides*, *Ceanothus cuneatus*, *Quercus wislizenii* var. *frutescens*, and *Heteromeles arbutifolia*. Herbs are often dense and include 20 typical species, the majority of which are not present on serpentinite chaparral.

The xeric subtype occurs on ridgetops and is dominated by thick stands of *Adenostoma fasciculatum* and *Ceanothus cuneatus* with lesser numbers of *Arctostaphylos manzanita*, *A. glandulosa*, *A. canescens*, *Quercus wislizenii* var. *frutescens*, *Q. durata*, *Q. x morehus*, *Heteromeles arbutifolia*, *Cercocarpus betuloides*, *Ribes malvaceum*, and *Haplopappus linearifolius*. Herbs and grasses are few, with annual *Bromus* dominant.

Serpentinite Riparian and Valley Bottom (83220 in part): 57 acres (23 ha). This is the most hydrophilic vegetation in the RNA. It is subdivided into three types: strict riparian (permanent water), mesic valley bottom (moist and shady, but no year-round water), and rivulet herbaceous association (along intermittent, sunny streams). Characteristic woody species of the strict riparian type include *Rhododendron occidentale*, *Salix breweri*, *Calycanthus occidentalis*, Sargent cypress, and *Rhamnus californica* ssp. *crassifolia*. Understory species include *Aquilegia exima*, *Achillea millefolium*, *Lilium pardalinum*, *Stachys albens*, *Epipactis gigantea*, *Castilleja miniata* ssp. nov., *Carex serratodens*, *Scirpus americanus*, *Senecio clevelandii*, *Heleocharis* sp., *Helenium bolanderi*, *Angelica tomentosa*, and *Juncus mexicanus*.

The mesic valley bottom type is dominated by Sargent cypress and California bay (*Umbellularia californica*) (often mutually exclusive). Other woody species include *Ceanothus integerrimus* var. *californicus*, *Rhamnus californicus* ssp. *crassifolius*, *Toxicodendron diversilobum*, and *Cercis occidentalis*. Many species of herbs are shared with adjacent serpentinite chaparral. Tree densities range from 700 to 6200/ha. Seedling densities (all Sargent cypress) range from 100 to 600/ha. Basal area ranges from 6.5 to 72.3 m²/ha. Mean dbh ranges from 3.5 to 31.0 cm.

The rivulet herbaceous association type species include *Mimulus brachiatus*, *Centaurium* sp., *Mimulus bicolor*, *M. glabrescens*, *Epilobium minutum*, and *Gayophytum* sp. Shading restricts growth of the characteristic herbs.

Pine-Oak Woodland (71322, 83210): 36 acres (15 ha). This association occurs on N., NE., and NW.-facing slopes at the head of the drainage, off serpentinite. Canyon live oak (*Quercus chrysolepis*) is dominant, with knobcone pine (*Pinus attenuata*) and, occasionally, foothill pine emerging from the canopy. Understory species are *Cercocarpus betuloides*, *Heteromeles arbutifolia*, *Arctostaphylos manzanita*, *A. canescens*, *Toxicodendron diversilobum*, *Berberis dictyota*, *Lotus crassifolius*, *Cynoglossum grande*, *Symphoricarpos acutus*, *Ribes californicum*, *Dodecatheon hendersonii*, *Sanicula crassicaulis*, and *Keckiella lemmonii*.

Non-Serpentinite Riparian (no Holland equivalent): 3 acres (1 ha). This association is restricted to a small area of Frenzel Creek on Franciscan rocks. Species include California bay (dominant), Fremont cottonwood (*Populus fremontii*), *Salix laevigata*, *Sambucus mexicana*, *Vitis californica*, *Rubus ursinus*, *Rhus trilobata*, *Clematis ligusticifolia*, *Potentilla glandulosa*, *Cystopteris fragilis*, *Adiantum jordanii*, *Perideridia kelloggii*, *Lotus* sp., and *Datisca glomerata*.

Plant Diversity

One hundred eighty species are listed.

Conflicting Impacts

Off-road vehicle use adjacent to the RNA may have light impact on upper drainage. Fire suppression practices may necessitate controlled burning to maintain MacNab cypress stands in the future.

Note: for Graham Pinery, see Iron Mountain, #46

31. Grass Lake (Beguin and Major 1975, Burke 1987, Berg 1991a)

Location

This established RNA is in the Lake Tahoe Basin Management Unit in the Eldorado National Forest. It lies immediately W. of Luther Pass on State Highway 89 and is approximately 12 miles (19 km) SSE. of South Lake Tahoe. It lies within sects. 13, 14, 15, 22, 23, and 24 T11N, R18E MDBM (38°47'N., 119°59'W.), USGS Freel Peak quad (fig. 64). Ecological subsection – Glaciated Batholith and Volcanic Flows (M261Ek).

Target Element

Moss Bog

Distinctive Features

Significance of the Bog: Peatlands and bogs are rare in California. Grass Lake is the largest *Sphagnum* bog in California and is considered the best representative floating bog in the Sierra Nevada (fig. 65). Grass Lake has been the focus of several scientific surveys including palynological and phytosociological research.

Varied and Pristine Environment: This is a large site with a complex association of habitats ranging from aquatic and meadow types through upland forest types. This diversity, along with a largely intact watershed surrounding the marshlands and meadows, contributes to the value of this site. This site supports a number of boreal plant species unusual in the Sierra Nevada. In addition, several species of plants occur locally at substantially lower elevations than typical elsewhere in the Sierra Nevada. Along with a few uncommon or disjunct plants, the wetlands support three species of carnivorous plants and four species of orchids. The plant associations are relatively pristine with virtually no introduced plants in the bog and meadow associations. The bog and meadow associations are diverse, with 11 types described.

Physical Characteristics

The survey area covers about 2400 acres (972 ha), although the final established area is much smaller (360 acres [146 ha]). Grass Lake is a small body of water surrounded by a large *Sphagnum* bog. Portions of the marshland are underlain by water, forming a true quaking bog. Grass Lake is in a low-lying basin between peaks in the Carson Range, E. of the main Sierra Crest. Elevations range from 7680 to 9497 ft (2341-2895 m). Slopes vary from 0° to 50°. Three streams feed the lake and bog from the N., and one stream and several small seeps feed

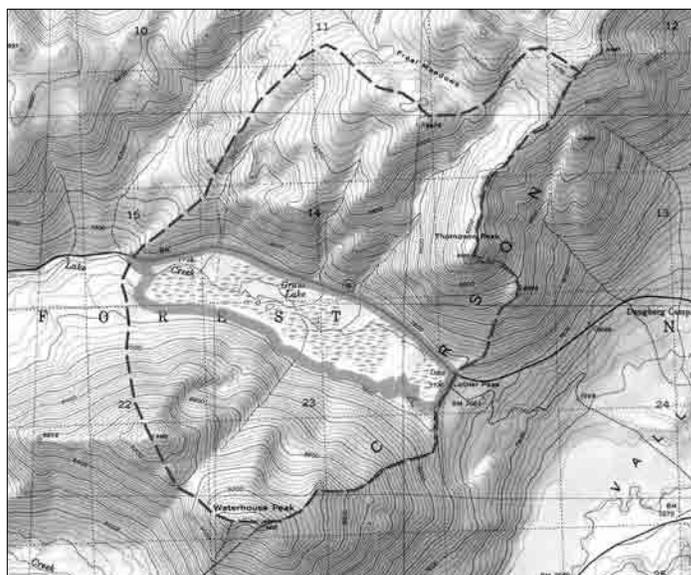


Figure 64—Grass Lake RNA

Dashed line = Ecological study area;
Solid gray line = RNA Boundary

it from the S. The basin was glacially scoured in the Pleistocene. The Grass Lake Basin drains to the W., but before the damming by a Pleistocene terminal moraine it drained to the E. over Luther Pass.

Rocks are all granitic, including the Bryan Meadow Granodiorite, the Echo Lake Granodiorite, and the Waterhouse Peak Granodiorite. The first is the most extensive. Quaternary alluvium underlies the meadow and lake of the main basin. Soils include marsh soils, Meeks very stony loamy coarse sand, 15-30 percent slopes; Meeks extremely stony loamy coarse sand, 15-30 percent slopes; Tallac stony coarse sandy loam, 5-15 percent slopes; Rock Land, Rock Outcrop-Cagwin complex, 30-50 percent slopes; and Rock Outcrop-Toem complex, 30-50 percent slopes. Precipitation is estimated at about 40 inches (1016 mm) annually with the majority as snow. Average minimum temperatures are 15 to -24 °F (-9 to -31 °C), and average maximum temperatures are 72-82 °F (22-28 °C). Frost-free days average 70-120 per year.

Association Types

The plant associations of the Grass Lake RNA are divided into five main groups. Four of these are tree-dominated; the fifth includes the *Sphagnum* bog and meadow associations. Extensive sampling was conducted by Beguin and Major (1975) in the bog and associated wet meadow vegetation. However, no additional sampling was done for this survey.

Jeffrey Pine Forest (85100, 85210): 1274 acres (516 ha), not included in the RNA. This is typically a tall, open forest dominated by Jeffrey pine (*Pinus jeffreyi*) and white fir (*Abies concolor*), occurring on S-facing slopes. The relatively sparse understory includes *Artemisia tridentata*, *Chrysolepis sempervirens*, *Chrysothamnus nauseosus*, *Symphoricarpos* spp., *Ceanothus cordulatus*, and *Arctostaphylos nevadensis*.

On the steepest S-facing slopes the forest is very open (about 30 percent canopy cover), and Jeffrey pine is associated with white fir and lodgepole pine (*Pinus contorta* ssp. *murrayana*). Open ground or rocks may cover up to 75 percent of the surface. However, scattered shrubs of *Artemisia tridentata*, *Eriogonum umbellatum*, *Symphoricarpos acutus*, as well as herbs such as *Wyethia mollis*, *Cirsium andersonii*, *Castilleja* spp., *Hieracium albiflorum*, and *Lupinus* spp. may sometimes cover up to 50 percent of the surface.

In hollows on steep slopes *Arctostaphylos nevadensis* or *Ceanothus cordulatus* form thickets of up to 100 percent cover under a very open canopy. On relatively level slopes with deeper soil, the understory is similar to an open meadow with such species as *Chrysothamnus nauseosus*, *Sitanion hystrix*, *Wyethia mollis*, *Monardella odoratissima* ssp. *pallida*, *Stipa* spp., and *Erigeron* spp. averaging 25-30 percent cover.

Red Fir Forest (85310): 819 acres (332 ha); 36 acres (15 ha) are included in the RNA. Locally red fir (*Abies magnifica*) grows to 197 ft (60 m) tall and 300-400 years old. The forest is typically dense and casts heavy shade. Understory vegetation is very sparse, with scattered species such as *Pyrola picta*, *Chimaphila menziesii*, *Poa* sp., and *Monardella odoratissima* ssp. *pallida*. At high elevation,

Figure 65—Grass Lake, the Grass Lake RNA contains the largest and best example of *Sphagnum* fen in the Sierra Nevada. Note dense stand of *Eriophorum gracile* in foreground. (around 1986)



occasional mountain hemlock (*Tsuga mertensiana*) may be intermixed along with western white pine (*Pinus monticola*). At lower elevations adjacent to the wetlands, lodgepole pine also occurs.

Slopes are typically steep. On open avalanche slopes, *Arctostaphylos nevadensis* forms low thickets. Around rocks, *Penstemon newberryi* and *Heuchera* sp. may occur. Rock cover in this association varies from 10 to 85 percent.

Meadow and Bog Vegetation (45100, 45210, 51110, 51200, 52430, 63500): 250 acres (101 ha) are included in the RNA. Beguin and Major (1975) sampled 73 stands (relevés) in the meadows and wetlands of Grass Lake. They described 11 associations. These are listed below with common names rather than the original Latin names:

Brown Moss-Bladderwort Association: The most aquatic grouping, this association occupies the open water (up to 3-4 m deep). Brown moss (*Drepanocladus fluitans*) and the bladderwort (*Utricularia vulgaris*) dominate along with *Myrophyllum spicatum* ssp. *exaltescens*, *Nuphar polysepalum*, and *Potamogeton natans*. *Potentilla palustris* may also codominate at some sites.

Monkeyflower-Shortsedge Association: This association is the classic quaking bog. It is dominated by *Menyanthes trifoliata*, *Carex limosa*, a dense understory of brown moss, and *Sphagnum squarrosum*. *Potentilla palustris* and *Mimulus primuloides* var. *pilosellus* are widespread. *Eriophorum gracile* may form conspicuous dense stands. This association typically borders the brown moss-bladderwort association in shallower water.

The Long- and Short-Beaked Sedge Association: This association also often lines the edge of open water; it is dominated by the large sedges *Carex rostrata* and *C. simulata*. *Sparganium angustifolium*, *Heleocharis palustris*, and *Glyceria grandis* also may be important. *Drepanocladus fluitans* and *Utricularia vulgaris* from the brown moss-bladderwort association overlap frequently.

The Shortbeak-Inflated Sedge Association: This association occurs some distance away from the deepest water and is dominated by *Carex vesicaria*. It is similar to the long- and short-beaked association, but the presence of *Juncus balticus*, *Deschampsia caespitosa*, and occasionally *Muhlenbergia filiformis* indicate drier conditions. There is some species overlap with the previous three associations, but those species show reduced vigor and coverages compared to their optimum habitats.

Nebraska Sedge Association: *Carex nebrascensis* is blue-green and, thus, this association is clearly distinguished from others adjacent to it. This association occurs between the drier meadow and the wetter sedge associations. Other common species include *Deschampsia caespitosa*, *Muhlenbergia filiformis*, and *Aster andersonii* var. *alpigenus*.

Nevada Rush-Spikerush Association (Holland 51200): The outer edges of the bog intergrade into a wet meadow with *Juncus nevadensis*, *Heleocharis quinqueflora* var. *suksdorfiana*, and *Carex simulata*. This association is restricted to areas where cold spring water and melt water keep the soil above field capacity throughout the summer.

Mountain Bluegrass-Smooth Beaked Sedge Association: This dry meadow association intergrades with surrounding lodgepole pine forest. It is dominated by *Poa epilis*, *Carex integra*, *Penstemon oreocharis*, and *Erigeron peregrinus*. Lodgepole pine is scattered, often with an understory of *Poa pratensis*. Two subassociations occur: a xerophytic type with *Artemisia tridentata*, *Cirsium drummondii*, and *Stipa columbiana* (typical of open disturbed areas, e.g., high gopher activity or human disturbance), and a more hydric type characterized by *Mimulus primuloides*, *Aster andersonii*, and *Polygonum bistortoides*.

Alpine Laurel-Lodgepole Pine Association: This association occurs on the land bridge between the two main parts of Grass Lake. It is a relatively open community with stunted lodgepole pines and a well-developed shrub stratum

including *Kalmia polifolia* ssp. *microphylla*, *Vaccinium occidentale*, *Salix orestera*, *Lonicera caurina*, and *Ledum glandulosa*. Herbs include *Luzula comosa*, *Saxifraga oregana*, *Allium validum*, *Pedicularis groenlandica*, *Carex aquatilis*, and *Carex capitata*.

Willow Thicket Association: This is an area of shrubby riparian thickets dominated by *Salix rigida* in low swales and along some stream courses within the Grass Lake basin. These thickets intergrade with meadow associations in wet fine-grained soils or with red fir and lodgepole pine forest on coarser, better-drained soils. Associated species include *Lupinus polyphyllus* ssp. *supurbus*, *Veratrum californicum*, *Achillea lanulosa*, *Potentilla glandulosa*, *Castilleja miniata*, *Aconitum columbianum*, *Aquilegia formosa*, *Senecio triangularis*, *Thalictrum fendleri*, *Allium validum*, and *Mimulus guttatus*.

Sandwort-Cudweed Association: This is an ephemeral streamside association occurring on sandy terraces of the numerous meandering rivulets in the basin. *Sagina saginoides*, *Gnaphalium palustris*, *Rorippa curvisiliqua*, *Tofieldia glutinosa* ssp. *occidentalis*, and *Mimulus suksdorfii* are characteristic. The high proportion of annuals is remarkable for such a boreal association.

Few-Flowered Alkali Grass Association: This association, dominated almost exclusively by *Torreyochloa* (*Puccinellia*) *pauciflora*, occurs on wet sandy soils covered with decomposing matter. Other infrequent species include *Deschampsia caespitosa*, *Carex vesicaria*, and *Juncus balticus*.

Lodgepole Pine Forest (86100): 57 acres (23 ha), all included in the RNA. This association occurs around the meadows of the Grass Lake basin. Lodgepole pine accounts for most of the 50 percent canopy cover, with red fir and mountain hemlock as occasional associates. At the ecotone between this forest and the meadows, mountain alder (*Alnus tenuifolia*) forms thickets. Understory associates include *Ribes* spp., *Holodiscus microphyllus*, *Chrysolepis sempervirens*, and *Arnica* spp. In moist sites *Epilobium angustifolium*, *Aster andersonii*, *Castilleja miniata*, *Aquilegia formosa*, *Thalictrum fendleri*, *Senecio triangularis*, and *Equisetum* spp. occur. In drier sites *Ledum glandulosum*, *Pedicularis* spp., and *Rubus parviflorus* are typical understory members.

Aspen Riparian Forest (61520): This association is of limited extent and unmapped in this study. Seventeen acres (7 ha) are included in the RNA. A fairly open riparian growth dominated by aspen (*Populus tremuloides*) follows the streams which feed Grass Lake from the N. Perennial and annual understory species are often dense. They include *Aquilegia formosa*, *Veratrum californicum*, *Habenaria sparsiflora*, *Mertensia ciliata*, *Smilacina stellata*, *Sphenosciadium capitellatum*, *Thalictrum fendleri*, and *Castilleja miniata*.

Plant Diversity

Two hundred seventy-six species of lower and higher vascular plants are listed.

Conflicting Impacts

A major State highway (89) runs through the area and borders the sensitive bog on its N. side. Several turnouts have been built along the marsh and bog area, and these areas are used frequently as scenic viewing sites. Until recently, gravel roads led into meadow areas and had a serious impact on the vegetation. The roads have been closed, ripped, and sewn with non-native grasses (which are unlikely to invade the wet meadow and bog). Recreational impact on the most sensitive areas is not heavy; most people appreciate the wetlands from afar. The accessibility of Grass Lake to the public may be useful for publicizing the values of RNAs. The most serious potential impact to the area may be road salting in the winter. Illegal gathering of firewood has been a problem in the N. part of the area.

32. Green Island Lake (Fiedler and others 1986)

Location

This recommended RNA is on the Lassen National Forest. It lies about 16 miles (26 km) SW. of Canyon Dam. The area occupies portions of sects. 5, 6 T25N, R6E and sects. 1, 2 T25N, R5E MDBM (40°03'N., 121°22'W.) USGS Jonesville and Belden quads (fig. 66). Ecological subsection – Lassen-Almoanor (M261Dm).

Target Element

Moss Bog

Distinctive Features

Meadow and Aquatic Resources: Meadows are found throughout the area either as small patches in forest openings or as large successional types surrounding lakes (fig. 67). Four permanent lakes and five ephemeral ponds occur in the area. The large lakes are described individually. They vary in their productivity, with Saucer Lake being deeper and less productive than Green Island Lake, which contains a large population of introduced but reproducing brook trout as well as numerous aquatic insects and plants. Frog Lake is also relatively productive. Several small streams are partially included in the rRNA, and the main streams of Firstwater and Soda creeks form the E. and N. boundaries, respectively. Although there are no true quaking bogs in the area, the wet meadows bordering Green Island and Frog lakes are well-developed and diverse. A great variety of aquatic insects inhabit the aquatic habitats of this basin.

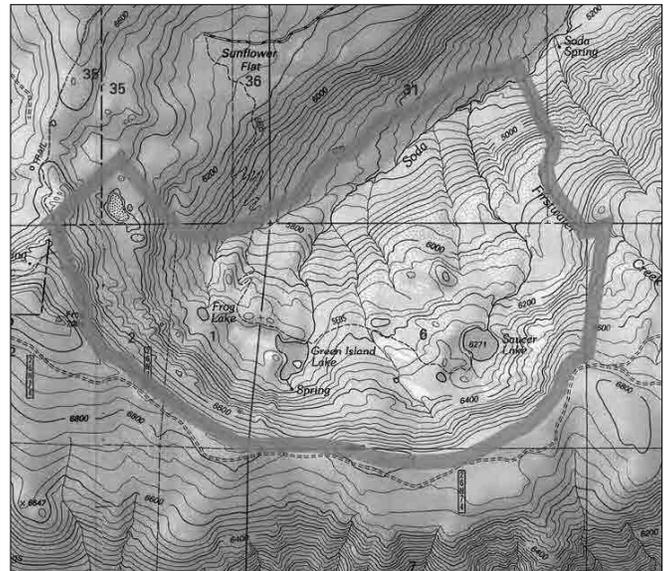


Figure 66—Green Island Lake rRNA

Vegetation Dynamics and Diversity: The vegetation at this rRNA consists of an interdigitation of forest, meadow, riparian thickets, and montane chaparral communities in a dynamic arrangement. Various stages of succession are present, ranging from lake to meadow to lodgepole pine (*Pinus contorta* ssp. *murrayana*) forest to red fir (*Abies magnifica*) forest, or from chaparral to upper-elevation mixed conifer forest. Portions of the area are underlain by ultramafic (*serpentine*) rock, which is vegetated with an open form of montane chaparral.

Rare Fauna: Wolverine (*Gulo gulo*, State-listed threatened species, Forest Service-listed sensitive species) and northern goshawk (*Accipiter gentilis*, California species of special concern, Forest Service-listed sensitive species) have been seen in the basin.

Physical Characteristics

This study area covers 1185 acres (480 ha). Elevations range from 5280 ft (1609 m) at the junction of Firstwater and Soda creeks to 7088 ft (2160 m) atop the ridge at the SW. corner. The area drains to the NE. with moderate to steep topography. The lakes occupy a cirque basin and were formed by Pleistocene glacial action and, in some cases, by organic damming of outlet streams. Lakes range from less than one acre to 14-acre (6-ha) Green Island Lake.

The area is near the northernmost extension of the Sierra Nevada ecological section, with Cascades volcanic rocks within 1 mile (1.6 km) to the N. and W. Most of the area is mapped as underlain by the Calaveras formation (primarily metasedimentary phyllite, quartzite, and metachert, but also some meta-volcanics). However, there are large areas of ultramafic rock, perhaps associated with the Melones fault zone. Soils are not described. Weather records are

summarized from Canyon Dam and Chester, both with different climates than the rRNA. Precipitation is estimated (Rantz 1972) at 70-80 inches (1778-2032 mm) annually, with most falling as snow in the winter.

Association Types

The montane coniferous forest was sampled along three transects using the point-centered quarter technique. Vegetation of the hydric associations is qualitatively described.

Montane Coniferous Forest (84180, 85310): 820 acres (332 ha). In general, this forest is open (boulders scattered throughout) and dominated by red fir (*Abies magnifica*). One transect at the upper elevations on N.- and NE.-facing slopes was relatively closed forest strongly dominated by red fir (88 percent relative cover) with 337 trees/ha and 79 m²/ha basal area. In the more open sites (transects 2 and 3), red fir still dominates and averages 220 trees/ha with a basal area of 28 m²/ha. However, red fir makes up only 40 percent of the cover. Other important species include white fir (*Abies concolor*), western white pine (*Pinus monticola*), and lodgepole pine (*Pinus contorta* ssp. *murrayana*). The density and cover values of these three species are 183/ha, 23 m²/ha; 2/ha, 15 m²/ha; and 44/ha, 19 m²/ha, respectively. At elevations below the transects, Jeffrey pine (*Pinus jeffreyi*) and sugar pine (*P. lambertiana*) also occur.



Figure 67—Green Island Lake, “floating bog” (*Carex hystericina*) at Frog Lake. (around 1986)

Understory vegetation is dominated by scattered-to-dense montane chaparral shrubs including *Quercus vaccinifolia*, *Arctostaphylos nevadensis*, *Prunus emarginata*, and *Ribes roezlii*. Forty-four herbs are listed for this forest. These vary depending on site conditions and include *Aster elatus*, *Allium campanulatum*, *Aquilegia formosa*, *Calyptridium umbellatum*, *Corallorhiza maculata*, *Delphinium depauperatum*, *Gayophytum decipiens*, *Hackelia nervosa*, *Ligusticum grayi*, *Osmorhiza occidentalis*, *Phacelia purpusii*, *Pyrola secunda*, *Sarcodes sanguinea*, and *Trifolium productum*.

Chaparral (37510): 311 acres (126 ha). This association is broken into two phases. The larger portion is a sparse type on ultramafic ridges and openings. *Arctostaphylos nevadensis* and *Quercus vaccinifolia* occur as scattered shrubs with large rocky openings with perennial forbs such as *Calochortus leichtlinii*, *Erysimum* spp., *Monardella odoratissima* ssp. *pallida*, *Achillea millefolium*, and *Sanicula tuberosa*. A smaller area of closed chaparral is dominated by *Arctostaphylos patula*, with occasional *Quercus vaccinifolia* and *Spiraea densiflora*. The herb understory of this type is sparse.

Alder Riparian (63500): 34 acres (14 ha). Streams of the area support a riparian scrub of *Alnus tenuifolia* with occasional *Acer glabrum* var. *torreyi* at the higher elevations. A small clone of aspen (*Populus tremuloides*) occurs along upper Soda Creek. *Alnus tenuifolia* thickets also occur adjacent to meadows at the lower elevations. The herbaceous flora includes *Sphenosciadium capitellatum*, *Senecio triangularis*, *Heracleum lanatum*, *Lilium* sp., *Perideridia parishii*, and *Polygonum bistortoides*.

Wet Meadow (45100): 20 acres (8 ha). Wet meadows occur most extensively adjacent to the three main lakes. These are densely vegetated meadows bordering forest vegetation in recently glaciated terrain. Most can be classified as stringer-type meadows. Eighteen species are listed as characteristic, including *Achillea millefolium*, *Calochortus nudus*, *Carex* spp., *Danthonia unispicata*, *Dodecatheon jeffreyi*, *Erythronium purpurascens*, *Juncus howellii*, *J. nevadensis*, *Potentilla glandulosa*, and *Veratrum californicum*.

Aquatic Communities/Submerged Macrophytes (52430): 29 acres (12 ha). This association is well developed in the area and includes the submerged macrophytes *Potamogeton filiformis* var. *macounii*, *Isoetes bolanderi*, and *Ranunculus aquatilis* var. *capillaceus*. The floating macrophytes are concentrated near the shores of all three main lakes. They include *Ruppia maritima*, *Potamogeton* spp., and *Sagittaria cuneata*.

The emergent zones are well developed at all three lakes and were considered the "floating bog" target during initial reconnaissance. Species (24 listed) include *Carex rostrata*, *C. vespicaria*, *C. hystericina*, *Menyanthes trifoliata*, *Potentilla palustris*, and *Heleocharis acicularis*.

Plant Diversity

One hundred fifty taxa are listed.

Conflicting Impacts

The area is relatively isolated and undisturbed. All three lakes have introduced populations of either brook or rainbow trout.

33. Grizzly Mountain (Big Grizzly Mountain) (Petersen 1994b, Keeler-Wolf 1987a)

Location

This established RNA is on the Stanislaus National Forest and is about 8 miles (13 km) NW of El Portal, the entrance to Yosemite National Park. The area lies within portions of sects. 29, 30, 31, and 32 of T2S, R19E MDBM (37°42'N., 119°55'W.), USGS Kinsley quad (fig. 68). Ecological subsection – Upper Foothills Metamorphic Belt (M261Eg).

Target Element

California Black Oak (*Quercus kelloggii*)

Distinctive Features

Fire History and California Black Oak Forest Structure:

The California black oak is fire-adapted and has burned locally several times in the recent past. The most recent fire, in September 1987, affected most of the area. The fieldwork for the ecological survey took place one year before this burn; hence the opportunity exists for pre- and post-fire study.

Analysis of charred and fire-scarred stems of oaks and other trees indicates that there was a major fire in the mid-1930s. This fire burned the N. slopes of Big Grizzly Mountain more completely than the N. slopes of Little Grizzly Mountain. Hence, survivor stems of black oak (up to 31 inches, 79 cm dbh) were found in the latter locality as well as several ponderosa pines (*Pinus ponderosa*) and incense-cedar (*Libocedrus decurrens*) that pre-dated the 1930s. Before the 1930s, the last fire appears to have occurred about 1885. Thus, the Big Grizzly

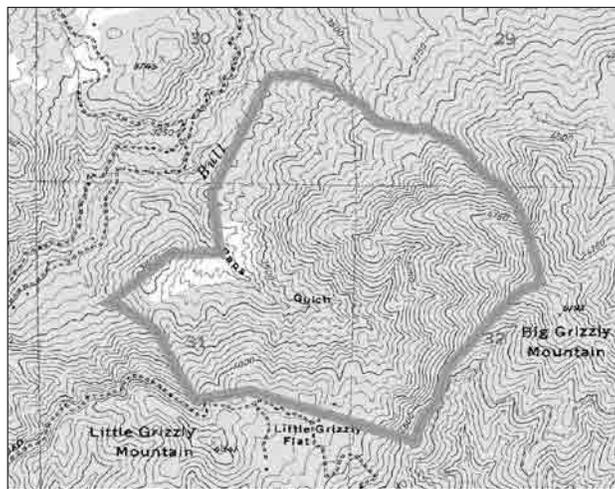


Figure 68—Grizzly Mountain RNA

area has had a major fire on average of once every 50 years for the past 100 years. It is likely that fires have maintained the California black oak forest in this area for centuries.

Comparisons with Other California Black Oak RNAs: Several other areas in California have been selected to represent this target element (Devil's Rock-Hosselkus, Devil's Basin, and Cahuilla Mountain). Each of these areas has unique features but also many similarities. Compared to the others, Grizzly Mountain has the largest percentage of its area dominated by California black oak. It also has a relatively uniform stocking and cover of California black oak, making it less variable than the other areas. The local forest is restricted to N. exposures, whereas Devil's Rock-Hosselkus has largely S. and W. and Cahuilla Mountain has W. and E. exposures. The confined distribution of forest on N. exposures at Grizzly Mountain may be related to the fact that the Grizzly Mountain area receives less summer moisture than the other two sites. *Toxicodendron diversilobum* dominates the understory at most sites, and a number of other species of herbs are shared between the sites.

Rare Plants: Three rare species may possibly occur here. Congdon's woolly sunflower (*Eriophyllum congdonii*, CNPS 1B, State-listed rare species), slender-stemmed monkey-flower (*Mimulus filicaulis*, CNPS 1B), and Small's southern clarkia (*Clarkia australis*, CNPS 1B) have been sighted near the boundaries of this RNA.

Physical Characteristics

The area covers about 668 acres (270 ha) on the N. slopes of Big and Little Grizzly mountains, which are separated by a small canyon with an intermittent stream (Paps Gulch). Elevations range from 3200 ft (975 m) in Paps Gulch to about 5192 ft (1583 m) at the summit of Big Grizzly Mountain. Slopes are moderate throughout the lower elevations, steeper at mid-elevations, and become moderate again at the upper elevations. Exposure is generally N. with some S.- and W.-facing slopes in Paps Gulch.

Rocks are mesozoic granitics of the Sierra Nevada Batholith and shaley to schistose Paleozoic metasediments. Gneissic intergrades between granite and metamorphics occur on upper Big Grizzly Mountain. Two soil mapping units occur. These are the Josephine family, moderately deep Dystric Lithic Xerochrepts association derived from metasediments, and the granitically derived Lithic Xerumbrepts-Holland family deep association. Precipitation averages about 60 inches (1524 mm) annually with very little between April



Figure 69—Grizzly Mountain, California black oak forest on NW-facing slope showing typical multiple stems from base and arching interlocking canopy ca. 45 ft (14 m) high. (1986)

and October. Estimated mean annual temperatures range from 51.4 to 53.6 °F (10.8-12 °C) with January means from 35.1 to 37.2 °F (1.7-2.9 °C) and July means from 69.4 to 71.6 °F (20.8-22 °C).

Association Types

Twenty 100-m² plots were sampled in the California black oak forest.

California Black Oak Forest (71120, 81340): 395 acres (160 ha). California black oak strongly dominates, with an average of 1090 stems/ha (relative density 85 percent). California black oak has highest frequency, density, and basal area cover (importance value 230.3). Only occasional small trees of ponderosa pine, incense-cedar, knobcone pine (*Pinus attenuata*), canyon live oak (*Quercus chrysolepis*), and California bay (*Umbellularia californica*) occur. California black oak cover averages 49 m²/ha (89 percent relative cover). As a result of a fire in the mid-1930s, most stems of black oak are of uniform dimensions, averaging 10 inches (25 cm) dbh, 45 ft (14 m) tall, and 3.5 stems per resprout clump (fig. 69). Seedlings of California black oak are abundant; however, saplings and young trees are rare.

The shrub layer is strongly dominated by *Toxicodendron diversilobum*, averaging 35 percent cover. *Ribes roezlii*, *Chamaebatia foliolosa*, and *Rubus glaucifolius* occur irregularly along with five other shrub species. Herbs are uncommon except for *Clarkia unguiculata* and *Dryopteris arguta*. Twenty-four other species occur as trace cover on fewer than 50 percent of the plots. The understory is conspicuously affected by density of oak canopy, with the occasional small opening having a grassy understory including *Achillea millefolium*, *Bromus tectorum*, *Calochortus venustus*, *Centaurea melitensis*, *Clarkia rhomboidea*, *Daucus pusillus*, *Festuca pacifica*, *Madia elegans*, *Plectritis* sp., *Rumex angiocarpus*, and *Trifolium microcephalum*. Openings in the rocky upper elevations near the summit of Big Grizzly Mountain house several native perennials including *Melica aristida*, *Koeleria macrantha*, *Bromus carinatus*, *Calochortus venustus*, *Arabis* sp., and *Stipa lemmonii*.

Ponderosa Pine Forest (84210): 143 acres (58 ha). Small lobes of ponderosa pine forest extend into the lower portion of the area on deep soils. This forest also burned in the 1930s, and trees are uniformly young with average dimensions of 19 inches (48 cm) dbh and 66 ft (20 m) height. Other trees are sparse and include scattered young incense-cedar, which may have colonized later than the pines. There are also occasional knobcone pine, California black oak, canyon live oak, and California bay. The understory is sparse, with scattered senescent chaparral shrubs. In small openings, such understory species as *Dichelostemma volubilis*, *Agoseris grandiflora*, *Calochortus* sp., *Bromus tectorum*, *Calystegia* sp., *Hieracium albiflorum*, *Trifolium microcephalum*, *Vicia americana*, *Pteridium aquilinum*, and *Lupinus* sp. occur.

Chaparral (37110, 37520, 37810): 87 acres (35 ha). This type covers the S. exposures of upper Paps Gulch. *Arctostaphylos mariposa* marginally dominates with *Ceanothus cuneatus* as the major subdominant. Shrubby canyon live oak is important, particularly on SW. exposures. The dispersion of *A. mariposa* is fairly uniform, but *C. cuneatus* is more clumped with occasional small pockets of dominance. Occasional snags and a relatively large number of ponderosa pine at the upper reaches of the chaparral suggest that at least portions of this type may have been an open ponderosa pine-dominated forest before the mid-1930s fire.

Canyon Live Oak Forest-Woodland (81320): 43 acres (17 ha). Canyon live oak dominates small areas on steep, concave N. slopes. These forests contain trees of similar age and diameter to surrounding California black oak forest, but are typically up to 15 ft (5 m) shorter (30-35 ft, or 9-11 m tall). The understory is rockier than in California black oak forest, but still dominated by *Toxicodendron*. On shallow soils with a SW. exposure, canyon live oak forms a shrubby woodland mixed with chaparral shrubs such as *Arctostaphylos mariposa* and *Ceanothus cuneatus*.

Riparian (61510): No acreage given. The lower part of Paps Gulch has permanent moisture and some associated riparian growth. This includes white alder (*Alnus rhombifolia*) in the overstory, with an understory of *Rubus*

34. Guatay Mountain

lacinatus, *R. ursinus*, *Urtica holosericea*, *Artemisia douglasiana*, *Ribes nevadense*, *Rumex californicus*, *Woodwardia fimbriata*, *Vitis californica*, *Datisca glomerata*, and *Aquilegia formosa*.

Plant Diversity

Ninety taxa are listed.

Conflicting Impacts

In general, human impact has been slight in the area. However, prior use by Miwok Indians may have been relatively heavy. Several inventoried archeological sites are in and adjacent to the area. The 1987 fire greatly altered the vegetation from the type discussed in the survey. However, this is a natural occurrence and will allow a great deal to be learned about succession in, and stability of, this forest type. Portions of the ponderosa pine forest were thinned around 1976. An overgrown, unused jeep road barely enters the N. part of the area at Paps Gulch.

34. Guatay Mountain (Gautier and Zedler 1980)

Location

This proposed RNA (pRNA) was dropped in 1987 in order to expand the boundary; it was then renominated in 1995. The pRNA is on the Cleveland National Forest, approximately 3.5 miles (5.7 km) NNW. of Pine Valley and includes portions of sects. 21, 28, and 29 T15S, R4E SBBM (32°50'N., 116°33'W.), USGS Descanso quad (fig. 70). Ecological subsection – Palomar-Cuyamaca Peak (M262Bo).

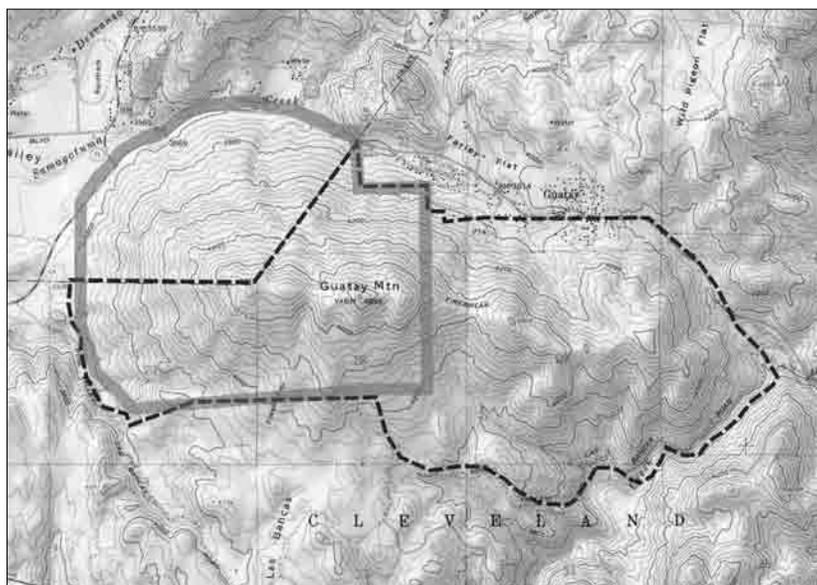


Figure 70—Guatay Mountain pRNA

Dashed line = Ecological study area;
Solid gray line = RNA Boundary

Target Element

Tecate Cypress (*Cupressus forbesii*)

Distinctive Features

Tecate Cypress: Tecate cypress occurs only in scattered stands on several mountains in S. California and into Baja California. Considered rare (CNPS List 1B), it is a candidate for California State listing as threatened. One large

stand and many scattered individuals are represented in the pRNA (fig. 71). It is a major component of the unique local chaparral. The local population is remarkable for the great size and age of the individuals. Most are more than 100 years old.

In California intense fires have reduced the numbers of Tecate cypress in recent years. Fire management is a crucial issue because of the conflicting needs of the vegetation and the local human population. Tecate cypress requires fire for reproduction. However, only certain types of fire, affecting cypress populations of certain ages, are optimum for initiating release of seeds from the serotinous cones. Stands younger than 40 years tend to produce relatively few seedlings when burned, perhaps because of the small number of cones present on young trees. Low-intensity fire can kill the trees without opening the cones, and thus may do more harm than good. Crown fires every 50-100 years are best for high yields of seedlings.

Although the stands at Guatay Mountain are relatively old, their vigor is high, with few senescent individuals. However, without fire, the stand would have to be artificially reseeded, which would alter the natural dynamics of the ecosystem (through scraping of soil, etc.). Dunn (1987) recently conducted a more detailed study of the population dynamics of Tecate cypress including the population at Guatay Mountain.

Gabbro Endemism: Guatay Mountain is underlain by the Guatay Mountain Gabbroic Pluton. A number of rare endemic plants are associated with gabbro, an ultramafic rock, in the Peninsular Ranges. Locally at least two species (*Calochortus dunnii* and *Calamagrostis densa*) are rare gabbro endemics. The first is a member of CNPS List 1B and is listed by the State of California as rare. The other is a member of CNPS List 4.

Other Rare Plants: In addition to the cypress and the gabbro endemics, *Mimulus clevelandii* (CNPS List 4) is present along the ridges on the upper slopes of Guatay Mountain.

Physical Characteristics

This area is not well-defined in the survey. The vegetation types add up to about 2884 acres (1167 ha). Guatay Mountain rises as an E.-W.- trending ridge with three high points averaging about 1000 ft (305 m) higher than the surrounding lowlands. The highest point is 4885 ft (1470 m). Slopes range from 10 to 70 percent. N.- and E.-facing slopes are steeper than S.-facing slopes.

The Guatay Mountain Gabbroic pluton includes amphibole gabbro, gabbro, and olivine gabbro. The mountain is surrounded by tonalites (granitic rock) except for a small area of Julian Schist in the SE. of the area. The well-rounded conical shape of the mountain is characteristic of gabbro weathering. The soils are well-drained zonal soils with a high erosion hazard; they are classified as Las Posas series. Temperatures are mild, and precipitation occurs primarily in the winter months. Estimated annual precipitation for the area is 25-37 inches (635-940 mm). Estimated highest and lowest temperatures are about 100 °F (38 °C) and -4 °F (-19 °C), with mean January and July temperatures of 39 °F (3.9 °C) and 70.1 °F (21.2 °C), respectively.

Association Types

No quantitative vegetation sampling was conducted in this survey.

California Mixed Chaparral (37110): 2036 acres (824 ha). This association occurs on N.- and W.-facing slopes. Predominant shrub species include *Arctostaphylos glandulosa*, *Adenostoma fasciculatum*, *Ceanothus greggii*, *Quercus dumosa*, *Cercocarpus betuloides*, and *Yucca whipplei*. The understory is unusual in its relatively high cover of the prostrate shrub *Salvia sonomensis*.

On N. sides of the mountain, canyon live oak (*Quercus chrysolepis*) forms dense island-like clumps 13-33 ft (4-10 m) tall in a sea of mixed chaparral. This suggests that with low fire frequencies canyon live oak forest could come to dominate this area.

Another subtype of mixed chaparral occurs on the highest S.-facing slopes of the mountain where *Haplopappus arborescens*, *Ceanothus foliosus*, and *Helianthemum scoparium* dominate.

Southern Interior Oak Woodland (71160, 61310): 467 acres (189 ha). This association occurs in drainageways around the base of the mountain. These



Figure 71—Guatay Mountain, Tecate cypress (*Cupressus forbesii*) on northern edge of the Guatay Mountain pRNA adjacent to the old campground along Highway 80. (1995)

woodlands are dominated by coast live oak (*Quercus agrifolia*). Grasses are usually abundant in openings, with shrubs and herbaceous species predominating in shady areas. No additional information is available.

Chamise Chaparral (37200): 335 acres (136 ha). This association, dominated by *Adenostoma fasciculatum*, occurs on S.-facing slopes at lower elevations. *Arctostaphylos glandulosa* is scattered throughout the stand. Understory vegetation is virtually non-existent.

Southern Interior Cypress Forest (83330): 47 acres (19 ha). This association is dominated by Tecate cypress, which occurs on a N.-facing slope and consists of dense pockets of cypress interspersed with mixed chaparral. A large area in the middle of the stand is devoid of cypress, containing sparse cover of *Cercocarpus betuloides*. The dense pockets of cypress have poor understory development, but in open stands herbs such as *Sanicula crassicaulis*, *Bloomeria crocea*, and *Gutierrezia sarothrae* are common.

Twenty-four Tecate cypress individuals were cored. The mean age is 92 years (range 24-122). Trees at the bottom of the slope are younger (about 80 years old) than those upslope (about 100 years old). A small number of trees are scattered throughout one of the main N. slope drainages to the E. of the main stand. These scattered trees are substantially younger than the main stand (their mean age is 29 years).

Plant Diversity

Eighty-one taxa of vascular plants are listed.

Conflicting Impacts

There is much private land associated with the Guatay Mountain cypress population. The area was reclassified as a Special Interest Area in 1987 largely because of the small amount of cypress on Forest Service land and its relatively small total population size.

35. Hale Ridge (Keeler-Wolf 1987c, Johnson 1995)

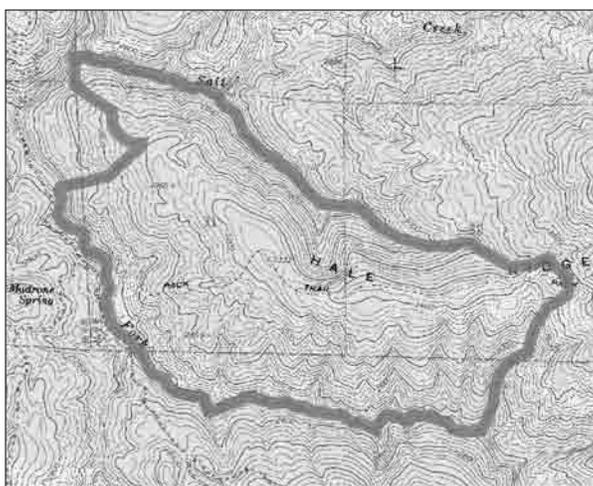


Figure 72—Hale Ridge RNA

Location

This established RNA is on the Mendocino National Forest about 10 miles (16 km) NE. of Upper Lake. It lies within portions of sects. 30, 31, and 32 T17N, R8W; sect. 36 of T17N, R9W; and sects. 5 and 6 of T16N, R8W MDBM (39°15'N., 122°48'W.), USGS Potato Hill quad (fig. 72). Ecological subsections – Eastern Franciscan (M261Ba) and Central Franciscan (M261Bb).

Target Element

Knobcone Pine (*Pinus attenuata*)

Distinctive Features

Knobcone Pine Woodland: The local Lake County stands are among the best developed in the species' range and the most extensive off ultramafic soils. The ecology of this

species remains relatively unknown, particularly in the realm of vegetation ecology and soil/parent material relationships. Questions regarding effectiveness of post-fire reseeding, wind-dispersal effectiveness onto nonburned areas, and growth rates on differing exposures could be answered here in conjunction with a program of prescribed burning. The presence of large areas of

adjacent and intermixed chaparral and Douglas-fir (*Pseudotsuga menziesii*)-dominated vegetation provides a typical context in which to view the successional patterns of the knobcone pine woodland (fig. 73).

Serpentinite Indicator Species not on Serpentinite: Certain species such as the leather oak (*Quercus durata*), commonly considered as being highly restricted to serpentine soils (Kruckeberg 1984), are locally common in the RNA where no serpentine soil occurs. In addition, a number of other species considered by Kruckeberg as local or regional indicators of serpentine soils also occur in the study area: *Arctostaphylos stanfordiana*, *A. glandulosa*, *Castilleja foliolosa*, *Chaenactis glabriscula*, *Eriophyllum lanatum*, *Galium ambiguum*, *Phacelia imbricata*, and knobcone pine. Perhaps the generally poor, infertile soils of Franciscan graywacke form less competitive environments than typical nonserpentine soils for these species, thus allowing them to occur here.

Fire: Approximately 50 percent of the RNA was burned in December 1988, after the ecological survey. Fire in 1932 and prescribed burning (80 acres [32 ha]) in 1983 and 1984 were also recorded.

Physical Characteristics

The area covers 975 acres (395 ha). Hale Ridge is a W.-trending spur of Goat Mountain. The ridge has a relatively steep slope, but generally flat top. The Rice Fork of the Eel River and Salt Creek delimit the boundaries on the N., S., and W. Slope exposures are varied, but predominantly N.- and S.-facing. Elevations range from 2400 to 3600 ft (732-1097 m). Rocks are all Franciscan assemblage dominated by graywacke sandstone with some shale. Soils are generally shallow and infertile and include the Boomer-Hoda-Speaker, the Maymen-Etsel-Speaker, and the Speaker-Maymen-Marpa associations. Mean annual precipitation is 45-55 inches (1143-1397 mm). July maximum temperatures are 102-106 °F (39-41 °C) and January minimums are about 22 °F (-6 °C).

Association Types

Ten 10- by 10-m plots were sampled in knobcone pine forest, and six 10- by 10-m plots were sampled in the Douglas-fir dominated forest.

Knobcone Pine Woodland (83210): 380 acres (154 ha). This association may be divided into high-, moderate-, and low-density phases. All are a result of a fire which swept through the area in 1932. Basal area cover varies depending on density of the trees, from 18 m²/ha on high-density plots to 47 m²/ha on low-density plots.

High-density stands (2500-3500 knobcone pine/ha) have a NW. to NE. aspect, low cover (trees average 3 inches [8 cm] dbh), sparse shrub understory, and virtually no herbs. *Arctostaphylos canescens* and interior live oak (*Quercus wislizenii*) are the dominant shrubs. Occasional canyon live oak and Douglas-fir saplings suggest future dominance by these species.

The moderately dense phase, which occurs on WNW.- to SW.-facing slopes, averages 1600 knobcone pine/ha. The understory is well developed, dominated



Figure 73—Hale Ridge, view south from the eastern edge of the Hale Ridge RNA across mixed chaparral and open phase of knobcone pine woodland. (1987)

by *Arctostaphylos glandulosa* and interior live oak (*Quercus wislizenii*). *Toxicodendron diversilobum*, *Ceanothus lemmonii*, and *Adenostoma fasciculatum* are also characteristic. Total understory cover ranges between 25 and 80 percent. Successional stage varies from site to site. Douglas-fir forest may colonize the most mesic sites, but in general, the poor soil and xeric exposures are conducive to chaparral dominance.

The open phase, primarily on S. exposures, is characterized by low-density knobcone pine (800-1300/ha). These trees are the largest-boled individuals in the area, ranging to 13 inches (33 cm) dbh, although their heights (13-16 m) are only 2-3 m taller than average trees in denser types. A relatively dense shrub layer dominated by xerophilic species such as *Adenostoma fasciculatum*, *Arctostaphylos glandulosa*, *Pickeringia montana*, and *Quercus wislizenii* var. *frutescens* covers 35-65 percent of the surface.

Portions of the open phase have burned in several small controlled burns in recent years. Typical regenerating species do not include knobcone pine, but they do include *Adenostoma fasciculatum*, *Arctostaphylos glandulosa*, interior live oak, *Haplopappus linearifolius*, *Ceanothus lemmonii*, *Eriodictyon californicum*, and *Rhus trilobata*. Early successional herbs not otherwise noted in the type, such as *Hypericum concinnum*, *Gilia capitata*, *Lotus humistratus*, *Clarkia rhomboidea*, *Cirsium vulgare*, *Wyethia angustifolia*, and *Mentzelia dispersa*, add to the cover provided by the resprouting and seedling shrubs for a total of about 65 percent.

Douglas-Fir-Dominated Forest (84110 [84230 in the establishment record]): 320 acres (129 ha). This type is dominated by Douglas-fir with a subcanopy of scattered canyon live oak (*Quercus chrysolepis*). Substantially less important are sugar pine (*Pinus lambertiana*), incense-cedar (*Libocedrus decurrens*), knobcone pine, Pacific madrone (*Arbutus menziesii*), and ponderosa pine (*Pinus ponderosa*). Total tree density is 1410/ha, and total cover is 112 m²/ha. Dominant trees are 3-4 ft (0.9-1.2 m) dbh and 250-350 years old. Saplings and seedlings average 980/ha with canyon live oak most important, followed by Douglas-fir, sugar pine, and madrone. Cover of herbs and shrubs is low (averaging 4 percent) with no clearly dominant species (8 shrub and 12 herb and grass species recorded). This forest occurs primarily on N.-facing slopes, but may also occur in slightly different form in sheltered S.-aspect ravines.

Chaparral (37110, 37200, 37530, 37E00): 165 acres (67 ha). The chaparral may be divided into three phases: mixed, chamise, and mechanically disturbed successional. The mixed phase is most extensive. It varies from 60 to 100 percent cover of such species as *Arctostaphylos glandulosa*, *A. canescens*, *A. stanfordiana*, *Adenostoma fasciculatum*, *Ceanothus cuneatus*, *Pickeringia montana*, *Quercus durata*, *Q. wislizenii* var. *frutescens*, *Lonicera interrupta*, *Cercocarpus betuloides*, and *Garrya fremontii*. Herbs are rare. A few young foothill pine (*Pinus sabiniana*) occur. This phase has the greatest potential for longevity and productivity with the lowest fire frequency. It typically occupies relatively mesic sites on SW-, SE- and even locally N.-facing slopes.

Chamise chaparral is most xerophilic of the three types. It occupies the driest S.-facing slopes with shallow, rocky soils. It has low species diversity, with *Adenostoma fasciculatum* comprising 65-100 percent of the woody cover, and only occasional shrubs of *Arctostaphylos glandulosa*, *Ceanothus cuneatus*, or *Pickeringia montana*. Herbs are rare, except on portions that were recently control-burned, where herbs are similar to those previously noted in knobcone pine burns. Areas with annual grass-dominated openings between shrubs are senescent.

Unclassified: 11 acres (4.5 ha). This is a mechanically disturbed chaparral area, occupying the periodically cleared fire trail. On most sites *Ceanothus integerrimus*, *C. cuneatus*, and *C. lemmonii* dominate along with *Pickeringia* and *Adenostoma*. This is the tallest form of chaparral, reaching 15-20 ft (4.6-6.1

m). Successional trends vary depending on slope exposure. Mesic N.-facing slopes have been invaded by Douglas-fir and young knobcone pine; on SW. slopes chaparral species from surrounding mixed types are the only species in evidence.

Plant Diversity

One hundred four taxa are listed.

Conflicting Impacts

Because the knobcone pine woodland is fire dependent, the vegetation is likely to require management through controlled burning. Impacts include light off-road vehicle use along the existing fuel break through the center of the RNA and erosion (gullying) on the steeper portions of the fuel break.

36. Hall Canyon (Keeler-Wolf 1986e, 1989k)

Location

This established RNA is on the San Bernardino National Forest, Riverside County. It is about 5.3 miles (8.5 km) NW. of Idyllwild and lies in portions of sects. 15, 16, 21, and 22 T4S, R2E SBBM (33°48'N., 116°46'W.), USGS Lake Fulmor quad (*fig. 74*). Ecological subsection – San Jacinto Mountains (M262Bm).

Target Element

Mixed Conifer Forest

Distinctive Features

Research Precedent: The RNA lies adjacent to the small but heavily used James Reserve, managed by the University of California, Riverside. This scientific reserve, part of the University of California Natural Lands Reserve System, has been in operation since 1966. A large number of research projects have taken place at least partially within the RNA. Virtually all of the visitors to the James Reserve (well over 1800 user-days annually) have made some use of the RNA for research, field trips, or casual observation. No other RNA in California except the Harvey Monroe Hall has such a precedent of research use. Because of the excellent facilities (e.g., electricity, herbarium, refrigeration, computer access, etc.) at the James Reserve, there is great potential for further research. A remote sensing station was installed at the Black Mountain Lookout in 1987 by James Reserve to monitor many points within the RNA for phenological and successional change.

Mixed Conifer Forest: This is the only surveyed RNA representing the mixed conifer forest in S. California. A large elevation span assures the representation of a broad zone of mixed conifer and associated vegetation types from the chaparral to the upper elevation mixed conifer forest. The area is representative of much of the mixed conifer forest of the Southern California Mountains and Valleys ecological section (Peninsular Ranges).

Fire History: The fire history over the RNA varies and is indicative of the effects of fire and its importance in shaping the various plant associations in the area. Most of the area of mid- and upper-slopes below about 6500 ft (1981 m) was burned in an extensive fire that occurred in approximately 1880. Most stems of conifers and re-sprouts of canyon live oak are younger than 108 years. The only survivors of the fire are in rocky areas or in the canyon bottom incense-cedar (*Libocedrus decurrens*) forest. At upper elevations, fire intensity has been lower,



Figure 74—Hall Canyon RNA

with many survivor stems of sugar pine (*Pinus lambertiana*) and white fir (*Abies concolor*). The 1974 fire did not burn extensively into the upper elevation mixed conifer forest, probably largely as a result of the open nature of this forest dictated by the numerous rock outcrops.

Rare Plants: One species, *Lilium parryi*, is a member of CNPS List 4. It is a characteristic component of the riparian scrub along Indian Creek.

Physical Characteristics



Figure 75—Hall Canyon, sugar pine-white fir forest on west-facing upper slopes of Black Mountain. (1985)

The area covers approximately 667 acres (270 ha) on the W. slopes of the San Jacinto Mountains. The RNA occupies the upper reaches of a SW.-trending drainage (Indian Creek) heading at Black Mountain (7772 ft, 2369 m) and stretches to within 650 ft (200 m) of the small reservoir known as Lake Fulmor (5380 ft, 1640 m), with an elevation range of 2392 ft (729 m). SW.-facing slopes predominate with some S.-, W.-, N.-, SE.-, and E.-facing exposures. Slopes are steepest at the upper elevations and gentlest along two bench systems at the middle elevations.

Rocks are entirely late Cretaceous granitics from the San Jacinto Pluton. Numerous outcrops occur, particularly at the upper elevations. Soils have been mapped as five units. These are Wapi-Pacifico families/rock

outcrop complex 50-75 percent slopes, Pacifico-Wapi families complex 30-50 percent slopes, Pacifico-Preston families complex 30-50 percent slopes, Green Bluff-Brader families association 15-50 percent slopes, and rock outcrop areas. Only the Green Bluff-Brader, which occurs in the flatter valley bottom areas, has relatively deep, sandy loam soil; the other types are typically shallow and rocky. The 50-year-average annual precipitation at Idyllwild at 5397 ft (1645 m) is 25.3 inches (643 mm) although the estimated annual average atop Black Mountain is 40 inches (1020 mm). Snow depth averages 10-25 inches (25-64 cm) on April 1 at the upper elevations. The mean annual temperature at Idyllwild is about 53 °F (11.7 °C).

Association Types

Ten 100-m² plots were sampled on the white fir-sugar pine (*Abies concolor*-*Pinus lambertiana*) forest, seven in canyon live oak (*Quercus chrysolepis*) forest, ten in ponderosa pine (*Pinus ponderosa*) forest, five in California black oak (*Quercus kelloggii*) forest, and eight in incense-cedar (*Libocedrus decurrens*) canyon bottom forest.

White Fir-Sugar Pine Forest (84230, 85320): 245 acres (99 ha). This association is included under mixed conifer forest in the establishment record. It contains the most characteristic form of the mixed conifer series in the RNA. Canyon live oak is not as important a species as in lower-elevation forests (occurring only on xeric exposures), and the forest is clearly dominated by conifers. Typically, sugar pine dominates (*fig. 75*) on W.- and SW.-facing slopes at the upper elevations (> 6700 ft, 2042 m), while white fir dominates on more N.-facing slopes.

This forest is open, averaging 780 trees/ha. A large portion of the ground is covered with massive outcrops, especially on the W.- and SW.-facing slopes. At such exposures sugar pine covers more than twice the basal area of white fir. However, white fir occurs in higher densities than sugar pine in many areas. This is particularly true on the small unburned area of NW. exposure. Here white fir is codominant with sugar pine, Jeffrey pine (*Pinus jeffreyi*), and incense-

cedar. On W.- to SW.-facing slopes (where the plots are located) total basal area cover averages 102 m²/ha. Sugar pine comprises 46 percent of the basal area, white fir only 19 percent. However, white fir averages 41 percent relative density, whereas sugar pine averages only 14 percent. Typical dominant sugar pines are relatively slow growing, between 330 and 400 years, and 24-30 inches (61-76 cm) dbh. The largest trees in the sample area are about 46 inches (117 cm) dbh and may be 600 years old. The understory is sparse, with occasional patches of *Chrysolepis sempervirens* at the upper elevations.

Canyon Live Oak Forest (81320, 84140): 218 acres (88 ha). Canyon live oak is the most numerous tree in the RNA. There is a broad zone in the middle elevations of the area where this species is dominant in cover and density. Typically, Coulter pine (*Pinus coulteri*) and sugar pine tower over the smaller oaks in a scattered, open canopy. Exposure is generally W. to SW.; slopes are steep. Understory is rocky and, virtually, without herb cover.

Most canyon live oak stems are resprouts (often 8-10 per clump) resulting from widespread fire about 1885. Stems of the oaks average <20 inches (51 cm) dbh and 40 ft (12 m) tall. Stem density is relatively high (1620/ha) with basal area cover averaging 85 m²/ha. Canyon live oaks make up 56 percent of the stems and 42 percent of the basal area. Other species, in descending importance, include sugar pine, Coulter pine, *Quercus x morehus*, *Arctostaphylos pringlei* var. *drupacea* (tree size), white fir, and interior live oak (*Quercus wislizenii*). Herbs and shrubs are sparse, except at lower elevations where *Rhamnus californica* may be common.

Ponderosa Pine Forest (84210): 93 acres (38 ha). This forest occurs at elevations below 6000 ft (1829 m). It dominates on deep alluvial soils of the valley bottom and also on N.- and NW.-facing slopes. It co-occurs with Coulter pine, sugar pine, white fir, incense-cedar, California black oak, and canyon live oak. Basal dominance by ponderosa pine is more than 2 times greater than any other species (24 m²/ha), with total basal area cover averaging 65 m²/ha. Tree densities average 1140/ha. Canyon live oak comprises 46 percent of the stems. The understory is sparse with much duff. Three shrub and 19 herb species are listed on the sample plots, with *Galium angustifolium* the only species occurring on 50 percent or more of the plots. Trees grow relatively rapidly with ponderosa pine attaining diameters of 30-33 inches (76-84 cm) in slightly over 100 years.

California Black Oak Forest (81340): 60 acres (24 ha). This deciduous forest occupies NW.- to W.-facing slopes between 5500 and 6150 ft (1676-1874 m). It occurs on relatively deep soils. Total basal area cover is 113 m²/ha, with California black oak comprising 57 percent of that value. Total tree density is 980/ha, with black oak relative density 55 percent. Most California black oak are 15-25 inches dbh (38-61 cm), 17-22 m tall, and 70-100 years old. Other subdominants, in order of importance value, include Coulter pine, incense-cedar, Jeffrey pine, sugar pine, and canyon live oak. Shrub and herb cover is relatively high, with average ground cover estimated between 15 and 20 percent, representing 27 species. Among the most typical are *Galium angustifolium*, *Bromus marginatus*, *Bromus orcuttianus*, *Castilleja martinii*, *Thalictrum fendleri*, and *Angelicatomentosa*.

Montane Chaparral (37520, 37530): 44 acres (18 ha). Two types are described: an early successional *Ceanothus* type dominated by either *C. leucodermis*, *C. integerrimus*, or hybrids between the two, covering 34 acres (14 ha); and a more persistent manzanita type dominated by *Arctostaphylos glandulosa* or *A. pringlei* var. *drupacea*, covering 10 acres (4 ha). *Ceanothus* chaparral is most extensive where the 1974 fire occurred on the NW. side of the RNA. Manzanita chaparral occurs in small isolated remnant patches that may have resulted from fires more than 100 years ago. The understory of both types is typically sparse.

Incense-Cedar Canyon Bottom Forest (84230, 63500): 7+ acres (3 ha). This association is included in the discussions in the establishment record of mixed conifer forest and montane riparian scrub. Incense-cedar dominates in a narrow zone along the banks of Indian Creek near permanent moisture. Before the 1974 fire, incense-cedar dominated this semiriparian strip from the lowest reaches of the RNA up to about 6900 ft (2103 m). At present this type gives way to snags at about 6500 ft (1981 m).

Sample plots indicate a density of 1600 trees/ha and a total cover of 205 m²/ha. Incense-cedar comprises 23 percent relative density and 63 percent relative cover. Other trees, in descending order of importance value, include white fir, canyon live oak, sugar pine, ponderosa pine, California bay (*Umbellularia californica*), Coulter pine, and black oak. The age of some of the incense-cedars is estimated at more than 500 years, and several measured more than 60 inches (1.52 m) dbh. The valley bottom location is relatively well-protected from fire. The dense forest tends to suffer major canopy damage if burned.

Herbs and shrubs are typically riparian hydrophilic species and may cover more than 50 percent in small, sunny creekside openings. They include *Rhododendron occidentale*, *Euonymus occidentalis*, *Ribes nevadense*, *Pteridium aquilinum*, *Chimaphila menziesii*, *Woodwardia fimbriata*, and *Lilium parryi*. A similar group of species is associated with several seeps (Holland 45400) scattered throughout the area.

Plant Diversity

Two hundred forty-five taxa of vascular plants have been reported from the vicinity of the RNA; however, some are typical of lower elevations (e.g., locally only within the neighboring James Reserve).

Conflicting Impacts

The area is adjacent to the heavily used Lake Fulmor recreational site, although a chain-link fence forming the boundary of the James Reserve effectively prevents casual entry from the SW. A small area of the SE. side of the area was removed from the original RNA proposal because of impact by woodcutting and camping. A small area of the 1974 burn was revegetated with non-native giant sequoia (*Sequoiadendron giganteum*).

37. Harvey Monroe Hall (Taylor 1984)

Location

This established RNA is on the Inyo National Forest. The S. end of the RNA is only 1 mile (1.6 km) N. of Tioga Pass (Highway 120). It occupies all or portions of sects. 34 and 35 T2N, R24E and sects. 1, 2, 3, 10, 11, 12, 13, and 14 T1N, R24E MDBM (37°58'N., 119°19'W.), USGS Tioga Pass quad (*fig. 76*). Ecological subsection – Glaciated Batholith (M261Eo).

Target Element

Alpine Meadows and Sierran Mixed Subalpine Forest

Distinctive Features

Long History of Research: This RNA was one of the first established in California (1933). The Carnegie Institute of Washington's classic studies on genotype-environment interactions made much use of the transplant gardens at the S. end of the RNA. Many related studies were carried out in the 1940s and 1950s at these gardens. Since then, other researchers have used the area, studying social organization of Belding ground squirrels, dynamics of wind-

blown detritus in snow banks, and community structuring of subalpine forest birds. A partial bibliography listed by the author of this survey cites 41 references pertaining to the RNA.

High Floristic and Vegetational Diversity: Despite the high elevation of the RNA, a great variety of plants and association types occur. The many studies and botanical collections made in the area have made this one of the best-known RNAs botanically. Three hundred ninety-eight taxa of vascular plants in 190 genera and 55 families are represented. An extensive program of vegetation sampling conducted in this survey revealed 10 major habitat types, which were broken down into 31 vegetation alliances and 66 plant associations.

Rare Plants: Two species present in the RNA are members of CNPS List 2: *Salix brachycarpa* and *Salix reticulata* ssp. *nivalis*. The following are members of CNPS List 4: *Astragalus kentrophyta* var. *danaus*, *Podistera nevadensis*, and *Scirpus clementis*.

Aquatic Values: Fifteen lakes occur in the RNA in addition to a number of smaller perennial and ephemeral ponds. Lakes occur on various substrates (metamorphic and granitic) which affect their chemistry and biota. Eight small watersheds of approximately equal size are present, each with a perennial stream. Most of the streams arise from snowmelt. Three glaciers occur in the RNA; the largest is about 160 acres (65 ha).

Physical Characteristics

The RNA covers 3883 acres (1571 ha). Elevations range from 9600 ft (2926 m) along Lee Vining Creek to 12,590 ft (3837 m) atop Mount Conness. The entire area is drained by Lee Vining Creek, which flows from NW. to SE. Glaciation strongly affected the topography. Several deeply glaciated NE.-facing cirques are present, with steep headwalls and flats or lakes at their floors. Much of the lower elevation area is stepped topography resulting from differential erosion along jointing planes in the granitic bedrock. The granitic rocks are part of the Cathedral Peak Quartz Monzonite and the Half Dome Quartz Monzonite. They occupy the W. part of the area. The E. portion is underlain by various metamorphic rocks including Paleozoic and Mesozoic metasediments, metadacite, banded calc-silicate hornfels, calc-silicate hornfels varying to limestone-marble, and basic metavolcanics. Soils are typically shallow and poorly developed except in meadows. The climate is high Sierran montane with copious winter snowfall. Average annual precipitation is estimated to be more than 25 inches (635 mm). There is great variation in temperature and growing season, between S.- and N.-facing slopes, valley bottoms, and so forth.

Association Types

A total of 374 stands of vegetation were sampled (releve method), and the results classified using the computer-generated TWINSpan hierarchical system and detrended correspondence analysis ordination to produce the association tables. The primary division is between dry and wet sites. Within dry sites the next division is made between alpine and subalpine communities (a reflection primarily of temperature differences). The next level of division within dry sites is related to late and early snow-melt patterns. Wet site classification is based on site productivity with graminoid-dominated meadows being 2-3 times less productive than tall, herb-dominated associations. A total of 66 vegetation

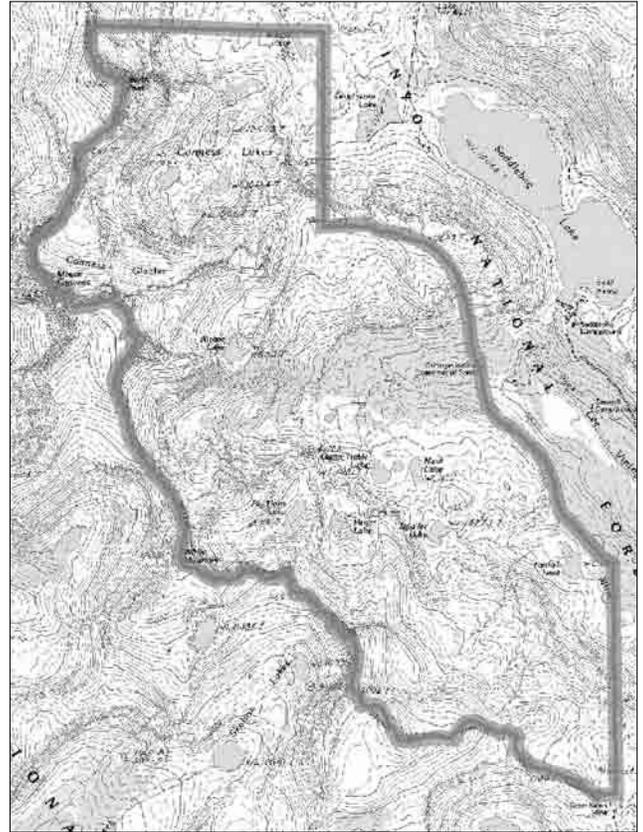


Figure 76—Harvey Monroe Hall RNA

associations, grouping into thirty-one alliances, were delineated. The following summary lists the ten major habitat types with their corresponding alliances and associations. Sizes for associations are not given.

1. Rock Fissures (91200):

Cystopteris fragilis alliance

Heuchera rubescens-Cystopteris fragilis association

Oxyria digyna alliance

Draba lemmonii-Oxyria digyna association

2. Scree, Talus and Rock Outcrop Communities (91200):

Carex congdonii-Arnica amplexicaulis alliance

Arnica amplexicaulis-Carex congdonii association

Sambucus microbotrys-Carex congdonii association

Artemisia rothrockii alliance

Holodiscus dumosus (H. microphyllus)-Mimulus suksdorfii association

Stipa occidentalis-Eriogonum nudum association

Artemisia rothrockii-Monardella odoratissima association

Saxifraga nidifica-Mimulus rubellus alliance

Saxifraga nidifica-Mimulus rubellus association

Rhodiola integrifolia-Selaginella watsonii association

Saxifraga bryophora association

Polygonum minimum association

Penstemon newberryi-Streptanthus tortuosus alliance

Sedum obtusatum-Muhlenbergia montana association

Spiraea densiflora association

Pentaphylloides floribunda (Potentilla fruticosa) alliance

Pentaphylloides floribunda-Danthonia unispicata association

3. Xeric Alpine Communities (91120):

Minuartia nuttallii (Arenaria nuttallii)-Haplopappus macronema alliance

Minuartia nuttallii association

Calamagrostis purpurascens alliance

Calamagrostis purpurascens-Leptodactylon pungens association

Chrysothamnus monocephalus-Leptodactylon pungens association

Elymus (Sitanion) hystrix-Phlox covillei alliance

Festuca minutiflora-Penstemon davidsonii association

Podistera nevadensis-Erigeron pygmaeus association

Astragalus kentrophyta-Draba oligosperma association

Elymus hystrix-Phlox covillei alliance

Phlox covillei-Eriogonum incanum association

Ivesia muirii association

Hulsea algida alliance

Macronema discoideum (Haplopappus macronema)-Phacelia frigida association

4. Subalpine Forests (86100, 86210, 86220, 86600):

Pinus contorta (lodgepole pine) alliance (fig. 77)

Pinus contorta-Carex rossii association

Pinus contorta-Thalictrum fendleri association

Pinus contorta-Ledum glandulosum association

Pinus albicaulis (whitebark pine) alliance
Pinus albicaulis-Poa nervosa association
Pinus albicaulis-Penstemon davidsonii association
Tsuga mertensiana (mountain hemlock) alliance
Tsuga mertensiana-Arnica cordifolia association

5. Snowpatch Communities (91300):

Juncus parryi alliance
Juncus parryi-Eriogonum incanum association
Phyllodoce breweri association
Carex spectabilis-Sibbaldia procumbens association
Carex helleri alliance
Eriogonum incanum-Raillardella argentea association
Carex helleri-Ivesia lycopodioides association
Saxifraga tolmiei-Luzula divaricata association
Carex breweri alliance
Carex breweri association

6. Well-Drained Meadows (45220, 45210):

Carex exserta alliance
Carex exserta-Saxifraga aprica association
Calamagrostis breweri alliance
Calamagrostis breweri-Vaccinium caespitosum association
Calamagrostis breweri-Kalmia microphylla association
Salix orestera-Calamagrostis breweri association
Juncus drummondii-Calamagrostis breweri association
Danthonia unispicata alliance
Piltagrostis (Oryzopsis) kingii-Senecio scorzonella association
Phleum alpinum-Danthonia unispicata association
Melica bulbosa alliance
Stipa lemmonii-Carex stramineiformis association
Juncus balticus association

7. Tall-Herb and Willow Thickets (63500, 45210):

Salix orestera-Allium validum alliance
Salix orestera-Allium validum association
Salix orestera-Senecio triangularis association
Salix planifolia-Carex scopulorum association
Veratrum californicum alliance
Veratrum californicum-Senecio triangularis association
Senecio triangularis-Carex spectabilis association
Arnica mollis alliance
Arnica mollis-Arabis davidsonii association

8. Poorly-Drained Meadows (45210):

Carex luzulaefolia alliance
Carex luzulaefolia-Ranunculus alismaefolius association
Carex scopulorum-Pedicularis groenlandica alliance
Eriophorum crinigerum-Carex scopulorum association
Carex scopulorum-Pedicularis groenlandica association



Figure 77—Harvey Monroe Hall, View of typical subalpine landscape representative of the H.M. Hall RNA with *Pinus contorta* in the foreground. (1982)

38. Haypress Meadows

Eleocharis pauciflora association

Carex deweyana alliance

Rorippa curvisiliqua-*Carex deweyana* association

Juncus mertensianus association

Carex nigricans alliance

Salix arctica association

Carex subnigricans-*Dodecatheon alpinum* association

Carex nigricans-*Kalmia microphylla* association

Carex vernacula-*Antennaria alpina* association

9. Flowing Springs and Shallow Streams (45210, 63500):

Mimulus tilingii alliance

Claytonia nevadensis association

Mimulus tilingii-*Poa gracillima* association

Deschampsia caespitosa alliance

Deschampsia caespitosa-*Solidago multiradiata* association

10. Shallow Ponds and Standing Water (52430):

Carex rostrata alliance

Torreyochloa (Puccinellia) pauciflora-*Isoetes bolanderi* association

Carex rostrata association

Plant Diversity

Three hundred ninety-eight taxa of vascular plants are listed.

Conflicting Impacts

The area is bounded on the SE. by a good gravel road to Saddlebag Lake and is only a few miles by road from Tioga Pass (Yosemite National Park E. entrance). However, recreational use of the area is apparently not a significant impact in most areas. In the late 1800s and early 1900s sheep apparently overgrazed much of this area. However, no certain evidence of this impact remains.

38. Haypress Meadows (Imper 1988a)

Figure 78—Haypress Meadows cRNA



Location

This candidate RNA is within the Marble Mountain Wilderness on the Klamath National Forest. It lies within portions of sects. 17, 18, 19, and 20 T13N, R7E HBM (41°30'N., 122°23'W.), USGS Some Bar quad (fig. 78). Ecological subsection – Upper Salmon Mountains (M261Ag).

Target Element

Red Fir (*Abies magnifica*)

Distinctive Features

Red Fir: Approximately 80 percent of the area is described as Shasta red fir (*Abies magnifica* var. *shastensis*) forest. Some small areas are dominated by exceptional old-growth stands. However, the actual area of canopy dominance of Shasta red fir is only about 9 percent of the total. The remaining area has red fir in the understory. Other species such as white fir (*Abies concolor*), incense-cedar (*Libocedrus decurrens*), Douglas-fir (*Pseudotsuga menziesii*), and sugar pine (*Pinus*

lambertiana) are important canopy constituents. The study area offers a good cross-section of habitats at the lower elevation range of the red fir zone.

The area is unusual for its undetermined genetic status of firs. Some attributes of the local fir populations are more like noble fir (*Abies procera*) than typical Shasta red fir. These include the extreme projections of the cone bracts and the characteristic way "red fir" locally codominates with mountain hemlock (*Tsuga mertensiana*). However, definitive genetic determinations have not been made. The name Shasta red fir is used loosely in this report to describe all trees with red or noble fir characteristics.



Figure 79—Haypress Meadows (#1), with mountain hemlock, Shasta red fir, and lodgepole pine invading drier portions, meadow had had a history of grazing. (D. Imper, 1988)

General Habitat Diversity: Habitat diversity in the area is high, given the narrow elevational range. The diversity is related to the abundance of surface water and varied fire history of the area. Several wet and dry meadow associations are present. Forests range from the open, sparse understory of the Shasta red fir-prince's pine association to the dense lush understory of the Shasta red fir-vanilla leaf association, and the dense shrub layer of the Shasta red fir-Sadler oak association. Well-developed riparian vegetation lines several miles of creeks in the area, and mountain chaparral dominates burned sites.

Meadow Ecology: The broad range of wet meadow types, their exceptional floristic diversity, and proximity to trailheads makes them conducive to study. Livestock grazing has declined over the past several decades, and some of the meadows that were overgrazed are undergoing successional changes (fig. 79). Other meadows suffered little impact from grazing and are essentially pristine. A number of potential succession-related studies focusing on the meadows could be undertaken. These include meadow recovery processes following heavy grazing, grazing impact on soil loss, general successional relationship between meadows and surrounding coniferous vegetation, and factors governing *Alnus viridus* (*sinuata*) invasion of meadows.

Rare Plants: *Carex halliana* (CNPS List 2) and *Gentiana setigera* (CNPS List 3) are present in the meadows. The following species are members of CNPS List 4: *Lupinus tracyi*, *Lilium wigginsii*, *Epilobium oregonum*, *Veronica cusickii*, and *Collinsia linearis*. Two hybrids (*Veratrum californicum* x *V. viride* and *Vaccinium membranaceum* x *V. uliginosum* ssp. *occidentale*) are unusual and occur in the meadow-forest ecotone.

Physical Characteristics

The survey area covers about 1250 acres (506 ha). Elevations range from 4400 to 5400 ft (1341-1646 m). Most of the area is gently sloping, with slopes of all aspects represented. The steepest slopes (up to 60 percent) are in the Cub Creek valley, the major N.-flowing drainage in the E. of the area. The series of flats supporting meadows is in the S. half of the area. The area is underlain by granitic rock (Wooley Creek Pluton). Soils are classified as the Entic Xerumbrepts-Gerle family-Tallac family association 15-50 percent slopes. Climate is moderately marine influenced. Precipitation averages somewhat above 70 inches (1778 mm) annually (Rantz 1972).

Association Types

A total of twenty 0.1-acre (0.04-ha), circular plots were sampled in four forest associations.

Shasta Red Fir-Vanilla Leaf Forest (84240, 85310): 310 acres (125 ha). This association occupies moist N. slopes and meadow borders between 4700 and 5400 ft (1432-1646 m). Soils may be well developed and moist, but rocky. Most of this association occurs as narrow borders along meadows. The canopy is dominated by white fir with Shasta red fir, Douglas-fir, incense-cedar, and sugar pine as subdominants. Shasta red fir is the principal reproducer. Fire is less important than in other forest associations in the red fir zone. Stands may be even or uneven aged (fig. 80).

Figure 80—Haypress Meadows (#2), Shasta red fir/vanilla leaf forest at base of north-facing slopes, the lushest and most species-rich of the local forest types. (D. Imper, 1988)



Productivity is the highest of any forest, and on four plots basal area ranges from 57.4 to 82.6 m²/ha. Dominant Shasta red fir and white fir average 30-50 inches (76-127 cm) dbh, and occasional sugar pines and Douglas-fir are greater than 75 inches (190 cm) dbh. Many of the larger trees have been protected from fire by their mesic meadow border location.

The understory is rich and well developed, the most diverse of any forest association. Twenty-eight typical species are listed, including *Achlys triphylla*, *Trillium ovatum*, *Linnaea borealis*, *Rubus lasiococcus*, *Gaultheria ovatifolia*, *Adenocaulon bicolor*, *Pyrola secunda*, *Anemone deltoidea*, *Penstemon laetus*, *Disporum hookeri*, and *Mahonia (Berberis) nervosa*.

Shasta Red Fir-Prince's Pine Forest (84240, 85310): 310 acres (125 ha). This forest occurs at similar elevations and contains the same tree species as the previous association, but occurs on distinctly more xeric locations. Ponderosa and Jeffrey pines (*Pinus ponderosa* and *P. jeffreyi*, respectively) are uncommon indicators of the more xeric conditions as is

the typical scattered understory dominated by *Chimaphila umbellata* (to >40 percent cover). An open shrub layer of *Quercus sadleriana*, *Rhamnus purshiana*, and/or *Rosa gymnocarpa* is also typical. *Lilium washingtonianum* is common along with other species such as *Pteridium aquilinum*, *Hieracium albiflorum*, *Chrysolepis chrysophylla*, *Symphoricarpos mollis*, *Arctostaphylos nevadensis*, *Corylus cornuta*, *Trientalis latifolia*, *Penstemon anguineus*, and *Viola sheltonii*.

Productivity is second only to the previous association, and basal area on five plots ranges from 60 to 83 m²/ha. The largest Douglas-fir is about 60 inches (152 cm) dbh. With several even-aged cohorts dating to 35, 65, 105, and 165 years, fire history in this type is complex. Many stands are distinctly two-layered with young understory and mature overstory. Large relict Douglas-fir, ponderosa pine, or incense-cedar are conspicuous. Some areas on warmer slopes may never become dominated by Shasta red fir. A number of shade-suppressed *Quercus sadleriana* seedlings are present in the understory. *Q. sadleriana* dominates the understory of stands with less than 69 m²/ha basal area and less than 60 percent canopy cover. Some of the many fires may have been caused by humans, to improve the range capabilities of the meadows.

Shasta Red Fir-Sadler Oak Forest (84240, 85310): 140 acres (57 ha). This is another forest dominated by white fir, but with reproduction predominantly from red fir. Relative cover figures are similar to those of the previous forest;

however, the canopy is more open (<60 percent). There are many snags and down logs. *Quercus sadleriana* dominates the understory in dense cover of 60-90 percent. A few other species occur including *Chimaphila umbellata*, *Apocynum androsaemifolium*, *Rosa gymnocarpa*, *Pyrola secunda*, *Arctostaphylos nevadensis*, *Symphoricarpos mollis*, and *Rhamnus purshiana*.

Dominant white and red fir are typically 40-50 inches (1.02-1.27 m) dbh, and basal areas on three plots range from 34 to 51 m²/ha. The largest Douglas-firs are 6.8 ft (2.08 m) dbh and 500 years old.

Wet Meadow-Riparian Complex (45100, 63500): 136 acres (55 ha). This category includes a range of association types in the wet meadows and the riparian corridors. There are four main subtypes:

1. *Alnus* scrub: 82 acres (33 ha). This association is dominated by *Alnus viridus*, with *Salix* spp., *Cornus stolonifera*, *Sorbus californica*, *Ribes marshallii*, *Rhododendron occidentale*, *Acer glabrum*, *Prunus emarginata*, and a rich variety of understory herbs. It occurs as dense thickets over many of the hydric openings, especially in the N. half of the area such as along Cub and Haypress creeks.

2. *Vaccinium* meadow is an open meadow type, generally near saturation in early summer. It is dominated by *Vaccinium uliginosum* ssp. *occidentale* with many herbs.

3. *Carex* meadow is the predominant type of wet meadow with high species diversity. It is saturated or immersed much of the growing season. *Carex rostrata* dominate the wettest areas. Other species include *Pedicularis attolens*, *Dodecatheon alpinum*, *Lupinus polyphyllus*, *Gentiana setigera*, *Viola macloskeyi*, *Veratrum viride*, *Lilium wigginsii*, *Scirpus congdonii*, *Glyceria elata*, *Caltha leptosepala*, and *Ranunculus gormanii*.

4. *Helenium* meadow is the driest of the wet meadow types. It is dominated by *Helenium bigelovii*, *Castilleja miniata*, and other herbs.

White Fir-Prince's Pine Forest (84240): 125 acres (51 ha). This association occurs on dry upper slopes and is characterized by nearly pure stands of white fir with local concentrations of Douglas-fir, sugar pine, and incense-cedar, as well as occasional ponderosa or Jeffrey pine. Shasta red fir occurs in mesic sites. The understory is depauperate with occasional individuals of *Rhamnus purshiana*, *Chimaphila menziesii*, and *Pteridium aquilinum*. Older stands have scattered *Quercus sadleriana* and sparse mats of *Chimaphila umbellata*. The even-aged structure of the forest underscores the importance of fire. No sampling was done in this forest.

Shasta Red Fir-Thinleaf Huckleberry Forest (85310): 110 acres (45 ha). This is the only association clearly dominated by Shasta red fir in the canopy and understory. It occurs in canyons and sheltered N.-facing slopes. Substrate is rocky and moist. Mountain hemlock is the principal subordinate tree, and there are occasional Douglas-fir, Brewer spruce (*Picea breweriana*), western white (*Pinus monticola*) and lodgepole (*Pinus contorta* ssp. *murrayana*) pines. The shrub layer is generally dense, dominated by *Quercus sadleriana* and *Vaccinium membranaceum*. The herb layer includes *Gaultheria ovatifolia*, *Rubus lasiococcus*, *Clintonia uniflora*, *Linnaea borealis*, *Achlys triphylla*, *Smilacina stellata*, and *Paxistima myrsinites*.

Basal area on seven plots ranges from 37 to 74 m²/ha. Shasta red fir is represented by several age classes with dominants 35-50 inches (89-127 cm) dbh. Largest individuals are 57 inches (1.45 m) dbh, 160 ft (49 m) tall, and 400+ years old.

White Fir-Vanilla Leaf Forest (84240): 105 acres (43 ha). This is a mesic low-elevation association ranging from 4400 to 4700 ft (1341-1433 m) on N.-facing slopes and to over 5100 ft (1554 m) on gentle S.-facing exposures. The understory is lush with well-developed shrub and herb layers; the substrate is often rocky. Stands are typically uneven-aged, and fire is not an important factor.

Pussypaws-Western Needlegrass Dry Meadow Complex (45120): 7 acres (3 ha). This category includes a variety of associations in the Haypress Meadows area, all apparently related to past overgrazing. Typical herb cover in the dry sandy meadows includes *Calyptidium umbellatum*, *Lupinus albicaulis*, occasional *Carex* spp., *Eriogonum umbellatum*, and *Stipa occidentalis*. More mesic sites have greater species diversity including such taxa as *Sanicula graveolens*, *Ipomopsis aggregata*, *Monardella odoratissima*, *Penstemon laetus*, *Linanthus nuttallii*, *Gayophytum nuttallii*, *Phacelia mutabilis*, and *Rumex acetosella*.

Tobacco Brush-Greenleaf Manzanita Scrub (37510): 6 acres (2 ha). This chaparral is seral to Shasta red fir forest. It is associated with relatively recently burned patches on ridgetops or steep S.-facing slopes. Conifer reproduction is typically poor. Species include *Ceanothus velutinus*, *Arctostaphylos patula*, *A. nevadensis*, *Chrysolepis sempervirens*, *Apocynum androsaemifolium*, *Anemone deltoidea*, *Quercus sadleriana*, and *Lilium washingtonianum*.

White Fir-Pinemat Manzanita Forest (84240): 3 acres (1 ha). This association occurs as a small patch on a xeric, steep S.-facing slope. Douglas-fir and sugar pine dominate the canopy, white fir the understory. *Arctostaphylos nevadensis* may cover 50 percent of the surface. Soil is poorly developed and rocky. The rare *Collinsia linearis* occurs here along with *Silene campanulata*, *Chrysolepis chrysophylla*, *Polystichum imbricans*, *Arctostaphylos patula*, and *Eriogonum nudum*.

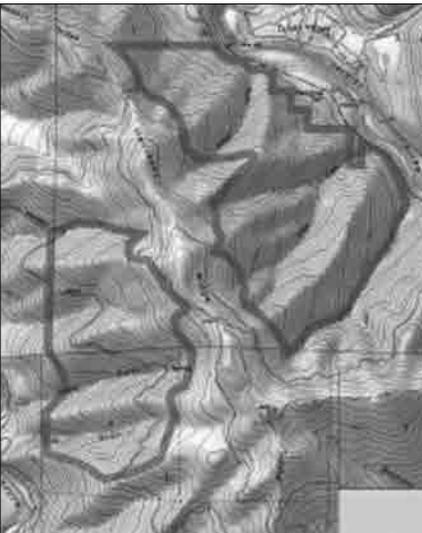
Plant Diversity

Two hundred twelve taxa are listed.

Conflicting Impacts

Because the area is entirely within the Marble Mountain Wilderness, there may be some conflict with recreational use. Several of the lush meadows are adjacent to trails, and the meadows are attractive camping sites. Thus, some impact on potential meadow research projects may be expected. Apparently some cattle still graze the meadow and riparian zones. It is suggested that the actual area of Shasta red fir dominance could be increased by adding land S. of the proposed boundary.

Figure 81—Hennessy Ridge
rRNA



39. Hennessy Ridge (Thornburgh 1987)

Location

This recommended RNA is on the Six Rivers National Forest, Trinity County, about 4 miles (6 km) SE. of the town of Salyer. It is divided into two units. The E. unit includes part of sects. 29, 30, 31, and 32 T6N, R6E HBM, and the W. unit includes part of sect. 31 T6N, R6E and sects. 5 and 6 T5N, R6E HBM (40°55'N., 123°32'W.), USGS Hennessy Peak quad (fig. 81). Ecological subsection – Western Jurassic (M261Aa).

Target Element

Pacific Douglas-Fir (*Pseudotsuga menziesii*)

Distinctive Features

Variation in Forest Structure: Analysis of a grid system of ten 0.2-acre (0.08-ha) plots indicates a high degree of irregularity in the stand structure of the local mixed Douglas-fir-hardwood forest. The clumpiness of the stand structure suggests that both hardwoods and Douglas-fir regenerated in small (<10-acre, 4-ha) gaps. The presence of small clumps of different

ages lends support to the concept that Douglas-fir-dominated forest in the Klamath Mountains ecological section is capable of maintaining its climax status by relying on relatively small stand disturbances for regeneration.

Successional Status: Most of the forest stands were determined to be at or near climax. Stands are all-aged and have all sizes of the dominant species: Douglas-fir, tanoak, canyon live oak (*Quercus chrysolepis*), and a small but consistent amount of sugar pine (*Pinus lambertiana*) (fig. 82). Ground fires, small areas of crown fire, and fallen tree create light gaps. Gaps of these types are the principal sources of successful tree reproduction throughout the survey area.

Relationship to Other Areas: Relative to other studies in the Klamath Mountains ecological section (e.g., Atzet and Wheeler 1984, Mize 1973, Bridge Creek candidate RNA), the local Hennessy Ridge Douglas-fir-hardwood forests are on the dry end of the scale, and many plant indicators of the more mesic types of Douglas-fir hardwood forest are missing from this survey area.

Physical Characteristics

The E. unit includes approximately 1008 acres (408 ha) with elevations from 800 to 3020 ft (244-921 m). The W. unit includes about 772 acres (312 ha) and ranges from 1000 to 3280 ft (305-1000 m) in elevation. The two units lie on the middle and lower slopes of the W. and NE. sides of Hennessy Ridge, a prominent ridge that separates the S. Fork and main Trinity rivers. In the E. unit, small streams have deeply dissected these slopes into several draws and gulches with steep N.- and S.-facing slopes. Most slopes are extremely steep (averaging about 75 percent). The W. unit is dissected into four "gulches"; the NW. slopes are extremely steep (80 percent), while the SW. slopes are only moderately steep.

The rock type is upper Jurassic marine sedimentary and metasedimentary rock, consisting of slaty and phyllitic sandstones, shale, and minor conglomerates. Soils are skeletal, often deep, with at least 35 percent of the total volume occupied by rock fragments. The surface is typically covered with loose stones, and slumps and slope failures up to 500 ft (152 m) long are common along the gulches. Precipitation averages 55 inches (1397 mm) annually, with most occurring from November to March. January mean minimum temperature is 32 °F (0 °C), and July maximum is about 90 °F (32 °C).

Association Types

On the basis of 77 releves sampled, the forests are divided into three association types distinguished by the dominant reproducing hardwood tree species and characteristic shrubs.

Douglas-Fir-Tanoak-Poison Oak Association (81100, 81400, 82420): 1141 acres (462 ha). This forest is located on mesic sites, but also occurs on steep slopes with high surface rock cover. Typical stands have a broken canopy of old-growth Douglas-fir with occasional sugar pine, lying over a solid canopy of mixed evergreen hardwoods with a few Douglas-fir and sugar pine of mixed ages. The mid-canopy is dominated by tanoak with variable madrone and canyon live oak.



Figure 82—Hennessy Ridge, all-aged stand of Douglas-fir and tanoak with large madrone and seedlings of tanoak and Douglas-fir occurring in clumps; Douglas-fir – tanoak – poison oak type. (D. Thornburgh, 1987)

Tanoaks range from seedlings to 70 inches (1.78 m) dbh. There is a fair amount of stand variability: some areas are dominated by young stands of Douglas-fir, others by large old tanoak and madrones, still others by large, old-growth Douglas-fir that makes up 70 percent canopy cover, some with higher dominance of ponderosa pine, and others with an equal mixture of young Douglas-fir and tanoak. Understory shrubs and herbs are poorly represented, with poison oak (*Toxicodendron diversilobum*) and *Whipplea modesta* most important.

Douglas-Fir-Canyon Live Oak (81100, 82420): 521 acres (211 ha). This forest is characterized by a two-story canopy with old-growth Douglas-fir forming a broken canopy up to 200 ft (61 m) high while the evergreen hardwoods form a lower continuous canopy up to 120 ft (37 m) high. This type occurs on the warmer, drier sites, on low-elevation S. exposures, and on steep rocky slopes. The stands are dominated by large Douglas-firs with occasional sugar or ponderosa pines. The subcanopy is usually dominated by canyon live oak; this species also dominates the seedling layer. Canyon live oak may be the only hardwood in some stands; in others, canyon live oak and tanoak may be more evenly mixed. Other species of the subcanopy are occasional pole-sized Douglas-fir, sugar pine, and ponderosa pine (*Pinus ponderosa*). The major species are typically all-sized and all-aged. Herbaceous ground cover is low and in some stands almost nonexistent. This type is considered to be among the most xeric of the Douglas-fir-hardwood associations in the Klamath Mountains ecological section.

Douglas-Fir-Tanoak-Oregon Grape Association (82420): 118 acres (48 ha). This is the most mesic of the three associations, occurring on the highest elevations on N.- and NE.-facing slopes. Typical stands have an upper old-growth Douglas-fir canopy over a mid-canopy of all-aged tanoak with a few Douglas-firs. The upper Douglas-fir canopy is usually denser than the upper canopy of the average stand in the Douglas-fir-tanoak-poison oak association. The understory in these stands is almost nonexistent, with only a very few Oregon grape (*Berberis nervosa*) shrubs and clumps of sword fern occurring on the forest floor. *Chimaphila menziesii*, *Vancouveria hexandra*, and *Whipplea modesta* are the most common herbs, with a total cover of less than 2 percent.

Riparian (61510): Small patches and narrow stringers of riparian vegetation dominated by white alder (*Alnus rhombifolia*), *Acer circinatum*, *Woodwardia fimbriata*, *Adiantum pedatum*, and *Oxalis oregana* occur along the six small streams in the area.

Plant Diversity

Seventy taxa are listed.

Conflicting Impacts

Several recent nonnatural disturbances occurred in the area. These include installations of plastic water pipes (running from some of the creeks on the E. unit of the area to the town of Hawkins Bar), two old water ditches (in the lower portion of the E. unit), one old water ditch (in the W. unit), a county road (bisecting the W. unit), and a series of clear-cuts which lie above both units. The clear-cut blocks were logged between 1958 and 1977 and have been planted with ponderosa pine or Douglas-fir. A small, 15-acre (6-ha) clear-cut, harvested in 1957, lies within the E. boundary.

40. Highland Lakes (Nachlinger 1988a)

Location

This area has been dropped from consideration as an RNA. It is on the Stanislaus National Forest, Alpine County, and lies adjacent to the Carson Iceberg Wilderness, 5.5 miles (9 km) S. of Ebbetts Pass, 17 miles (27 km) NW. of Sonora Pass in the Calaveras Ranger District. The survey area is included in sects. 4 and 5 of T7N, R20E and sects. 32 and 33 of T8N, R20E MDM (38°29'N., 119°48'W.), USGS Dardanelles Cones quad (fig. 83). Ecological subsection – Glaciated Batholith and Volcanic Flows (M261Ek).

Target Element

Mountain Hemlock (*Tsuga mertensiana*) Forest

Distinctive Features

Mountain hemlock forests are present here in diverse stand sizes and age structures. Stands range from open, old-growth populations in stable habitats to dense successional stands in unstable habitats.

In addition to mountain hemlock, the area contains distinctive examples of central Sierran subalpine landscapes with diverse topographic and geologic features (subalpine tarns), a species-rich flora, and diversity of plant communities (including shrublands, meadows, and fell-fields) (fig. 84).

Physical Characteristics

The area covers 440 acres (178 ha) with an elevation of 8700-9235 ft (2650-2815 m). The most common slope directions are NW., N., and NE.

NE. of Hiram Peak, at the headwaters of Arnot Creek, are several small cirque lakes caused by glacier erosion. Subalpine tarns are present below Hiram Peak. The area includes the headwaters of two Sierran river systems; the larger Highland Lake flows to the N. Fork of the Mokelumne River, and the smaller Highland Lake flows to the N. Fork of the Stanislaus River.

Tertiary pyroclastic volcanics and mudflow deposits are present throughout the area. Highland Peak (just N. of the survey area) is a good example of a rhyolitic dome and cinder cone. Some pre-Tertiary granitic rocks are present W. of the immediate survey area.

No comprehensive soil survey has been conducted for this area, but soils in adjacent areas have been described as: 1) Cindery Typic Cryadepts (moderately deep, cobbly, coarse sandy loams), found on strongly sloping to steep slopes that support subalpine forest and scrub vegetation, and 2) unclassified incipient "soils" of rock outcrops, talus, and scree slopes derived from slightly weathered volcanoes.

No permanent weather station exists in the survey area. Climate data are estimated from the nearest climate station at Twin Lakes, about 20 miles (32 km) N. and 900 ft (275 m) lower than the Highland Lakes area. Mean annual temperature and precipitation are estimated as 38 °F (3.3 °C) and 89 inches (2265 mm), respectively, for the Highland Lakes area.

Association Types

Two representative mountain hemlock stands were sampled using a randomly positioned, 100-meter-long transect line with 10- by 10-m plots placed along random sides of the transect.

Whitebark Pine-Mountain Hemlock Forest (86210): 225 acres (103 ha). Most of the survey area is dominated by relatively pure stands of mountain hemlock

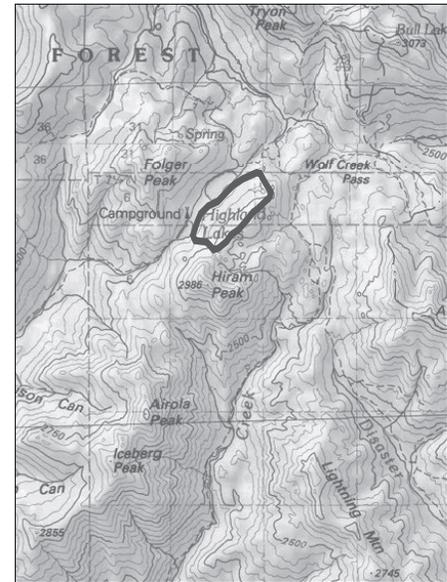


Figure 83—Highland Lakes ecological survey area

forest. The area is well-suited for supporting mountain hemlock due to the abundance of moderately steep to steep, N.-trending slopes that accumulate large snow packs and retain moisture late into the growing season.

Hemlock stands found on gentle, protected slopes are open, old-growth forests of well-spaced individuals, with *Evernia* spp. growing on tree trunks and downed wood scattered on the forest floor. Tree density in these mature stands is 400 stems/ha, and basal area is 104 m²/ha. Younger stands have a tree density of 6100 stems/ha, and a basal area of 61 m²/ha. Steeper slopes support stands of tightly clumped trees, often asymmetrically swollen at the bases, with broken limbs and ground layering, characteristics indicative of very deep, heavy snowpacks and snow creep.

Other conifers commonly present in these forests are *Abies magnifica* (at the lowest elevations), *Pinus albicaulis*, *P. monticola*, and *P. contorta* var. *murrayana*. Understory cover is depauperate. Common plants found in association with mountain hemlock forests are *Arabis platysperma* var. *howellii*, *Carex rossii*, *Chrysopsis*



Figure 84—Highland Lakes, a wet subalpine meadow at 9105 ft (2775 m) on the upper bench of Arnot Creek in the Highland Lakes study area. The lowest vegetation cover is composed of tufted graminoids while the taller shrub is *Salix eastwoodiae*. Surrounding forest vegetation is whitebark pine-mountain hemlock. (1987)

breweri, *Juncus parryi*, *Ligusticum grayi*, *Lupinus lyallii*, *Luzula divaricata*, *Phyllodoce breweri*, and *Ribes montigenum*.

Wet Subalpine Meadow (45210): Approximately 62 acres (25 ha). This association type is found on gentle slopes and flats throughout the survey area and is surrounded by subalpine vegetation (whitebark pine-mountain hemlock forest vegetation). Herbaceous perennials and woody shrubs (shrubby thickets dominated by *Salix eastwoodiae* are common) develop 100 percent cover. Common herbaceous species found in subalpine meadows include *Aster alpigenus* ssp. *andersonii*, *Calamagrostis breweri*, *Carex scopulorum*, *Castilleja miniata*, *Dodecatheon alpinum* ssp. *majus*, *Gentiana newberryi*, *Juncus mertensianus*, *Kalmia polifolia* var. *microphylla*, *Luzula comosa*, *Mimulus primuloides*, *Phleum alpinum*, *Phyllodoce breweri*, *Potentilla flabellifolia*, *Scirpus criniger*, *Senecio triangularis*, *Veratrum californicum*, and *Vaccinium nivoictum*.

Sierra Nevada Fell-Field (91120): With alpine talus and scree slopes (91200), this type covers 124 acres (50 ha). This association occurs at the highest elevations along principal ridgelines and between whitebark pine-mountain hemlock stands near treeline. Plants are low and rock-hugging, as is characteristic of plant physiognomy in fell-fields, although slightly taller plants occur on more protected sites. Common species in this community include *Antennaria media* var. *media*, *Carex spectabilis*, *Haplopappus acaulis*, *Leptodactylon pungens* ssp. *pulchriflorum*, *Linum perenne* ssp. *lewisii*, *Phoeniculis cheiranthoides*, *Primula suffrutescens*, and *Silene sargentii*.

Alpine Talus and Scree Slope (91200): With Sierra Nevada fell-field (91120), this type covers 124 acres (50 ha). This is a minor plant community in the survey area, developed on the slopes of Hiram Peak. Common species found in these areas are *Arenaria kingii* var. *glabrescens*, *Carex spectabilis*, *Eriogonum incanum*, *Haplopappus suffruticosus*, *Phlox diffusa*, *Polygonum davisiae*, *P. shastense*, and *Stipa californica*.

Dry Subalpine Meadow (45220): This association is a minor community type found at the edges of subalpine forest. The vegetation is low and fairly open. It consists of *Achillea lanulosa* ssp. *alpicola*, *Antennaria alpina* var. *media*, *Calyptridium umbellatum*, *Carex exserta*, *Erigeron peregrinus* ssp. *callianthemus*, *Juncus parryi*, *Lewisia nevadensis*, *Penstemon heterodoxus*, *Saxifraga aprica*, and *Trisetum spicatum*.

Plant Diversity

A list of 200 plant taxa that have a high probability of occurrence within the study area is included in the Nachlinger surveys (1988a, 1988b).

Conflicting Impacts

The Pacific Crest Trail skirts the main Sierra Nevada crestline E. of the area, with heavy hiker use on this trail. A well-graded dirt road exists to Highland Lakes. Heavy summer overnight camping in both the upper basin and the established campground between the two Highland Lakes appears to pose little impact on the area outside of the lake and stream areas.

Cattle grazing occurs around Highland Lakes and on higher open slopes adjacent to the mountain hemlock stands. Additional evidence of grazing is present throughout the area (including at the subalpine tarns), except within the densest forest stands.

41. Home Camp Creek (Jensen 1992)

Location

This proposed RNA is on the Sierra National Forest in Fresno County, approximately 50 miles (81 km) NE. of Fresno and directly NW. of the W. end of Huntington Lake. The survey area includes all or a portion of sections 3, 4, 5, 8, 9, 10, 16, and 17 of T8S, R25E MDM (37°15'N., 119°15'W.), USGS Musick Mountain, Huntington Lake, Kaiser Peak, and Mammoth Pool Dam quads (fig. 85). It lies within the Kaiser Wilderness of the Pineridge Ranger District. Ecological subsection – Upper Batholith (M261Eq).

Target Element

Although red fir (*Abies magnifica*) is more abundant than white fir in the pRNA, white fir (*Abies concolor*) has been identified as a target element in the area due to rare later-seral white fir populations.

Distinctive Features

The white fir stand in this pRNA seems to be a localized climax species and ranges from seedlings to trees more than 100 years old. Red fir and white fir ecotones are present at several places in the E. portion of the pRNA and would serve as important research sites.

In addition to the white fir and red fir locales, an array of different environments is found within the pRNA. These include wet meadows, dry ridges, and rocky outcrops, all within a range of slope gradients.

Rare Vertebrates: The pRNA is a wintering area for the California spotted owl (*Strix occidentalis*). The great gray owl (*Strix nebulosa*), a State-listed endangered bird, and the wolverine (*Gulo gulo*), a State-listed threatened species, occur in the pRNA. Sensitive species that may occur in the pRNA include the northern goshawk (*Accipiter gentilis*) (California species of special concern, Forest Service-listed sensitive species) and the marten (*Martes pennanti*).

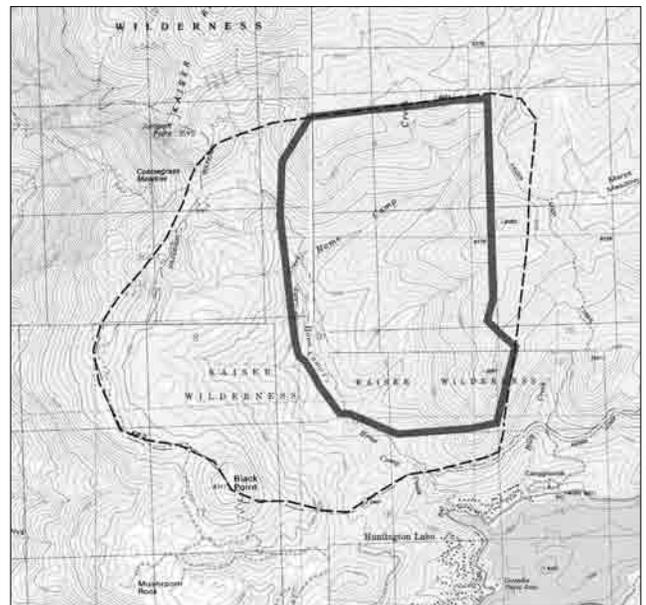


Figure 85—Home Camp Creek pRNA

Dashed line = Ecological study area;
Solid gray line = RNA Boundary

Rare Plants: One small population of *Hulsea brevifolia* (CNPS list 4) occurs in the red fir forest above Home Camp Creek.

Fire History: The most recent fire (the Lake Fire) occurred in 1988 and was allowed to burn. This slow-burning ground fire covered approximately 175-200 acres (71-81 ha) and consumed several large trees. Many small white firs in section 4 were killed on the S.-facing slope above Home Camp Creek. However, most of the large white firs were spared. Additionally, old fire scars are found on some larger red firs, indicating a fire previous to 1988.

Physical Characteristics

The area covers 2450 acres (980 ha). Only about half of the survey area, 1200 acres (486 ha), is proposed as an RNA in the Forest Plan. The lower portion is composed of gentle to moderate forested slopes, while the upper portions consist of steeper slopes and rocky outcrops. Elevations range from 7200 to 8100 ft (2194-2469 m). The area is nearly encircled by ridgelines that define the watershed. The pRNA encompasses the lower two-thirds of Home Camp Creek (San Joaquin River drainage), which flows into Huntington Lake on the S.

The rocks of the pRNA are quartz diorite of the Kaiser Peak Pluton, which is one of the oldest formations in the Huntington Lake area. A Tertiary trachybasalt intrusion (Black Point) occurs at the S. boundary of the area and is one of four volcanic peaks in the Huntington Lake area. The pRNA is characterized by cold, young soils with coarse texture and high leach rates due to the granitic parent materials. Low to moderate slopes in the lower elevations (7000-8300 ft [2120-2520 m]) of sects. 4 and 9 are composed of a complex of two soils: Typic Cryumbrept and Dystric Cryochrept. Higher elevations (8000-9500 ft [2420-2880 m]) and steeper slopes are made up of a complex of dystric cryochrept and typic cryopsamment (cold, coarse-textured entisol). On even steeper slopes, to the W. of Home Camp Creek, soils are dystric xero- or cryopsamments of the Cagwin family. In the N. part of the pRNA, near Jump Off Point, rock outcrops dominate with lithic xeropsamment.

Figure 86—Home Camp Creek, open, mixed stand of Jeffrey pine, white fir and red fir on ridge which forms western boundary of Home Camp Creek RNA. (1990)



The climate is typical for mid- to high-elevation areas on the W. slope of the central Sierra Nevada. The growing season is short with cold, wet winters and warm, dry summers. Most precipitation falls during winter as snow, and in the high elevations, the snow often persists until June or September. Annual temperatures follow fairly consistent patterns, although year-to-year precipitation varies greatly.

Specific climate information is available only for nearby Huntington Lake, which is lower and, therefore, warmer and drier than the area encompassed by the pRNA. Climate information at the lake is as follows: The average temperature is 34 °F (1.1 °C) in January, and 61 °F (16.1 °C) in July. The average annual minimum temperature is 33 °F (0.6 °C).

Freezing temperatures are possible during any month of the year, particularly from October to May. The average annual precipitation is 34.43 inches (87.45 cm), mostly falling in December through February as snow.

Association Types

Red Fir Forest (85310): 2042 acres (817 ha). This type occurs in a wide array of stand ages, densities, and under various ecological conditions. Most stands are nearly pure red fir, but other conifer species often share the canopy. Red fir intergrades with lodgepole pine (*Pinus murrayana*) forest along wet meadows and riparian areas. Along the dry ridge area of the W. boundary of the pRNA, mixed stands of red fir and white fir occur. Jeffrey Pine (*Pinus jeffreyi*) is present as a minor component along ridgelines and more arid sites (fig. 86). High elevation and rocky sites support western white pine (*Pinus monticola*). At lower elevational limits, white fir (*Abies concolor*) and sugar pine (*Pinus lambertiana*) are found.

Lower elevations and shallower slopes W. of Home Camp Creek contain both even- and uneven-aged stands of high-density (nearly 1000 trees/ha) small red fir (only 2 larger than 1 m dbh). Red fir seedlings comprise the majority of the herbaceous layer here.

In mature red fir forests, white fir comprises 22 percent of the individuals and 30 percent of the basal area. In other areas, white fir makes up 55-62 percent of the individuals in the stand. The density in these larger, matured forests is 136 trees/ha. Sixteen percent of the red fir has a dbh larger than 1 m, while the largest red fir measured in the sample transects is 2.22 m dbh. Basal area in the larger, mature stands is 68.15 m²/ha.

Understory cover is very low throughout this association, never reaching more than 5.85 percent. Characteristic species in the herbaceous layer are seedlings of *Abies magnifica*, *Viola purpurea*, *Pedicularis semibarbata*, and *Collinsia torreyi*.

White Fir Forest (84240): Two areas (located in sections 4 and 9). 128 acres (51.2 ha) total. White fir generally occurs at lower elevations and on more xeric sites than red fir. This association is found on S.-facing slopes at elevations below 8000 ft (2420 m). Section 9, the larger of the two stands, contains some Jeffrey pine and sugar pine. Section 4 contains a narrow band where white fir dominates within a red fir forest.

There is little evidence of significant regeneration (only 14 percent of individuals are in the smallest size class). Most trees are less than 1 m dbh, although one was measured at 1.76 m dbh. The density is 239 trees/ha, and the basal area is 48 m²/ha.

The association is characterized as having an open-stand structure. Understory vegetation is more abundant than in red fir stands. Average shrub cover is 14 percent. Average herb cover is 4 percent. The understory species composition is distinct from that of the red fir forest mostly due to the shrub composition of the white fir forest, of which *Ceanothus leucodermis* and *Chrysolepis sempervirens* are most common.

Lodgepole Pine Forest (86100): This type is found in cool, moist areas around meadow margins and streams (sects. 5 and 16). The stands are mainly even-aged and intergrade with the surrounding red fir forest as the soils become drier. The understory is often composed of *Ledum glandulosum* or dense meadow vegetation.

Western White Pine Forest (Mixed Subalpine Coniferous Forest) (86200): 79 acres (32 ha). Western white pine is restricted to a small area on the rocky outcrops in the SE. quarter of sect. 4. The stand is fairly open, with a significant component of red fir. Shrub species such as *Arctostaphylos nevadensis*, *Chrysolepis sempervirens*, and *Holodiscus microphyllus* are interspersed with herbaceous species such as *Monardella odoratissima*, *Sitanion hystrix*, *Brodiaea lutea*, *Silene montana*, and *Erysimum perenne*.

Montane Meadow (45100): Total acreage for five separate meadow areas is 88 acres (35 ha). This association type is the most floristically rich area in the pRNA. Some of the meadows are bordered by lodgepole pine forest; others are bordered by red fir forest. Common meadow species include: *Carex nebrascensis*, *Danthonia intermedia*, *Deschampsia elongata*, *Aster alpigenus* ssp. *andersonii*, *Hypericum anagaloides*, *Ranunculus alsimaeifolius*, and *Mimulus primuloides*. Narrow stringer meadows exist along streams and include plant species such as *Angelica breweri*, *Castilleja miniata*, *Arnica longifolia*, *Habenaria dilatata*, *H. sparsiflora*, *Mertensia ciliata*, and *Mimulus guttatus*.

Rocky Outcrop (no Holland equivalent): 19 acres (8 ha). No specific data was included in the ecological survey for this association.

Plant Diversity

One hundred fifty-four species of vascular plants are listed.

Conflicting Impacts

Nellie Lake (a popular camping and day-hiking destination) forms the headwaters of Home Camp Creek and is located approximately 0.5 mile (0.8 km) N. of the N. boundary of the pRNA.

The hiking trail along Home Camp Creek receives moderate use from numerous visitors to Huntington Lake, but there appears to be little evidence of adverse impacts resulting from this use. Kaiser Wilderness currently has a quota system to help manage recreational use.

Livestock grazing occurs within the survey area. There is evidence of grazing on some of the higher meadows and signs of cattle use in other forested areas within the pRNA. Continuance of existing grazing permits could conflict with maintaining the natural values of the montane meadows.

42. Horse Meadow (Burke 1992c, Phillips 1998d)

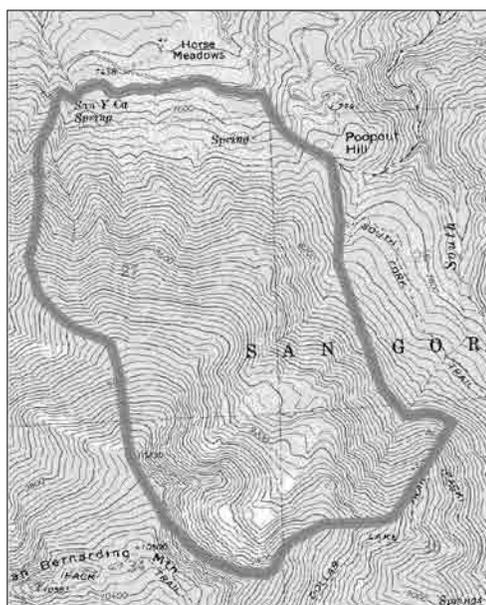


Figure 87—Horse Meadow RNA

Location

This established RNA is on the San Bernardino National Forest in San Bernardino County. It is approximately 21 miles (34 km) S. of Big Bear City, lying just S. of Barton Flats and NW. of San Gorgonio Mountain. It lies entirely within the San Gorgonio Wilderness of the San Gorgonio Ranger District. Its boundaries include portions of sections 22, 26, 27, 34, and 35 of T1N, R1E (34°08'N., 116°52'W.), USGS San Gorgonio Mountain quad (fig. 87). Ecological subsection – Upper San Gorgonio Mountains (M262Bh).

Target Element

White Fir (*Abies concolor*)

Distinctive Features

Much of the RNA consists of very steep, unstable slopes dominated by stands of small, young white fir. The S. California white fir stands in the RNA are more or less homogeneous and are of interest for comparison studies as a southern variation of both red fir and white fir forests.

In addition to the extensive white fir forest, several montane plant communities characteristic of mid- to high- elevation sites in the San Bernardino Mountains occur within the RNA.

Two avalanche chutes dissect the area and contribute to habitat diversity. The geologic instability and occurrence of these vegetated avalanche chutes add value to the area.

Rare Plants: Barton flat horkelia (*Horkelia wilderae*, CNPS List 1B) is present on the NE.-facing dry slopes of the Jeffrey pine-fir forest. Mountain dandelion (*Taraxacum californicum*, CNPS List 1B) is present on wet montane meadows. Heckard's Indian paintbrush (*Castilleja montigena*, CNPS List 4) is typically found in the forest-meadow ecotone. *Lilum parryi* (CNPS List 1B) is also present.

Rare Fauna: The spotted owl (*Strix occidentalis* ssp. *occidentalis*, California species of special concern) occurs along the N. boundary of the RNA. Williamson's sapsucker (*Sphyrapicus thyroideus*) and Lincoln's sparrow (*Melospiza lincolnii*), both of which are not on any protection list, also may occur on the RNA.

Geological: Glacial till deposits (some with unsorted angular fragments of gneiss and quartz monzonite as large as 10 ft [3 m] across) are found in a variety of locations in the RNA.

Fire History: The Ceanothus-Ribes patch at the N. end of the RNA burned in approximately 1959. Three other fires in the SW. quarter of sect. 22 T1N, R1E have been recorded since 1980. However, it is unclear whether these fires were inside the boundaries of the RNA.

A policy of fire suppression in the San Bernardino Mountains has been in place since the early 1900s. It is speculated that some white fir stands in the RNA are unnaturally dense due to this suppression. Additionally, the understory in the Jeffrey pine-fir forests of lower elevation is five times denser than is typical where ground fires are not suppressed.

Physical Characteristics

The area covers 946 acres (378 ha) with elevations 7520 to 10230 ft (2294-3120 m). The RNA lies on the N. and NE.-facing slopes of the ridge between San Gorgonio Mountain and San Bernardino Mountain. Slopes vary from 7° (12 percent) slope at the N. end to 30° (58 percent) slope along the steep terrain of the NE.-facing slopes at the W. boundary.

Several intermittent streams drain Horse Meadow along NE.-facing slopes. Morainal deposits occur on the RNA and affect spring flow.

Most of the RNA is composed of undifferentiated gneissic rocks of Precambrian Age. Near the top of the steep, N.-facing slopes, a small area of quartz monzonite (Mesozoic Age) occurs, which is a small outcropping of the extensive underlying granitic rock. The NE. boundary contains small areas of fanglomerate (mostly gneiss and quartz monzonite derived from pre-Tertiary rocks of adjacent mountains).

Four types of soil exist in the RNA:

1. Morical Hecker families complex occurs on alluvial fans or terraces with 15-30 percent (9-17°) slopes. These soils are brown, gravelly loams with a granular or fine granular structure. Surface soils are only 0-6 inches (0-15 cm) deep, but subsoils are very deep (6-60 inches [15-250 cm]). Jeffrey pine-fir forest is the typical vegetation for this soil type.

2. Merkel-Wapal families complex occurs on 30-50 percent (17-27°) slopes. These soils are light- to dark-brown, very gravelly loams with a weak to fine granular structure. The surface soils are 0-3 inches (0-7.5 cm) deep and the subsoils range from 3 to 27 inches (7.5 to 68 cm). Jeffrey pine-fir forest, southern California white fir forest, and southern California subalpine forest are the typical vegetation types on this soil complex.

3. Wapal family-Lithic Xerorthents, cool association, occurs on 50-75 percent (27-37°) slopes of mountainous uplands. The soil is a light olive brown, very gravelly, sandy loam with up to 80 percent rock fragments. The surface soils are 0-3 inches (0-7.5 cm) and the subsoils are rather shallow, ranging from 3 to 40 inches (7.5-100 cm). White fir forest is the typical vegetation for this soil type.

4. Lithic Xerorthents, cool-Rock outcrop complex, is present in the S. half of the site on 50-100 percent (27-45°) slopes. It is a shallow loam, sandy loam, or loamy sand with a high proportion of rock fragments. Lodgepole pine and Jeffrey pine are usually the dominant trees on this soil type.

Climate in this region typically includes a prolonged summer drought and infrequent winter storms. As winter storms move into S. California, precipitation increases from the W. edge of the mountains to the crest of the range. Located along the main crest of the San Bernardino Mountain Range, the RNA may receive up to 40 inches (100 cm) annual precipitation, much of which falls as snow. The nearest weather station is located at Big Bear Lake, which is at 34°15'N., 116°53'W., 6790 ft (2070 m) elevation. The average temperature ranges from 30 to 65 °F (-1 to 18 °C) with extremes ranging from a winter low of -7 °F (-22 °C) to a summer high of 87 °F (31 °C). High winter snowpack is typical. Elevation of the RNA is higher than that of the Big Bear Lake Weather Station; therefore, lower temperatures and higher precipitation should be expected.



Figure 88—Horse Meadow, in rocky outcrops at the top of the Horse Meadow ridge where tree roots can find stable soils, white firs can attain relatively large sizes. (between 1989 and 1991)

Association Types

Southern California White Fir Forest (85320): 375 acres (150 ha). This association is the most extensive vegetation type on the RNA. It is mostly a young forest occurring on mid- and upper N.- and NE.-facing slopes. White fir (*Abies concolor*) occurs on the RNA as nearly pure stands or in stands where dominance is shared. It is codominant with Jeffrey pine (*Pinus jeffreyi*) on drier, gentler, mid-elevation, NE.-facing slopes. Lodgepole pine (*Pinus contorta* ssp. *murrayana*) and limber pine (*Pinus flexilis*) share up to 50 percent dominance with white fir on steep slopes at high elevations. On these high, steep, unstable slopes, white fir occurs in dense stands of small trees. The trees here often have a pronounced basal crook, most likely due to sliding soils. On more stable soil (around rock outcropping on high, N.-facing slopes), white fir can reach great size (fig. 88).

Tree cover is between 80 and 100 percent, forming a dense, dark forest. White fir often comprises nearly 100 percent of tree cover on true N.-facing slopes. Understory is sparse or absent. Typical associates include *Pedicularis semibarbata*, *Poa fendleriana*, *Penstemon bridgesii*, *Penstemon labrosus*, *Draba corrugata*, and *Pyrola picta*. At lower elevation and drier sites where Jeffrey pine codominates, *Symphoricarpos parishii*, *Eriogonum wrightii* ssp. *subscaposum*, and *Galium* cf. ¹*nuttallii* occur. At higher elevation sites, *Ribes roezlii*, *Phyllodoce breweri*, *Pyrola picta*, *Poa fendleriana*, *Heuchera* ssp., and *Sedum spathulifolium* ssp. *andersonii* occur as associates of white fir, lodgepole pine, and limber pine. *Chrysolepis sempervirens* and *Arctostaphylos patula* ssp. *platyphylla* occur both as occasional understory associates and as a distinct shrubby vegetation type in forest openings.

Mixed Montane Chaparral (37510): 239 acres (96 ha). This association type occurs in two forms — as the more typical forest associate and also as thick, heterogeneous thickets occurring in avalanche chutes of NE.-facing slopes.

The more typical form of the (*Ceanothus cordulatus*-*Ribes cereum*) chaparral occurs at the N. end of the RNA. The rich vegetation present here is an indication that the area may have burned recently. Species include *Artemisia dracuncululus*, *Gayophytum diffusum* ssp. *parviflorum*, *Cryptantha* spp., *Euphorbia palmeri*, *Sitanion hystrix*, *Bromus* cf. *tectorum*, and *Agropyron trachycaulum*.

¹ Specific epithet uncertain, requires comparison with known specimens.

The avalanche chutes are dominated by *Chrysolepis sempervirens*. They reach the high-elevation slopes of the RNA, cutting through the subalpine, white fir, and Jeffrey pine-fir forests. Understories are very sparse, and associate species are few due to the nearly closed canopy.

Southern California Subalpine Forest (86500): 170 acres (67 ha). At higher, drier, and colder sites, white fir grades into S. California subalpine forest. Although this forest type is often a low krummholz (stunted-growth) tree structure in the San Bernardino Mountains, here the trees occur in upright, relatively dense stands. On the high-elevation ridges, lodgepole pine occurs as pure forest or as a codominant with limber pine. Understory is sparse, the slopes are very steep, and the ground is mostly bare except for a pine needle duff. Trees on the rocky ridges are subject to high winter winds.

Associated species include *Chrysolepis sempervirens*, *Carex* spp., *Penstemon caesius*, *Phyllodoce breweri*, *Pyrola picta*, *Pedicularis semibarbata*, and *Silene lemmonii*. In open hollows, where late lying snow provides water into the growing season, dense patches of *Pteridium aquilinum*, *Ribes montigenum* var. *pubescens*, *Aquilegia formosa*, and *Carex* spp. occur.

Jeffrey Pine-Fir Forest (85210): 162 acres (65 ha). This association occurs on the gentler, lower slopes of the RNA and along the S. Fork trail (E. boundary) where it grades upslope into white fir. The forest is tall and open, and the tree layer is codominated by white fir and Jeffrey pine. On the nearly level slopes of the far N. area of the RNA, black oak (*Quercus kelloggii*) is an important component of the vegetation. Tree cover ranges from 50 to 80 percent.

On steeper, drier slopes, associated species include *Symphoricarpos parishii*, *Chrysolepis sempervirens*, *Ceanothus cordulatus*, *Carex* spp., *Penstemon labrosus*, *Euphorbia palmeri*, *Eriogonum wrightii* spp. *subscaposum*, and *Leptodactylon pungens*. Rocky, open areas at low elevations include *Erysimum capitatum*, *Poa fendleriana*, *Penstemon grinnellii* ssp. *grinnellii*, *Sitanion hystrix*, and *Symphoricarpos parishii*. Moister areas contain *Pteridium aquilinum*, *Achillea millefolium*, *Potentilla glandulosa*, *Geranium richardsonii*, *Erigeron breweri*, and *Solanum xantii* ssp. *montanum*. Where black oak is an important dominant or near riparian washes, *Salix scouleriana*, *Ribes cereum*, *Ceanothus cordulatus*, *Gayophytum diffusum* ssp. *parviflorum*, *Castilleja martinii* var. *martinii*, *Delphinium parryi*, *Lotus nevadensis*, *Lupinus formosus*, *Bromus* spp., and *Calochortus invenustus* occur.

Montane Meadow (45100): No acreage given. This association occurs in small patches on saturated soils scattered along waterways in the Jeffrey pine and white fir forests. Slopes are nearly level or gentle (5-15 percent).

Poa palustris and *Carex hoodii* are the most dominant species here. *Salix lasiolepis* and *Salix scouleriana* are among the many associated plants.

Plant Diversity

One hundred twelve species of vascular plants are listed.

Conflicting Impacts

The entire RNA is within the S. Fork camping permit zone. The San Geronio Wilderness is heavily visited by campers and hikers, and its trails border the RNA. The RNA, however, is relatively free from disturbance. The most significant current disturbance is near the N. boundary in the Jeffrey pine-fir forest where there is evidence of illegal firewood gathering in areas of black oak and white fir.

Air pollution from the valley floor is a significant hazard to coniferous species of the area.

Note: for Hosselkus Limestone, see Devil's Rock-Hosselkus, #25

43. Indian Creek (Keeler-Wolf 1986c, 1990d)

Location

This recommended RNA is on the Lassen National Forest, Tehama County. It is about 9 miles (14 km) SE. of Paynes Creek. It occupies portions of sects. 33 and 34 T28N, R1E, sects. 2, 3, 4, 9, 10, 11, 12, 13, 14, and 15 T27N, R1E MDBM (40°13'N., 121°50'W.), USGS Panther Spring and Dewitt Peak quads (fig. 89). Ecological subsection – Tuscan Flows (M261Fa).

Target Element

Blue Oak/Foothill Pine (*Quercus douglasii*/*Pinus sabiniana*)

Distinctive Features

Blue Oak Woodland: Many blue oak stands throughout California are not reproducing as a result of varying effects of livestock browsing, rodent predation, and insect predation. The relatively even size-class representation at Indian Creek is indicative of a healthier population than in several other areas sampled elsewhere in the State (Griffin 1977). Recent reproduction is fairly good, with seedlings and small saplings on 32 percent of the sample points. Four size classes encompassing trees ranging from 2 to 16 inches (5-41 cm) dbh have frequencies greater than 15 percent.

Rare Plants and Range Extensions: *Calycadenia fremontii* and *Fritillaria eastwoodiae* (*phaenothera*) are members of CNPS List 3. The following species are on List 4 of CNPS: *Mimulus glaucescens*, *Astragalus pauperculus*, *Navarretia subuligera*, and *Polygonum bidwelliae*. A number of species were found N. of their listed ranges in Munz (1968). These include *Dyckia cymosa*, *Clarkia arcu-*

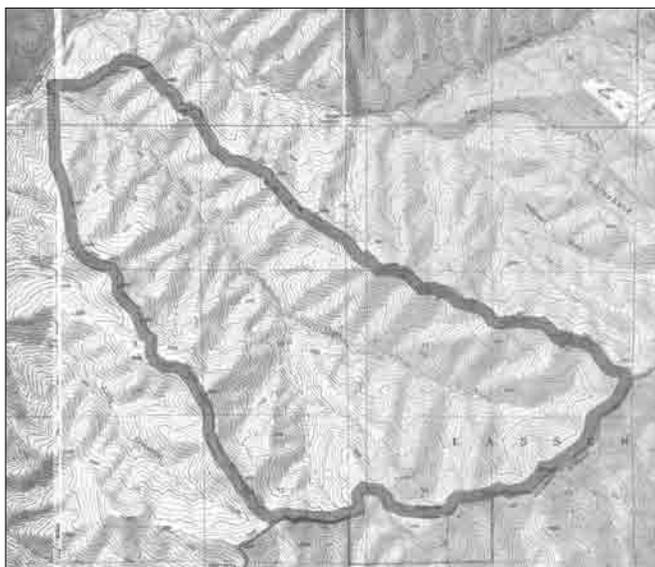


Figure 89—Indian Creek rRNA

ata, *Centaurium floribundum*, *Parvoisedum pumilum*, *Fritillaria eastwoodiae* (*phaenothera*), *Filago californica*, *Polygonum bolanderi*, *Layia platyglossa* ssp. *campestris*, *Polypodium californicum*, *Limnanthes alba*, *Melica torreyana*, *Githopsis pulchella*, and *Navarretia prolifera*. Two species (*Symphoricarpos mollis*, *Lomatium californicum*) are typically N. Coast Ranges species, not reported from the Cascade Range of California.

Riparian and Stream Biota: For a relatively small stream, Indian Creek contains a diverse mixture of plants and animals associated with it. Large populations of rainbow trout (*Salmo gairdneri*) and other fish as well as western pond turtles (*Clemmys marmorata*), California newts (*Taricha torosa*), aquatic garter snakes (*Thamnophis couchii*), and many species of aquatic invertebrates are associated with the stream. The riparian vegetation is well-developed and shows little evidence of human disturbance.

Physical Characteristics

The rRNA covers about 3900 acres (1578 ha) and includes nearly all of the Indian Creek drainage. Indian Creek is a small permanent tributary to Antelope Creek. The basin is about 1.5 miles wide, 4 miles long (2.4 km by 6.4 km). Elevations are 1320-3131 ft (402-954 m). The drainage is oriented NW.-SE. with Indian Creek flowing NW. Predominant exposures are SW. and NE. Slopes are variable, from gentle atop the ridges to moderate in the majority of the drainage and steep on many small escarpments.

Rocks are late Pliocene volcanic breccias (Tuscan formation), deposited in horizontal layers of varying resistance. The vegetation often conforms to these layers, showing up as distinct bands along the slopes. Soils are largely Toomes and Supan series. The latter series is deeper and supports denser oak woodland than the former, which is shallow and rocky, dominated by grassland and scrub.

Association Types

Twenty-two random points (point center-quarter method) were sampled in the blue oak woodland. The remainder of the vegetation is qualitatively described.

Live Oak Woodland-Scrub (37110, 37900, 37A00, 71150, 71322, 81330): 1265 acres (512 ha). This is a dense sclerophyll vegetation intermediate between woodland and chaparral. It is most extensive on NE.-facing slopes, but also occurs on sheltered W.- and SW.-facing slopes on rocky soil. Interior live oaks (*Quercus wislizenii*) dominate typically as shrubby, multi-stemmed individuals. Other woody species include California buckeye (*Aesculus californica*), *Rhamnus crocea*, *R. californica*, *Juniperus californica*, *Ceanothus cuneatus*, *Toxicodendron diversilobum*, *Cercocarpus betuloides*, *Cercis occidentalis*, *Arctostaphylos manzanita*, *Lonicera interrupta*, and scrubby canyon live oak (*Quercus chrysolepis*).

Foothill pine is unevenly distributed, tending to be most common on lower SW.-facing slopes. Beneath the scattered emergent foothill pines, the shrub layer is variable with some species (e.g., *Fraxinus dipetala* and *Cercocarpus betuloides*) attaining 13-20 ft (4-6 m). Herbs are uncommon.

At higher elevations and on more sheltered slopes, *Quercus dumosa* tends to replace interior live oak. Other species such as *Fraxinus dipetala*, *Rhus trilobata*, *Ceanothus integriramus*, *Fremontodendron californicum*, and *Ptelea crenulata* become more important. *Eriodictyon californicum* may be common in rocky areas. These sites resemble Holland's northern mixed chaparral and scrub oak chaparral (37110, 37900).

Ceanothus Scrub (37810): 945 acres (382 ha). This association occurs on NE.-, E.-, and S.-facing slopes. Dominated by one species, *Ceanothus cuneatus*, the scrub is relatively open and appears senescent, with no evidence of fire for the past 50-75 years. The shrubs are more widely spaced than in most *Ceanothus* chaparral. This scrub frequently surrounds areas of grassland, and has small grassy openings between the shrubs.

Grassland (42110, 42200, 45400): 875 acres (354 ha). Dominants of this grassland do not change appreciably with varying slope exposure and include *Bromus mollis*, *B. diandrus*, *Avena barbata*, and *Erodium cicutarium*, all introduced. Many native herbs also occur. These subordinates do tend to vary more in composition as a result of slope. Those species characteristic of SW.-facing slopes include *Orthocarpus lithospermoides*, *O. attenuatus*, *Clarkia arcuata*, *Astragalus pauperculus*, *Filago californica*, *Lupinus vallicola*, *Linanthus ciliatus*, *Trifolium microcephalum*, *T. ciliolatum*, *T. tridentatum*, *Lotus humistratus*, *Vulpia (Festuca) myuros*, *Dichelostemma multiflorum*, and *Centaurium floribundum*.

Native species on more sheltered NE.-facing slopes include *Lotus denticulatus*, *Linanthus dichotomus* ssp. *meridianus*, *Vulpia (Festuca) microstachys*, *Sanicula tuberosa*, *Trifolium depauperatum*, *Dichelostemma pulchella*, *Allium amplexans*, *Draba verna*, and *Platystemon californicus*.



Figure 90—Indian Creek,
blue oak woodland on
SW-facing slopes of lower
Indian Creek watershed.
(1986)

In very rocky soils where rocks cover more surface area than vegetation does, the grassland changes in character and becomes dominated by such species as *Selaginella hansenii*, *Dudleya cymosa*, *Lasthenia chrysostoma*, *Erodium cicutarium*, *Phacelia egeana*, *Tunica prolifera*, *Parvisedum pumilum*, *Polygonum bolanderi*, *P. bidwelliae*, *Tillaea erecta*, *Triteleia (Brodiaea) hyacinthina* var. *greenei*, *Gilia tricolor*, *Arenaria douglasii*, *Chorizanthe stellulata*, *C. polygonoides*, *Githopsis pulchella*, and *Navarretia prolifera*.

The annual grassland also contains small springy areas with several characteristic species. These include *Mimulus glaucescens*, *Trifolium varigatum*, *T. cyathiferum*, *Limnanthes alba*, *Briza minor*, *Hypericum anagalloides*, *Scutellaria austinae*, *Boisduvalia stricta*, *Juncus bufonius*, *Sisyrinchium bellum*, and *Epilobium* sp.

Blue Oak Woodland/Savanna (71140, 71410): 485 acres (196 ha). This association occurs largely on S.- and SW.-facing slopes. Blue oak is the most important species, averaging 128 stems/ha with a relative density of 80 percent. Basal area cover for blue oak averages 8.3 m²/ha. Other species on the plots, in order of importance, include canyon live oak, *Rhamnus crocea*, *Rhamnus californica*, foothill pine, and *Juniperus californica*. Interior live oak also occurs in rocky areas. Areas on shallow soil tend to be more open savanna; on deep Supan soil they are a woodland (>100 stems/ha) (fig. 90).

The understory of typical woodland is dominated by herbs and grasses (more than 50 species noted) with only scattered shrubs of *Ceanothus cuneatus*, *Rhamnus californica*, *R. crocea*, and *Toxicodendron diversilobum*. The shrubs are characteristic of rocky areas. Herbs and grasses include *Bromus mollis*, *Avena barbata*, *Erodium botrys*, *Tunica prolifera*, *Trifolium microcephalum*, and *T. ciliolatum*. Several native perennial grasses occur; the most common are *Stipa lemmonii* and *Poa scabrella*. Saplings and seedlings of blue oak are fairly common.

Deciduous Oak Woodland/Scrub (71120, 37541): 147 acres (60 ha). At higher elevations on NE.-facing slopes, small California black oaks (*Quercus kelloggii*) and dense thickets of Brewer oak (*Quercus garryana* var. *breweri*) occur. These deciduous species tend to occur adjacent to one another under similar ecological conditions. California black oak forms islands of 30- to 50-ft (9- to 15-m) tall stands surrounded by low scrubby (10 ft, 3 m) Brewer oak. Brewer oak covers a larger area than California black oak.

There are occasional small shrubs of *Ribes roezlii* and *Berberis dictyota* and a moderate cover of herbs and grasses including *Agoseris grandiflora*, *Crepis monticola*, *Senecio integerrimus*, *Calochortus monophyllus*, *Bromus marginatus*, *Cynoglossum grande*, *Lithophragma bolanderi*, and *Delphinium nudicaule*.

This association occurs on rocky, well-drained soil and is often bordered by open *Ceanothus* scrub. The deciduous oak woodland is analogous to the live oak woodland scrub at slightly higher and more mesic sites.

Canyon Bottom Woodland (81320): 147 acres (60 ha). Canyon live oak dominates the mesic canyon bottoms in the area. The dominants may be large, up to 3 ft dbh (1 m) and 70 ft (21 m) tall. The canyon live oaks coexist with smaller numbers of valley oak (*Quercus lobata*), California black oak, bigleaf maple (*Acer macrophyllum*), California bay (*Umbellularia californica*), and isolated individuals of ponderosa pine (*Pinus ponderosa*) and incense-cedar (*Libocedrus decurrens*).

The overall dominant understory species are *Toxicodendron diversilobum* and *Symphoricarpos mollis*. However, other mesophilic species occur, including *Philadelphus lewisii*, *Aristolochia californica*, *Asarum hartwegii*, *Saxifraga californica*, *Erythronium multiscapoideum*, *Trientalis latifolia*, *Adiantum jordanii*, *Dryopteris arguta*, *Polypodium californicum*, *Dicentra formosa*, *Melica torreyana*, *Osmorhiza chilensis*, *Galium aparine*, *Aquilegia formosa*, *Potentilla glandulosa*, *Heuchera micrantha*, *Lomatium californicum*, and *Hydrophyllum occidentale*.

Riparian Woodland (61510): 36 acres (15 ha). This association occurs along the perennially flowing part of Indian Creek in the lower half of the drainage. It is dominated by white alder (*Alnus rhombifolia*). Stem density is high along this creek, and there are several areas where an uninterrupted arching canopy of the dominant species covers several hundred meters of creekbed. Typical dominant white alders are 12-14 inches (31-36 cm) dbh and 50-70 ft (15-21 m) tall. Also occurring are occasional individuals of Fremont cottonwood (*Populus fremontii*), California sycamore (*Platanus racemosa*), bigleaf maple, and *Salix laevigata*. These species may attain large girth, up to 37 inches (94 cm) dbh in California sycamore.

Vitis californica is a common liana, and other common woody understory species include *Calycanthus occidentalis*, *Cornus glabrata*, *Clematis ligusticifolia*, *Philadelphus lewisii*, *Symphoricarpos rivularis*, *Rubus ursinus*, and *R. leucodermis*. Herbaceous species include *Carex senta*, *Erigeron philadelphicus*, *Mimulus cardinalis*, *Peltiphyllum peltatum*, *Artemisia douglasiana*, *Woodwardia fimbriatum*, and *Adiantum pedatum*.

Plant Diversity

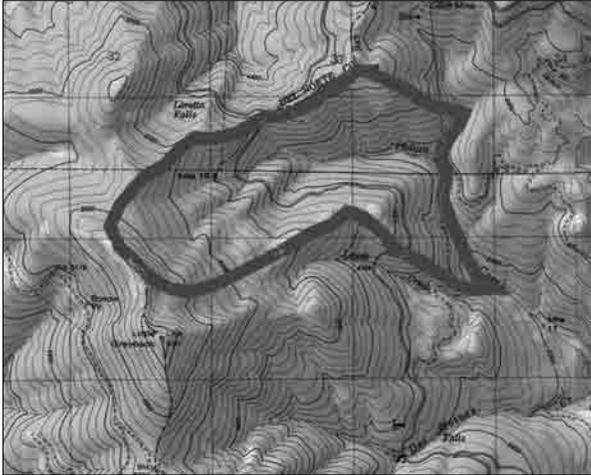
Two hundred twenty-nine taxa are listed in the establishment record, an updated version of the list in the ecological survey.

Conflicting Impacts

Cattle grazing has had some negative impact by increasing browsing pressure on trees and reproduction of blue oak and also by trampling and eroding stream banks and hillsides. A network of fences occurs throughout much of the area. These are in various states of repair but may serve to act as exclosures for cattle once the area is established.

44. Indian Creek Brewer Spruce (Sawyer and others 1978)

Figure 91—Indian Creek Brewer Spruce Special Interest Area



Location

Dropped from RNA consideration, the site was designated a Special Interest Area by the Klamath National Forest. It is in Siskiyou County approximately 15 miles (24 km) NW. of Happy Camp. It lies less than 0.5 miles (0.8 km) S. of the Oregon border. The area occupies portions of sections 32 and 33 T19N, R6E and sects. 4 and 5 T18N, R6E HBM (41°59'N., 123°31'W.), USGS Polar Bear Mtn. quad (fig. 91). Ecological subsection – Lower Salmon Mountains (M261Af) and Red Butte (M261An).

Target Element

Brewer Spruce (*Picea breweriana*)

Distinctive Features

Dominant Brewer Spruce: This area was rated as one of the best stands of Brewer spruce in the Klamath Region by the authors of the ecological survey (fig. 92). Particularly notable is the large area of dominance by this unique Klamath Mountains endemic.

Accessibility of Brewer Spruce Stands: Many Brewer spruce stands are relatively isolated and thus difficult to study. The proximity of this stand to a major paved Forest Service road (Happy Camp-O'Brian road) facilitates access and study.

Variability in Successional State: The recent cutting at the S. end of the area adds some variability to the vegetation, providing different conditions in which to study Brewer spruce regeneration from the adjacent forest stands.

Rare Plant Taxa: Three CNPS rare plants have been identified from the area. These are *Bensoniella oregona* (List 1B), *Pedicularis howellii* (List 4), and *Vaccinium coccinium* (List 3). The *Vaccinium* is a major component of the understory of the mesic phase forest.

Physical Characteristics

The area covers about 500 acres (202 ha) of the upper headwaters of Indian Creek, a major SE.-flowing tributary of the Klamath River. Elevations are from 3500 to 5700 ft (1067-1737 m). Slopes are largely NE.- and S.-facing with N.- and E.-facing slopes also well-represented. Slopes range from moderate to steep. Rocks are pre-Cretaceous metasediments. Soils show moderate development and appear to be internally well-drained. Precipitation at the site averages 70-80 inches (1778-2032 mm) annually (Rantz 1972). January mean minimum temperatures are on the order of 20 °F (-7 °C); July maximum temperatures are about 87 °F (31 °C).

Association Types

Twenty releves and 30 points (point-centered quarter method) were chosen to sample the only forest described from the area. Acreages are not given for the associations.

Brewer Spruce/*Quercus sadleriana* (85410, 85310): This association is placed in the red fir (*Abies magnifica*) zone of the W. Klamath Region (Sawyer and Thornburgh 1977). It can be classified as representing the Brewer spruce/*Quercus sadleriana* type. Two phases occur locally: a mesic *Achlys triphylla* phase and a more xeric *Arctostaphylos patula* phase. Only minor differences exist between samples in these phases.

The mid-slope *Achlys triphylla* phase has a relatively high diversity of understory herbs and shrubs (19 shrub and 21 herb species indicated). Both mid-slope and upper-slope phases are dominated by Brewer spruce and white fir (*Abies concolor*). Secondary associates are noble fir (*Abies procera*), Douglas-fir (*Pseudotsuga menziesii*), and sugar pine (*Pinus lambertiana*). Tree reproduction is mainly spruce and white fir. Of the understory species, *Vaccinium coccinium*, *Quercus sadleriana*, *Pyrola secunda*, *Chimaphila umbellata*, *Achlys triphylla*, *Rubus lasiococcus*, *Linnaea borealis*, *Clintonia uniflora*, and *Nothochelone (Penstemon) nemorosa* are among the most conspicuous in the mesic *Achlys* phase.

In the more xeric upper-slope, or *Arctostaphylos patula* phase, 14 shrub and 13 herb species are listed from the relevés. *Quercus sadleriana*, *Arctostaphylos patula*, *Vaccinium coccinium*, *Chimaphila umbellata*, *Pyrola secunda*, and *Pyrola picta* are among the most important species. Brewer spruce loses its dominance to white fir in this phase of the forest.

Stand analysis was made largely from the mesic *Achlys* phase. Tree densities are 219/ha, with white fir represented by 72 and Brewer spruce by 87 trees/ha. Douglas-fir dominates in basal area (14.2 m²/ha), followed by spruce (12.7 m²/ha) and white fir (5.3 m²/ha). The relatively low density and basal area values (see Rock Creek Butte cRNA) for the forest reflect the open nature of the stand. Growth rates were sampled from several cored trees of the major species. Brewer spruce has a mean radial growth of 0.12 cm/year (n=10), whereas that of white fir was 0.17 cm/year (n=7).

Rock Outcrops (no Holland equivalent): Small areas on the upper slopes near ridges are dominated with a sparse cover of rupicolous species such as *Quercus garryana* var. *breweri*, *Arctostaphylos nevadensis*, *Amelanchier alnifolia*, *Penstemon newberryi* ssp. *berryi*, and *Sedum obtusatum*.

Successional Montane Chaparral (37510): An old clear-cut block dominated by successional montane chaparral is located S. of the main Brewer spruce area. Brewer spruce seedlings are scattered among the shrubs of *Arctostaphylos patula* and *Quercus sadleriana*. *Penstemon anguineus*, *Nothochelone nemorosa*, and *Chimaphila umbellata* are also common here.

Plant Diversity

Ninety-nine taxa of vascular plants are listed.

Conflicting Impacts

The main stand of Brewer spruce is bisected by the Happy Camp-O'Brian road. The area has been dropped as a candidate RNA because of its relatively small size and the presence of a major road within the Brewer spruce stand. It is designated as a Special Interest Area because of its superior representation of Brewer spruce.



Figure 92—Indian Creek Brewer Spruce, Brewer spruce and noble fir at edge of Sadler oak-dominated chaparral. (L. Johnson, 1976)

45. Indiana Summit (Taylor 1980)

Location

This established RNA is on the Inyo National Forest in Mono County, about 8.5 miles (13.7 km) E. of June Lake. It includes portions of sects. 5, 6, 7, and 8 of T2S, R28E MDBM (37°49'N., 118 °55'W.), USGS Crestview quad (fig. 93). Ecological subsection – Glass Mountain (341DI).



Figure 93—Indiana Summit RNA

Target Element

Jeffrey Pine (*Pinus jeffreyi*)

Distinctive Features

Extensive Virgin Jeffrey Pine Forest: The Jeffrey pine forest at Indiana Summit is part of a large tract of essentially pure Jeffrey pine forest stretching from the E. flank of the Sierra Nevada across the divide between the Mono Basin and Owens River drainage. Much of this forest has been harvested for timber, and the RNA preserves a rare pristine example.

First California RNA: The Indiana Summit RNA was the first RNA established in California (1932). It is cited as an example of a coniferous forest ecosystem in widely-used

textbooks on ecology (Whittaker 1975) and also by the American Museum of Natural History, which has a diorama based on Indiana Summit.

Fire History: Fire is important in shaping the Jeffrey pine forest. A fire recurrence interval of about 15 years is verifiable in cut stumps adjacent to the RNA. No fires have occurred recently. Canopy structure indicates only ground fires in the past. Natural fires were apparently light and patchy. Reproduction of Jeffrey pine is also patchy, and the scales of fuel density and reproduction patches overlap, suggesting successful Jeffrey pine reproduction may depend on fire. Jeffrey pine reproduction, especially in the white fir (*Abies concolor*) forest, appears to be tied strongly to fire, with this species excluded from these sites if succession proceeds without disturbance. Crown fire potential has likely increased on adjacent lands due to increased stocking rates and lower canopies. Because of the xeric nature of the forest, brush densities following fires are low and do not alter stand regeneration times.

Rare and Endemic Plants: *Lupinus duranii*, a member of CNPS List 4, is a conspicuous member of the open Jeffrey pine forest and pumice-flat area. *Artemisia cana* ssp. *bolanderi* is endemic to the Mono Basin, but not considered rare by CNPS.

Archeological Value: The Paiute Indians harvested larvae of piagi (Pandora moth [*Coloradia pandora*]), which cyclically attack Jeffrey pine, by digging trenches encircling the trunks of mature trees. These piagi trenches may still be seen surrounding some of the larger Jeffrey pines, although their evidence has been largely obliterated by logging and other disturbance in adjacent areas.

Rare Fauna: A prairie falcon (*Falco mexicanus*), State-listed as species of special concern, was seen nesting in the area in 1977 during the ecological survey.

Physical Characteristics

The area encompasses 1162 acres (470 ha) and ranges from 7800 to 8500 ft (2377-2590 m). It is located on the southernmost margin of an extensive recent volcanic plateau characterized by small pumice basins interspersed between rolling

uplands formed by tuffaceous ash falls and volcanic flows. At the S. end, tuffaceous cliffs resulting from erosion create bold relief. The entire area is covered by ash-fall deposits, making for very well-drained soils.

Rocks are loosely welded volcanic tuff (Bishop formation) about 700,000 years old. The ash deposits are 700-10,000 years old, originating from the nearby Mono and Inyo Craters. Soils are Orthic Humic Entisols. Most precipitation falls as snow from November to March. Snow reaches 3.2 ft (1 m) deep and may last 3 months. Winter daily temperatures are estimated at 23-41 °F (-5 to +5 °C), while summer daily ranges are 50-81 °F (10-27 °C). Rainfall is estimated at 12-16 inches (305-406 mm) annually.

Association Types

Seven association types were defined using releves and following the construction of an association table. An additional fifteen 15-m-radius plots were sampled to estimate basal area cover and stem density for forest types. Acreage is not given for all types.

Jeffrey Pine/*Purshia tridentata* (85100): 872 acres (353 ha). Jeffrey pine is often the only conifer species in this association, but scattered lodgepole pine (*Pinus contorta* ssp. *murrayana*) occur. This is an open forest with typically less than 50 percent canopy cover. *Purshia tridentata* is the low shrubby dominant, covering up to 70 percent of the ground. Density of Jeffrey pine ranges from 113 to 877 stems/ha on eight plots. Basal area of Jeffrey pine ranges from 28.4 to 77.9 m²/ha. The site-index estimate for Jeffrey pine is less than 32 ft (10 m)/100 years. This low index indicates low productivity and probably low recruitment and regeneration rates.

Herb cover is sparse with only a few species tallied. These include *Carex rossii*, *Gayophytum diffusum* ssp. *parviflorum*, *Stipa californica*, *Stephanomeria tenuifolia*, *Lupinus duranii*, *Leptodactylon pungens* ssp. *pulchriflorum*, and *Linanthus nuttallii*.

Lodgepole Pine/*Calyptridium umbellatum* (86100): 174 acres (71 ha). In this association lodgepole pine is dominant, with occasional large Jeffrey pine. The shrub layer is the most poorly developed of all the forest types. *Artemisia tridentata* and *Purshia* are predominant with a low herb cover including *Calyptridium umbellatum*, *Chrysothamnus parryi*, and *Stipa elmeri*.

Lodgepole pine basal area ranges from 9.0 to 37.3 m²/ha on the four plots, and tree density ranges from 71 to 212/ha.

White Fir/*Prunus emarginata* (84240, 85210): 116 acres (47 ha). This type occurs on N.-facing slopes. It is codominated by white fir and Jeffrey pine; the former species is the climax dominant (fig. 94). The N. exposures are moister and therefore have more shrub cover and diversity compared to the Jeffrey pine-*Purshia tridentata* forest. The relatively deep snow pack not only provides more water with relatively low evapotranspiration rates (due to N.-facing slopes), but also reduces the threat of desiccation to winter drought-susceptible species.

The basal area of white fir ranges from 27.6 to 38.5 m²/ha in three plots. Total basal area ranges from 49.1 to 80.6 m²/ha. The mean dbh of white fir is 17.3 inches (44 cm) and for Jeffrey pine, 15 inches (38 cm). Total stem density ranges



Figure 94—Indiana Summit, upper boundary of Indiana Summit RNA. Ecotone seen is between *Abies concolor*-*Prunus emarginata* and adjacent *Artemisia-Symphoricarpos* on Bald Mt. *Pinus monticola* occurs in this ecotone. (1977)

from 424 to 452/ha. Sapling density (49/ha) is lower than in Jeffrey pine-dominated forest. After fire this type becomes dominated by *Artemisia tridentata*/*Symphoricarpos vaccinioides* vegetation.

Herb cover is sparse with only occasional individuals of *Bromus carinatus*, *Arabis holboellii* var. *retrofracta*, *Carex rossii*, *Poa fendleriana*, and *Leptodactylon pungens* ssp. *pulchriflorum*. Shrubs include *Prunus emarginata*, *Artemisia tridentata*, *Ribes cereum*, *Symphoricarpos vaccinioides*, *Ceanothus velutinus*, and *Chrysolepis sempervirens*.

***Artemisia tridentata*/*Symphoricarpos vaccinioides* (35210):** This association occupies shallow soils on steep, windswept slopes with light snow cover. It is subclimax on some sites, successional to the white fir-*Prunus emarginata* forest. Additional species include *Ribes cereum*, *Ceanothus velutinus*, *Bromus carinatus*, *Purshia tridentata*, *Stipa californica*, and *Leptodactylon pungens* ssp. *pulchrifolium*.

***Haplopappus bloomeri*/*Gayophytum diffusum* (no Holland equivalent):** This is a successional type following fire in the *Pinus*-*Purshia* type. Other species include *Ceanothus velutinus*, *Purshia tridentata*, *Stephanomeria tenuifolia*, *Eriogonum vimineum*, *Arabis platysperma*, *Eriogonum spergulinum* ssp. *reddingianum*, *Eriogonum nudum* ssp. *deductum*, and *Stipa elmeri*.

***Chrysothamnus parryi*/*Stipa elmeri* (35400):** This type occurs on excessively drained pumice flats. Other species contributing to the sparse cover include *Artemisia tridentata*, *Calyptridium umbellatum*, *Lupinus duranii*, *Mimulus coccineus*, *Agoseris glauca* ssp. *monticola*, *Hulsea vestita*, *Oenothera xylocarpa*, and *Sitanion hystrix*.

***Artemisia cana* ssp. *bolanderi*/*Carex douglasii* (no Holland equivalent):** This type occurs in moist areas in centers of large pumice basins and around moist flats. The dominant shrub is endemic to Mono County. Additional species include *Calyptridium umbellatum*, *Mimulus coccineus*, *Muhlenbergia richardsonis*, *Draba stenoloba* ssp. *nana*, *Juncus mertensianus*, *Haplopappus apargioides*, *Lupinus confertus*, *Thelypodium crispum*, and *Heleocharis palustris*.

Plant Diversity

Seventy-three taxa are listed.

Conflicting Impacts

Tracks resulting from off-road vehicles have been observed within the RNA although disturbance is minimal. Recent woodcutting, including cutting of standing snags useful as wildlife habitat, has occurred within the RNA. These problems could be lessened if signs around the periphery of the area were maintained and increased in frequency. There has been logging on three sides of the RNA up to the boundaries.

46. Iron Mountain (Graham Pinery) (Keeler-Wolf 1992)

Location

The ecological survey area was a candidate RNA, but now it is part of the proposed Iron Mountain RNA, the boundary of which has not yet been determined. The Graham Pinery study area is on the Lassen National Forest, Tehama County, about 23 miles (37 km) NE. of Chico. It occupies portions of sects. 32, 33, and 34 T26N, R2E and sects. 3 and 4 T25N, R2E MDBM (40°03'N., 121°45'W.), USGS Ishi Caves and Butte Meadows SW quads (fig. 95). The entire area is within the Federally-designated Ishi Wilderness. Ecological subsections – Tuscan Flows (M261Fa) and Shingletown-Paradise (M261DI).

Unless otherwise noted, the following descriptions applied to the Graham Pinery area only in May 1990 when the fieldwork of the ecological survey was conducted; they do not fully represent conditions at present.

Target Elements

Pacific Ponderosa Pine (*Pinus ponderosa*) and California Black Oak (*Quercus kelloggii*)

Distinctive Features

Fir History: A major fire, Campbell Fire, occurred in early August 1990, after the fieldwork of the ecological survey was completed. Field reconnaissance was made after the fire and reported in the ecological survey, providing valuable pre-fire and post-fire vegetation information. Before the Campbell Fire of 1990, the last fire to affect the area occurred in 1931.

Ponderosa Pine: The pinery, which refers to the pure ponderosa pine stand in the area (fig. 96), is near the low-elevation extreme of the Pacific ponderosa pine belt in this part of the Cascades. Compared to other RNAs in the region designated to represent the ponderosa pine association, this area represents the lower-elevation W.-side phase. Until early August 1990, the ponderosa pine core area was dominated by large, 200- to 400-year-old pines up to 54 inches (137 cm) dbh and 145 ft (44.2 m) tall. The 1990 fire, which affected nearly the entire area, killed most of the pines. The current value of the ponderosa pine component at this site is not as a well-developed example of the forest type, but as a natural laboratory of post-fire regeneration and succession.

California Black Oak: At Graham Pinery, extensive stands of oak with variable structure and understory composition cover large areas on the periphery of the ponderosa pine-dominated core. Until 1990 they were a far better representation of the black oak series than the small stands at other locations in the Southern Cascades ecological section. The 1990 fire burned almost all the big black oaks. Resprouting from the root crown was observed.

Biogeographic Significance: This area contains a large number of plant and animal species characteristic of both foothill and montane locations. Many plant species characteristic of montane elevations are associated with the interior portion of the pinery in the ponderosa pine stands. Low-elevation foothill species of plants are typical associates of the chaparral stands fringing the pinery. In addition to mixing of species from lower and higher elevations, this area also is situated at the N. extreme range of a group of plants typical of the Sierra Nevada foothills.

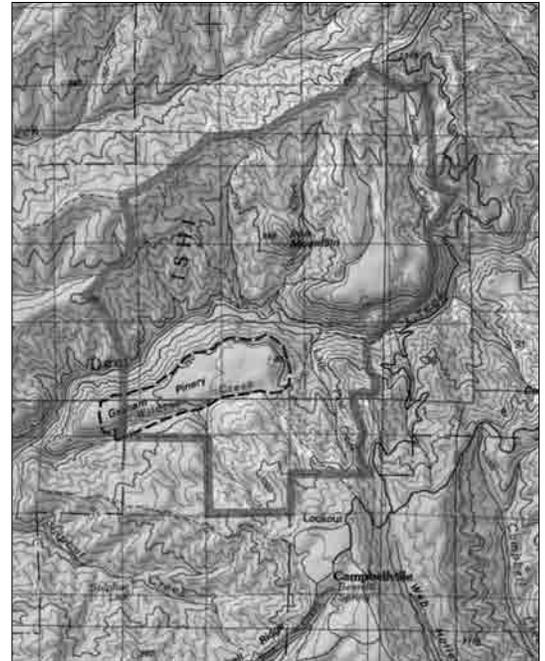


Figure 95—Iron Mountain pRNA

Dashed line = Ecological study area
Solid gray line = RNA Boundary

Rare Plants: Two rare species are found in the area. *Balsamorhiza macrolepis*, a plant characteristic of the foothill grasslands and woodlands of lower elevations, is on CNPS List 1B, while the recently described *Calystegia atriplicifolia* ssp. *buttensis* appears on CNPS List 3.

Physical Characteristics:

The study area covers 705 acres (285 ha). The Graham Pinery is a remnant of a volcanic peneplain perched along the S. rim of Deer Creek Canyon in the SW. portion of the Southern Cascades ecological section. The entire area is underlain by a series of Tertiary volcanic pyroclastic flows of the Tuscan formation whose source is thought to be two Pliocene volcanoes that no longer exist. The relatively flat tops of these remnant peneplains contrast sharply with the deeply eroded, steep slopes of the canyons that now cover most of the area.

Soils of the main part of the area are all one mapping unit, the Cohasset Gravelly Loam, 10-30 percent slopes. This soil includes small areas of Aiken, Guenoc, and Supan soils. A narrow rim of Guenocstony loam also occurs around much of the pinery and is substantially

shallower than Cohasset gravelly loam. Other peripheral soil mapping units are rock outcrop, rubble land, and small slivers of Iron Mountain rocky sandy loam.

Annual precipitation averages 30-40 inches (762-1016 mm). Precipitation is mostly in the form of rain falling between November and April. Snow falls regularly during the coldest months, but usually melts within a few days. Average annual temperature is about 53 °F (11.9 °C). The area lacks a permanent source of water.

Association Types

Vegetation was sampled with ten 10- by 10-m plots in the black oak forest and woodland and fifteen 20- by 20-m plots in the ponderosa pine forest to determine density, frequency, and basal area of the two tree species. Frequency and mean percent cover are determined for herbs and shrubs. Sampling was completed several months before the August 1990 Campbell fire.

Ponderosa Pine (84210): 223 acres (90 ha). Occupying the center of the area, the core of the pinery was vegetated with a mix of ponderosa pine, small shrub-dominated openings, and multi- and single-stemmed California black oak.

Although ponderosa pine clearly dominated the core area, it occurred in open, more-or-less discrete stands, not as an unbroken forest. Typically, the stands were dominated by large, old individuals, with scattered clumps of younger trees (59-100 years) and more recent reproduction on the periphery.

The shrubby openings were dominated by species typical of the conifer forest belt in the S. Cascades. These species also dominated the understory of open pine stands.

Several age groups of ponderosa pines were present. The youngest were seedlings and saplings, recently germinated in small openings adjacent to or within open stands of larger trees. These were rare and would not have been expected to restock the forest under static environmental conditions. About 40



Figure 96—Iron Mountain pRNA, small opening in ponderosa pine forest in core of pinery. Dominant shrubs are *Rhamnus rubra* and *Ceanothus lemmonii*. (1990)

percent of all trees sampled were of pole size, with dbh from 1 to 10 inches (2.5-25.4 cm); most of them were germinated in the previous 60 years. Another 10 percent were larger young trees, also germinated after the 1931 fire, but under uncrowded conditions and in areas of relatively deep soil. These 50- to 59-year-old, fast growing ponderosa pines attained diameters of 22-24 inches (56-61 cm) and heights of about 80 ft (24 m). The other 50 percent of sampled trees were older than 59 years. Within this group, several age groups were represented. The youngest ones were 110-120 years old (i.e., 50-60 years old when the 1931 fire occurred). Only a few were detected, indicating that most were killed in that fire. A much larger group was represented by trees between 160 and 165 years old. They varied in size from 21 to 36 inches (53-91 cm) dbh and were 100-120 ft (31-37 m) tall. The oldest were 200-400 years old. As a rule they did not exceed the 160- to 165-year-old group in height, but they were significantly larger in diameter.

Although ponderosa pine and black oak were nearly equal in density in the sample, ponderosa pine covered over four times the basal area of black oak. The understory of the open ponderosa pine stands was of similar composition to the black oak understory, although higher in species number and cover of several species. The most important understory species were *Rhamnus rubra*, *Ceanothus lemmonii*, *Stipa lemmonii*, and *Berberis dictyota*.

In the 1990 fire, mortality of ponderosa pine, particularly large, thick-barked trees, was surprisingly high. In general, the pines on the S. side of the area survived less well than those on the N. side. The presence of large, ancient pine snags in areas dominated by black oak suggests that the extent of ponderosa pine was once greater than when the area was sampled.

Black Oak Forest and Woodland (71120, 81340): 338 acres (137 ha). California black oak covered the largest portion of the study area, forming an irregular band around the central area dominated by ponderosa pine as well as small islands within it. Before the 1990 fire, most of the black oak forest was made up of even-aged sprouts resulting from the 1931 fire. The sprout forest was generally dense with canopy cover between 65 and 70 percent. Canopy height varied between 35 and 50 ft (10.6-15.4 m), and stems averaged about 7 inches (17.8 cm) dbh.

Beneath the uniform canopy of the virtually level or gently SW.-sloping summit of the pinery was a sparse, mixed understory. Dominants consisted of scattered small shrubs of *Rhamnus rubra*, *Toxicodendron diversilobum*, and *Berberis dictyota*, along with herbs such as *Carex multicaulis*, *Stipa lemmonii*, *Galium nuttallii*, and *Tauschia kelloggii*. On more mesic exposures the understory was dominated by *Toxicodendron diversilobum* accompanied by herbs characteristic of mesic environments such as *Delphinium nudicaule*, *Erysimum capitatum*, *Osmorhiza chilensis*, *Rubus ursine*, and *Lilium humboldtii*.

Throughout most of the black oak stands were occasional monarch oaks that had survived the fire of 1931. Some of these reached huge dimensions, the largest measuring 41 inches (104 cm) dbh and about 100 ft (31 m) tall. These survivors average about 4/acre (10/ha). Near the W. end of the pinery, the black oak stands become shorter and more spindly as the relatively low elevation and shallow, rocky soil combine to create a xeric setting. This type of black oak forest intergrades with chaparral dominated by *Arctostaphylos viscida* and *Quercus garryana* var. *breweri* with openings dominated by *Salvia sonomensis*.

Another type of black oak-dominated vegetation at the study area was composed of trees with stems predating the 1931 fire. This type, represented by small open stands of large black oaks, occurred within the main body of the ponderosa pine-dominated stands in the core of the pinery. These stands averaged about 50 percent crown cover and were dominated by single-stemmed oaks from 13 to 32 inches (33-81 cm) dbh; average canopy height was 50-60 ft

(15-18 m). Understory shrubs and herbs were similar to the multi-stemmed stands, with the exception of *Vulpia pacifica* and *Keckiella lemmonii* which occurred regularly but were not sampled in the multi-stemmed stands.

Chaparral (3700): The chaparral community was divided into four phases. They were:

Brewer oak (37541): 35 acres (14 ha). This type dominated large areas immediately adjacent to the multi-stemmed stands of California black oak. It was the most extensive form of chaparral in the study area before the 1990 fire. The species formed sprout thickets from 6 to 10 ft (1.8-3.1 m) tall and dominated in slightly rockier, more exposed sites than the multi-stemmed black oak dominated areas. Thickets were most common on both the N. and S. edges of the pinery where slopes range up to 30°. Occasional stands occurred on the main plateau adjacent to buck-brush and greenleaf manzanita (*Arctostaphylos patula*) stands. Brewer oak stands were burned in the 1990 fire, and basal resprouting was vigorous in most stands. Before the 1990 fire, the understory included a sparse mixture of herbs and low shrubs such as *Cynoglossum grande*, *Fritillaria* sp., *Bromus carinatus*, *Lonicera interrupta*, *Lepechinia calycina*, and *Lilium humboldtii*.

Greenleaf manzanita (37520): 18 acres (7 ha). This burl-forming species occurred largely on the edges of the pinery and was uncommon in the surrounding terrain. The most extensive stands were on the W. and N. sides of the study area immediately adjacent to the steep escarpments. The stands were variably affected by the 1990 fire. Some on the N. side barely burned at all, while stands on the W. side were subjected to a hot fire that destroyed much aboveground vegetation. Extensive resprouting occurred shortly after the fire. Before the fire, the understory of this phase was typically sparse, and scattered rocky openings frequently had mats of *Salvia sonomensis*.

Buck brush (*Ceanothus cuneatus*)/foothill pine (*Pinus sabiniana*) (37810, 71322): 25 acres (10 ha). Before the 1990 fire, *Ceanothus cuneatus* was a dominant chaparral species on much of the shallow rocky scabland soil to the E. of the pinery. The buck brush frequently associated with foothill pine and formed a matrix with a sparse, herb-dominated vegetation on the extremely rocky exposures of mudflow breccia. This vegetation type was the most xerophytic of the shrub phases, occurring on the shallowest soils in the most isolated situations. In the study area, only one small area along the E. side was dominated by this type.

Most of the scattered foothill pines were relatively young (<50 yr) and were no more than 35 ft (10.7 m) tall. Occasional shrubby California juniper (*Juniperus californica*) occurred in rocky, open areas along with scattered plants of *Arctostaphylos viscida*, *Eriodictyon californica*, and *Chrysothamnus nauseosus*. The herb-dominated openings had a sparse, although relatively diverse mixture of species including *Sidalcea hartwegii*, *Lotus humistratus*, *Allium amplexans*, *Calochortus luteus*, *Calycadenia truncata*, *Bromus rubens*, *Centaurea solstitialis*, *Arenaria douglasii*, *Chaenactis glabriuscula*, *Chorizanthe polygonoides*, *Eremocarpus setigerus*, *Penstemon azureus*, *Filago californica*, *Navarretia filicaulis*, and *Lessingia nemaclada*.

Due to the scattered, largely bare patches of vegetation, fire was spotty in this type. An opening in the NW1/4 sec. 34 atop the pinery remained largely unaffected by the 1990 fire. *Ceanothus lemmonii* and buck brush, with scattered mats of *Salvia sonomensis*, codominated in this opening.

Mesic N. slope chaparral (37E00): 18 acres (7 ha). A small portion of the chaparral on and adjacent to the N. escarpment fell in this category before the 1990 fire. There were no clear dominants. *Cercocarpus betuloides*, *Aesculus californica*, *Ptelea crenulata*, *Fraxinus dipetala*, *Arctostaphylos patula*, *Cercis occidentalis*, *Lepechinia calycosa*, shrubby canyon live oak (*Quercus chrysolepis*),

California bay (*Umbellularia californica*), and Brewer oak were all regularly occurring shrubs. The pre-1990 fire height of this type was 8-12 ft (2.4-3.7 m), taller than other chaparrals.

Canyon Live Oak Forest (81320): 48 acres (19 ha). This vegetation type dominated on the steep slopes below the pinery. Along the S. boundary it was adjacent to Wildcat Creek. This was the most mesophilic community in the area, dominated, before the 1990 fire, by largely multi-stemmed canyon live oak up to 40 ft (12 m) tall and 12 inches (31 cm) dbh. On the escarpment along the N. boundary of the study area, this was typically a closed canopy forest. California bay was a frequent subdominant. The understory included *Philadelphus lewisii*, *Torreya californica*, *Adiantum jordanii*, *Ceanothus intergerrimus*, *Cynoglossum grande*, *Dryopteris arguta*, *Erysimum capitatum*, *Galium aparine*, *Heuchera micrantha*, *Ribes roezlii*, *Trientalis latifolia*, and *Lomatium californicum*.

Despite its somewhat sheltered locations, the canyon live oak forest was largely consumed by the 1990 fire, underscoring the fire's intensity as it entered the S. side of the study area.

Plant Diversity

One hundred forty taxa are listed.

Conflicting Impacts

The relative isolation of this wilderness and the lack of water in the area minimize its attractiveness to recreational users. The pinery had been regularly used by a small number of deer hunters for many years. Before it was designated as wilderness area, this area was accessible by a primitive jeep road. The road's present condition indicates that it has not been driven upon for many years. One well-established camp site still exists on the pinery.

47. Jawbone Ridge (Fiedler 1986)

Location

This site, dropped from RNA consideration in 1987, is in S. Tuolumne County on the Stanislaus National Forest. It lies about 6.5 miles E. of Groveland and occupies portions of sects. 13, 14, 15, 22, 23, and 24 T1S, R17E MDBM (37°50'N., 120°6'W.), USGS Jawbone Ridge quad (fig. 97). Ecological subsection – Upper Foothills Metamorphic Belt (M261Eg).

Target Element

Chamise (*Adenostoma fasciculatum*) Chaparral

Distinctive Features

Rare Plants: A list including 16 rare plant species believed to occur in the area is included. However, because no actual fieldwork was conducted in the study area and this list encompasses the entire lower elevation area of the Stanislaus National Forest, it is not accurate for the area.

Rare Land Snails: Two candidates for Federal listing of endangered species (*Monodonia circumcarinata* and *M. tuolumneana*) endemic to the Tuolumne River Canyon may occur in the area.

Rare Birds: The bald eagle (*Haliaeetus leucocephalus*) and peregrine falcon (*Falco peregrinus*), which are considered by the Federal government to be endangered species, may occur in the area.



Figure 97—Jawbone Ridge ecological survey area

Jawbone Deer Herd: This study area and adjacent Jawbone Lava Flat are critical wintering ranges for mule deer (*Odocoileus hemionus californicus*).

Physical Characteristics

The area is rugged and remote, covering about 1442 acres (584 ha). Elevations range from 1250 ft (381 m) along the Tuolumne River to four summits atop Jawbone Ridge between 2841 and 3397 ft (866-1035 m). The S.-facing slopes of the Tuolumne River Canyon vary from 30 to 110 percent.

Rocks consist of two formations. The most extensive is the Paleozoic Calaveras formation composed of argillite, limestone, quartzite, and mica schist. The E. portion of the area is underlain by the late Cretaceous Chico formation. This formation is characterized by sandstone, shale, and conglomerate. Four soil mapping units occur: Dystric Lithic Xerochrepts/Rock Outcrop/Josephine family, Dystric Lithic Xerochrepts/Rock Outcrop/Typic Xerumbrepts, Fiddletown family/Lithic Xerumbrepts complex, and Ultic Haploxeralfs/Red Bluff family. The first unit is the most extensive. Mean annual temperature is estimated to be 59 °F (15 °C), mean December low 46 °F (7.8 °C), and mean July high 77 °F (25 °C). Precipitation estimates are 0.02 inch (0.5 mm) in August to 6.01 inches (153 mm) in January with a mean annual total of about 32 inches (813 mm).

Association Types

No sampling was conducted, and sizes of associations are not given.

Chamise Chaparral (37200, 37110): Typically this association has 20-100 percent cover composed of *Adenostoma fasciculatum* with less than 20 percent of remaining vegetation composed of herbs, grasses, or other shrub species. In some areas *Arctostaphylos manzanita*, *A. mewukka*, *Ceanothus cuneatus*, *C. diversifolius*, and *C. integerrimus* may exceed 20 percent cover. Occasional emergent foothill pine (*Pinus sabiniana*) is also present. Other species include *Lonicera* sp., *Chlorogalum pomeridianum*, *Eriodictyon californicum*, *Quercus chrysolepis*, *Castilleja* spp., and *Chamaebatia foliolosa*.

Chaparral covers the W. third of the area on S.- and W.-facing slopes, forming a distinct border with the pine/oak vegetation type (fig. 98).

Grassland and Savanna (42200, 71140, 71310): This association is composed of 10-100 percent cover by grasses and herbs. Foothill pine, blue oak (*Quercus douglasii*), and California buckeye (*Aesculus californica*) comprise less than 10 percent cover. The most common herbs include *Avena* spp., *Bromus* spp., *Elymus* spp., *Poa* spp., *Festuca* spp., *Aira caryophyllea*, and several members of *Polemoniaceae*, *Liliaceae*, *Scrophulariaceae*, and *Apiaceae*.

This association occurs in the W. corner of the area throughout the entire elevational range of the area. Slopes are very steep with rock outcrops and talus throughout.

Oak Woodland (71140, 71410, 81320): This type occupies the smallest acreage of the area, occurring in upper draws and along the river. Dominant species include canyon live oak (*Quercus chrysolepis*), blue oak, and foothill pine. Species of lesser importance include *Fraxinus dipetala*, *Umbellularia californica*, and *Cercocarpus betuloides*. Oak species cover 20-100 percent of the community. This is probably the most species-rich community in the area.

Figure 98—Jawbone Ridge, chamise chaparral and yellow pine/oak forest in the southeast section of the Jawbone Ridge study area. (1984)



Ponderosa Pine (*Pinus ponderosa*)/Oak Forest (71310, 71322): *Editor's note:* Despite the name, ponderosa pine is not likely to occur here except rarely. The typical pine species is foothill pine. Aspect is largely ESE. From photos in the report, foothill pine appears to dominate the canopy; the subcanopy is dominated by oaks of varying density. These are primarily canyon live oak, interior live oak (*Quercus wislizenii*), and blue oak.

Plant Diversity

The plant list included in the ecological survey is adopted from a survey made in the Clavy-Wards Ferry Area, a much larger area than the study site. It is, thus, inaccurate for the specific study area.

Conflicting Impacts

Because of the inaccessible nature of the area, this ecological survey bears the distinction as being the only one not actually visited by the author. This inaccessibility as well as the steep slopes within the area greatly reduces the area's usefulness as a research area; consequently, the candidate has been dropped from further consideration.

48. Junipero Serra Peak (Griffin 1975a)

Location

This area was dropped from RNA consideration in 1979. It lies in the Monterey Ranger District within the boundary of Ventana Wilderness in Los Padres National Forest, about 17 air miles (27 km) W. of King City in Monterey County. The study area comprises portions of sects. 27, 28, 33, and 34 in T20S, R5E (36°09'N., 121°25'W.), USGS Junipero Serra 7.5' quad (*fig. 99*). Ecological subsection – North Coastal Santa Lucia Range (261Aj).

Target Element

Sugar Pine (*Pinus lambertiana*)

Distinctive Features

The sugar pine in this area and nearby Cone Peak are topographically isolated from other sugar pine populations in the Coast Ranges. The closest sugar pine forest to the S. is in the San Rafael Mountains of Santa Barbara County where a significant area rises above 4000 ft (1219 m). To the N., the next sugar pine forest is near Mount St. Helena in Sonoma County at somewhat lower elevations. Understory shrubs and herbs associated with the pine forest are also isolated from distant forests, and many of them differ from the nearby isolated montane species on Cone Peak. The most interesting disjunct is *Cycladenia humilus* var. *venusta*, which has one population under the pines on the summit of Junipero Serra Peak and three tiny colonies on Cone Peak. The type specimen of this variety is collected at the peak of Junipero Serra Peak. Mountain chickadee (*Parus gambeli*), common in S. California and Sierra Nevada montane forest, is present in the S. Coast Ranges only in the Junipero Serra Peak and Cone Peak forests.

An interesting feature of this sugar pine population is the unexpectedly high frequency of a major gene for resistance to white pine blister rust. This fatal disease, caused by an exotic pathogen, has caused high mortality to sugar pine and other white pine in N. America. Natural resistance in other sugar pine populations ranges from near 0

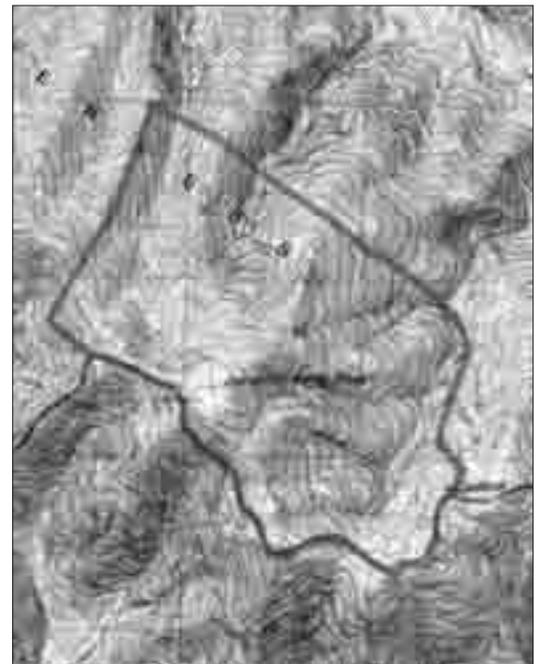


Figure 99—Junipero Serra Peak ecological survey area

percent in the S. Cascade Range to 8 percent in the S. Sierra Nevada; on Junipero Serra, it is 8.9 percent (Kinloch 1992). No blister rust has as yet been reported in this stand.

Rare plants: *Galium clementis* (CNPS List 4), *Lupinus cervinus* (CNPS List 4), and the following important disjunct plants: *Allium campanulatum*, *Aspidotis densa*, *Carex multicaulis*, *Cycladenia humilis*, *Eriogonum spergulinum* var. *reddingianum*, *Gayophytum heterozygum*, *Penstemon corymbosus*, *Pyrola picta* var. *aphylla*, *Ribes roezlii*, *Rubus leucodermis*, *Stipa (latiglumis) sp.*, and *Viola purpurea*.

Physical Characteristics

The study area covers approximately 1280 acres (518 ha). Elevations range from 3780 to 5844 ft (1152-1781 m) at the summit of Junipero Serra Peak. Topographically, except in one small area SW. of Junipero Serra Peak, it contains steep slopes on the N. flank of a ridge separating Santa Lucia Creek and San Antonio Creek watershed. Three streams dissect the area and flow into Santa Lucia Creek on the N.

The area was mapped as one geological unit, the Mesozoic granitics, and soils are relatively uniform. The main sugar pine forest on the summit and along the two N. streams was mapped as Junipero loamy sand, 30-50 percent slope. Most of the remaining forest and chaparral on N. aspects was mapped as a Sur-Junipero complex, 50-80 percent slopes. Some chaparral soils on the ridgetop and S. aspect were mapped as Cieneba-Rock outcrop complex, 50-75 percent slope. The rock patches on both aspects were called Rock outcrop-Xerorthents association. Detailed descriptions of these soils are not available.

Junipero Serra Peak is the tallest peak in the Santa Lucia Mountains. There is a fire lookout, with a tower and building, near the peak. No long-term weather records have been taken on Junipero Serra Peak. The only quantitative data from the summit were gathered by astronomers between August 1965 and October 1967. Temperatures during that period ranged from 13 to 86 °F (-11 to 30 °C). Recorded in the 1965-66 season were 19.88 inches (50.59 cm) of rain and 36.6 inches (93.13 cm) of snow. In the 1966-67 season, 39.35 inches (100.13 cm) of rain and 119.7 inches (304.58 cm) of snow were recorded.

Association Types

After study of aerial photos and field checks, vegetation was mapped according to dominant species. Four major types were delineated: chaparral, hardwood forest, conifer forest, and special communities.

Chamise Chaparral (37200): This is common in the Santa Lucia Range. In the study area it covers the lower slopes, and the dominant species is *Adenostoma fasciculatum*. *Arctostaphylos glauca* shrubs or small trees are widely scattered in this chaparral. On less exposed slopes a taller form of chaparral dominated by scrub oak (*Quercus dumosa* / *turbinella* complex) and *Quercus wislizenii* is common.

Montane Chaparral (37520): Above 4500 ft (1372 m) chamise was only a minor element in the chaparral on the most exposed sites. It was replaced by various forms of *Arctostaphylos glandulosa*; at least three subspecies have been keyed from plants on the peak. *Quercus wislizenii* has been gradually replaced on upper slopes by shrubby *Q. chrysolepis*. The only ceanothus at higher elevations is *Ceanothus integerrimus*, which is locally codominant with the manzanita. Some swales in the montane chaparral have *Lotus crassifolius* poking up through the shrubs. Other common species are *Antirrhinum multiflorum*, *Castilleja martinii*, *Cercocarpus betuloides*, *Dendromecon rigida*, *Eriogonum fasciculatum*, *Garrya flavescens* var. *pallida*, *Heteromeles arbutifolia*, *Lonicera interrupta*, *Lupinus albifrons*,

Monardella villosa, *Mimulus bifidus* ssp. *fasciculatus*, *Orobanche bulbosa*, *Penstemon breviflorus*, *Penstemon centranthifolius*, *Rhamnus californica* ssp. *tomentella*, *Rhamnus crocea* ssp. *ilicifolia*, and *Yucca whipplei*.

Hardwood Forest (81320): This vegetation type is poorly developed in the study area; in some areas this type is successional to chaparral. There is only one hardwood tree species, *Quercus chrysolepis*, in this vegetation type, which is distributed under and adjacent to the sugar pine forest. On poor soils *Q. chrysolepis* grades into shrubs and becomes part of the chaparral. On better soils that have not been burned for a long time, *Q. chrysolepis* forms closed thickets of scrubby trees. In spots these oak thickets are successional to chaparral, dead manzanita still forms an understory. Nowhere on the site did *Q. chrysolepis* show likelihood of forming tall productive forests. Only one large individual with dbh greater than 50 inches (127 cm) is known along the northernmost creek.

Conifer Forest (partially 84110): The total area of old-growth sugar pines is a little more than 300 acres (121 ha). Most of these are concentrated on the N. summit and the upper reaches of water courses. A few colonies of sugar pines occur on talus patches on the S. slopes. Several subtypes were identified:

Pine type: On gentle slopes near the summit, widely spaced old-growth sugar pines are mixed with a few old Coulter pines. Younger pines of both species are scattered on the slopes. Coulter pine mortality caused by bark beetles occurs. *Quercus chrysolepis* is almost absent from this type, and only a few tall *Rhamnus californica* and short *Ribes roezlii* shrubs are present. Large understory areas with pine needle duff and bare granitic sand bear no herbs at all. *Cycladenia humilis* is concentrated under this type near the fire lookout. A few herbs of *Viola purpurea* and *Silene lemmonii* are scattered in very low density. Colonies of *Asclepias eriocarpa* are present. This vegetation type receives disturbance from minor tree cutting, an unauthorized ski development, and hikers.

Pine-oak type: On steeper slopes dropping down into streams, sugar pines grow taller than those on gentle slopes. Here *Quercus chrysolepis* forms an understory of scattered shrubs or small trees. Only in the most favorable canyon bottoms do the oaks attain large size. Coulter pine is common on the edges of these areas closest to the chaparral, but it is absent in the central portion of the forest. *Rhamnus californica* is the only widespread shrub. The herb layer is depauperate and includes *Carex multicaulis*, *Gayophytum heterozygum*, *Mimulus subsecundus*, and *Pyrola picta*. *Lupinus cervinus* is locally common in openings, and *Galium clementis* is scattered on shady rock patches. Pine regeneration of many size classes is abundant, particularly in the blow-down area. Dense stands of *Ribes roezlii* occur in gaps of Coulter pine stands, resulting from bark beetle attacks on prior stands.

Pine-cedar-oak type: In areas adjacent to the streams, incense-cedars (*Libocedrus decurrens*) are mixed with the sugar pines. *Holodiscus discolor*, which is common along the creeks, might be scattered in this type. Other species found in this type are *Montia perfoliata*, *Pteridium aquilinum*, and *Polysticum munitum*.

Chaparral transition type: In a fringe around the summit forest, the pines have an understory of dead or dying chaparral. In this border zone, young Coulter pines might be as common as sugar pines. Below the pine-shrub zone there are large areas of chaparral with widely spaced young pines. This situation is conspicuous across the summit, SE. of the fire lookout, and the saddle, NW. of the fire lookout. In most of these chaparral transitions topographic conditions are favorable for intense fires; the young pines would be unlikely to survive the next chaparral burn. The most stable pine communities on the S. portion of the mountain are on the talus slopes, where fire is less threatening.

Riparian (61510): There is no surface water above 5000 ft (1524 m) in summer. In years with above-average rainfall some creeks may start at 4800 ft (1463 m);

permanent creeks flow at 4500 ft (1372 m). *Alnus rhombifolia* is a good indicator of reliable surface water. Distributions of alders follow the southernmost stream up to 4600 ft (1402 m), but they follow only up to 4500 ft (1372 m) along the other two streams. In all upper stream courses, *Aquilegia formosa*, *Aralia californica*, and *Lilium pardalinum* are likely indicators of summer water, but in dry years some seeps where these plants are often present may not have any surface flow. A list of 28 plants frequently associated with permanent summer water is available in Griffin (1975a).

Rock Outcrop (no Holland equivalent): On rock outcrops in the chaparral or large forest openings occur a number of plants not organized into recognizable associations. Seventeen species are common in these areas, but they are not distributed in a uniform way. Neighboring rock patches may have different species. Many of the rock outcrop species are floristically related to S. California or the S. Sierra Nevada.

Plant Diversity

Eighty-eight plant species were mentioned in the report.

Conflicting Impacts

The weedy flora on the disturbed sites is relatively low in species diversity (23 species are listed). Few exotic species are present above 4500 ft (1372 m), even along the trails through the chaparral. *Avena fatua* and *Bromus mollis* occur up to 4000 ft (1219 m).

Fire, insect, and other disturbances: Fire probably had been common in this area until the beginning of 20th century. Evidence on vegetation documented fire, fire suppression, and fire-hazard reduction work in the mid 1900s. The most recent fire was in 1977 (Marble Fire). Bark-beetle activity was high in the 1970s and caused mortality of many Coulter pines. Several very old stumps of incense-cedar indicate logging during the Spanish-Mexican era. Forests damaged by strong winds in the past are also present. Some sugar pines' stumps remain from shake-splitters' work, probably after 1900. The fire lookout building was constructed around 1935. An unauthorized skiing operation on the summit was reported sometime before 1970; however, its impact (if there was any) on the vegetation is not available.

49. King Creek (Reveal 1978; Keeler-Wolf 1990a, 1991e)

Location

This established RNA is on the Cleveland National Forest. It lies about 23 miles (37 km) NE. of El Cajon and occupies portions of sects. 24 and 25 T14S, R3E and sects. 19 and 30 T14S, R4E SBBM (32°56'N., 116°28'W.), USGS Cuyamaca Peak and Tule Springs quads (*fig. 100*). Ecological subsections – Palomar-Cuyamaca Peak (M262Bo) and Western Granitic Foothills (M262Bn).

Target Element

Cuyamaca Cypress (*Cupressus arizonica* var. *stephensonii*)

Distinctive Features

Cuyamaca Cypress: The 50-acre (20-ha) Cuyamaca cypress stands in King Creek drainage are the only naturally occurring Cuyamaca cypress in the world. All cypress stands are on the SW. slopes of Cuyamaca Peak. Cuyamaca cypress is the rarest cypress in California. Thirty-five acres (14 ha) of the Cuyamaca cypress are included in the RNA. The remaining 15 acres (6 ha) are in the Cuyamaca Rancho State Park adjacent to the RNA. All stands experienced fire in 1950 and one

stand was burned again in 1970. The 1970 fire reduced the then 20-year-old stand by about 75 percent because of premature burning (before adequate numbers of cones could be produced).

Frequent fire is a great threat to the Cuyamaca cypress. Although the tree needs fire to open the serotinous cones, fire cannot occur too early in the plant's life or the net result will be a decrease in population (see Guatay Mountain, #34).

Due to its geographic isolation and small population, Cuyamaca cypress is genetically distinct from other cypress in western N. America and lacks genetic diversity. The taxonomy and regeneration strategy of Cuyamaca cypress are discussed extensively in Reveal's (1978) report.

Rare Plants: The Cuyamaca cypress is a CNPS List 1B species. *Calamagrostis densa*, *Diplacus (Minulus) clevelandii*, lemon lily (*Lilium parryi*), and Engelmann oak (*Quercus engelmannii*) are members of CNPS List 4. *Calochortus dunnii* and *Brodiaea orcuttii* are CNPS List 1B species. In addition, two CNPS List 1B species, *Delphinium hesperium* ssp. *cuyamaca* and *Horkelia truncate*, are present in the vicinity of the RNA.

Disjunct Populations: Several mountain species occur in the RNA far from their next nearest occurrences in the Peninsular Ranges. These species include *Salvia sonomensis*, *Viola lobata*, *Ceanothus foliosus*, *Euphorbia palmeri*, *Lilium pardalinum*, *Phlox austromontana*, sugar pine (*Pinus lambertiana*), white fir (*Abies concolor*), and incense-cedar (*Libocedrus decurrens*).

Rare Fauna: Four California State species of special concern have been sighted in the RNA; they are Cooper's hawk (*Accipiter cooperi*), golden eagle (*Aquila chrysaetos*), San Diego horned lizard (*Phrynosoma coronatum blainvillei*), and San Diego mountain kingsnake (*Lampropeltis zonata pulchra*).

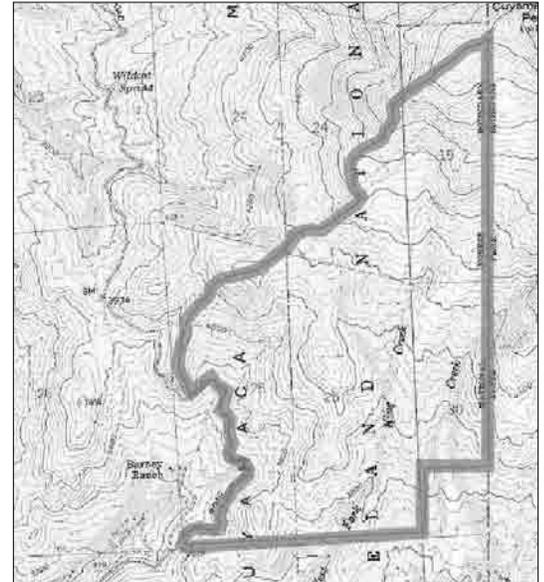


Figure 100—King Creek RNA

Physical Characteristics

The established RNA covers 1002 acres (406 ha). Elevations range from 3630 to 5800 ft (1106-1768 m). The area occupies the SW.-facing slope of Cuyamaca Peak (6512 ft, 1985 m elevation). The bulk of the cypress lines intermittent-to-dry upper drainages of the W. and the main forks of King Creek, which flow to the SW. and converge outside the area.

Geologically the area is divided at about the 4000-ft (1219-m) contour into an upper elevation area of Cuyamaca Gabbro and a lower elevation zone of Bonsal Tonalite (granitic). On the gabbro substrate two soil series occur, the Las Posas and the Cohasset. The cypress trees are restricted entirely to the Las Posas soil, which occurs around the base of the mountain. Las Posas soil is deep, reddish-brown, stony loam that retains water well. This quality has doubtless influenced the ability of cypress to survive continual drying of the environment since the Pleistocene. Annual precipitation averages 30-35 inches (750-900 mm), with 80 percent falling between December and May. Snow falls regularly at the upper elevations, but it melts quickly. Yearly minimum temperatures average 22 °F (-12 °C); maximum temperatures average 95 °F (35 °C).

Association Types

Reveal (1978) briefly delineated the area into five vegetation types: cypress vegetation, riparian vegetation, chamise-manzanita-ceanothus chaparral, chamise-ceanothus-scrub oak chaparral, and dry meadow. Keeler-Wolf (1990a) further mapped the area into the following 11 types.²

Diegan Sage Scrub (32500): 61 acres (25 ha). This type occurs on shallow, excessively well-drained soils on S. exposures both on granitic and gabbroic

² Scientific names are in accordance with Beauchamp (1986).

soil. On gabbroic soil this type usually occurs sporadically, as small patches of less than 1 acre (0.4 ha). Diegan sage scrub frequently forms a border around the meadows along the W. Fork of King Creek. Dominant species include white sage (*Salvia apiana*), *Eriogonum fasciculatum*, *Yucca whipplei*, *Gutierrezia californica*, *Penstemon centranthifolius*, *Lupinus* sp., and *Clarkia* sp.

Mafic Southern Mixed Chaparral (37122): 491 acres (199 ha). This is an open, low (2.5-3 ft, 0.8-0.9 m) chaparral dominated by Eastwood manzanita (*Arctostaphylos glandulosa* ssp. *glandulosa*) and chamise (*Adenostoma fasciculatum*). It occupies relatively xeric exposures on S., W., or E. aspects on gabbro soil. The two dominants are augmented with a number of other shrubs including *Ceanothus greggii* ssp. *perplexans*, holly-leaf red berry (*Rhamnus ilicifolia*), Cleveland's sage (*Salvia clevelandii*), *Ceanothus oliganthus*, and toyon (*Heteromeles arbutifolia*). Prostrate or creeping sage (*Salvia sonomensis*) dominates in the openings and semi-shaded areas beneath the shrubs. Other major understory species are *Calamagrostis densa*, *Calochortus* sp. (probably mostly *C. dunnii*), *Allium campanulatum*, *Sanicula tuberosa*, *Lomatium dasycarpum*, *Pellaea mucronata*, and *Yucca whipplei*. Six 200-m² plots were sampled in this type.

Scrub Oak Chaparral (37900): 229 acres (93 ha). This is a relatively mesic chaparral occurring on N. aspects and slopes surrounding ravine bottoms on both gabbroic and granitic soils. It is made up of dense, tall shrubs, with average heights of 6-10 ft (2-3 m). In addition to scrub oak, other large shrub species such as *Ceanothus leucodermis*, *Cercocarpus betuloides*, *Rhus ovata*, *Arctostaphylos pungens*, and *Ribes indecorum* add to the diversity of the vegetation. Chamise and Eastwood manzanita are common and may codominate with scrub oak on W. and E. exposures on gabbro soil. Hybrid Engelmann and scrub oaks may comprise up to 10 percent cover in some areas. Several woody climbing or sprawling species such as *Galium angustifolium*, *Clematis lasiantha*, *Marah macrocarpus*, *Toxicodendron diversilobum*, and *Lonicera subspicata* are present. Due to the tall and dense canopy, understory cover is poor. A grayish green foliose lichen (*Xanthoparmelia* sp.) makes up 10-15 percent of the ground cover on steep, rocky NW.-facing slopes on gabbro soil. Species composition on gabbro is different from that on granitic soil. On gabbro soil, scrub oak, chamise, and Eastwood manzanita codominate, all averaging about 15-20 percent cover; on granitic substrate, scrub oak dominates (averaging 40 percent on two plots) with relatively low densities of Eastwood manzanita and chamise. Associated species found on gabbro soils are *Ceanothus greggii* ssp. *perplexans*, *Salvia sonomensis*, and *Calamagrostis densa*, whereas *Ceanothus leucodermis*, *Solidago californica*, and *Stipa* sp. are found on granitic soils.

Valley Needlegrass Grassland (42110): 25 acres (10 ha). This type is limited to five or six small patches. Variation among patches is high, caused by differences in substrate, soil moisture, elevation, slope, and degree of disturbance. Important species are deergrass (*Muhlenbergia rigens*), *Bromus breviaristis*, *Koeleria macrantha*, *Stipa* sp., *Juncus macrophyllus*, and *Sitanion hystrix*. Other species found in this grassland are: *Linanthus dianthiflorus*, *Sanicula bipinnatifida*, *Trifolium depauperiatum*, *Sisyrinchium bellum*, *Gilia capitata*, *G. australis*, *Plantago erecta*, *Orthocarpus purpurascens*, *Layia* sp., and *Hemizonia fasciculata*. Number of weedy species appears to increase with decreasing elevation. Species such as *Erodium cicutarium*, *E. botrys*, *Hypochoeris glabra*, *Bromus rubens*, *B. diandrus*, *B. mollis*, and *Medicago polymorpha* appear more common in the lower W. Fork grasslands near the edge of the private land. The degree of disturbance may also be higher in these low-elevation areas. Seven 1-m² plots were sampled, and 32 species were recorded in this vegetation type.

Freshwater Seep (45400): 1 acre (0.4 ha). This type is restricted to one major springy area in the SE 1/4 sec 24 T14S, R3E. The vegetation is dominated by tall

herbaceous species and includes *Carex spissa*, *Cyperus parishii*, *Typha latifolia*, *Oenothera elata* ssp. *hirsitissima*, *Hypericum formosus* ssp. *scouleri*, *Lotus oblongifolius*, *Lythrum californicum*, and *Solidago confinis*. Surrounding vegetation is transitional oak woodland with canyon live oak, coast live oak, and scrub oak as dominants.

Southern Coast Live Oak Riparian Forest (61310): 22 acres (9 ha). This forest occurs in intermittent strips surrounding the mesic bottomland adjacent to the W. Fork of King Creek. Individual coast live oaks attain 4 ft (1.2 m) dbh and spread crowns up to 60 ft (18 m) across. Other tree species found in this forest type are: Coulter pine, incense-cedar, bigleaf maple, California black oak, and Engelmann oak. Understory vegetation is dominated by *Symphoricarpos mollis*, *Mahonia dictyota*, poison oak (*Toxicodendron diversilobum*), *Sanicula graveolens*, *Galium aparine*, *Viola purpurea*, and *Elymus glaucus*. Four 10- by 10-m plots were sampled. The average density of coast live oak is 293 trees/acre (725 trees/ha), and the average basal area cover is 355 ft²/acre (82 m²/ha).

White Alder Riparian Forest (61510): 2 acres (0.8 ha). This forest forms an intermittent cover surrounding the small stretches of permanently moist areas along the main and W. forks of King Creek. It is dominated by white alder, which may reach diameters of 24 inches (61 cm) and heights of 60 ft (18m). Also occurring are scattered individuals of California sycamore and the willows *Salix laevigata* and *S. lasiolepis*. A number of hydrophilic species occur in the understory, which includes *Lilium parryi*, *L. pardalinum*, *Rosa californica*, *Carex spissa*, *Potentilla glandulosa*, *Erigeron philadelphicus*, *Mentha spicata*, *Aquilegia formosa*, *Thalictrum fendleri*, and *Woodwardia fimbriata*.

Open Engelmann Oak Woodland (711810): 5 acres (2 ha). This type is limited to the lower W. Fork drainage where it occurs primarily on E. and SE.-facing slopes. It is a woodland codominated by Engelmann oak, coast live oak, and scrub oak. Dominant trees are small (15-20 ft, 4.5-6 m tall) and spindly. Soil is shallow, derived from granite. Associated species are a mixture of Diegan sage scrub (*Salvia apiana* and *Eriogonum fasciculatum*) and scrub oak chaparral (*Quercus dumosa*, *Rhus ovata*, *Ceanothus leucodermis*, chamise, and poison oak).

Canyon Live Oak Forest (81320): 52 acres (21 ha). This type is restricted to the higher elevations of the RNA above 4800 ft (1463 m). It occurs as a scrubby forest of varying density on steep to gentle slopes. The entire type was burned both in 1950 and 1970. Commonly associated woody species are *Rhamnus californica* ssp. *tomentosa*, Coulter pine, *Ceanothus leucodermis*, *Ceanothus palmeri*, *Mahonia dictyota*, and scrub interior live oak (*Quercus wislizenii* var. *fructescens*). Understory species include *Solidago californica*, *Bromus* sp. (perennial native), *Galium andrewsii*, and *Monardella* sp.

Southern Interior Cypress Forest (83330): 34 acres (14 ha). This is the generic name of the forest locally dominated by Cuyamaca cypress. Principal associates of Cuyamaca cypress include *Ceanothus greggii* ssp. *perplexans*, scrub oak, toyon, and *Salvia sonomensis*.

This forest type has high degree of variability. The most extensive, pure form of this type occurs within a matrix of southern mafic mixed chaparral. Eastwood manzanita and chamise are the typical subdominants of the cypress forest. Cuyamaca cypress also occurs as riparian gallery stands adjacent to coast live oak of white alder riparian vegetation. Understory species of the cypress stands in chaparral include many of the same species found in mafic mixed chaparral. Species associated with the cypress stands in riparian areas are shared with the white alder riparian type.

The largest cypress individuals occur in the mesic-to-hydric riparian areas along the upper reaches of the W. Fork of King Creek. Several trees are about 40

ft (12 m) tall and 28 inches (71 cm) in diameter (*fig. 101*). The densest stand occurs within mesic microsites surrounded by chaparral, as in small rills and on NW-facing aspects. These densely packed individuals average between 6 and 10 ft (2-3 m) tall and 2-3 inches (5-8 cm) in diameter. Cypress densities in chaparral average 1700-2630 trees/acre (4200-6500 trees/ha), while stream-side stands average 304 trees/acre (750 trees/ha). One particularly noteworthy species in the stands on NW. exposures is the orchid *Habenaria elegans*.

The rare *Brodiaea orcuttii* (CNPS List 1B) is known from cypress stands.

Coulter Pine Forest (84140): 80 acres (32 ha). Coulter pine stands scatter between 4000 and 5800 ft (1219-1768 m), among a matrix of mafic chaparral, scrub oak chaparral, and canyon live oak forest. The stands, occurring on various soil types and having different fire regimes, are very diverse. Low-elevation stands have trees up to 80 years old, 2 ft (61 cm) dbh, and 60 ft (18 m) tall. High-elevation stands, occurring on rocky soils and having burnt in 1970, are open, with small and slow-growing trees; most are less than 20 years old averaging 15 ft (5m) tall. Some stands are dense, with trees about 29 years old, 8-11 inches (20-28 cm) dbh, and 25 ft (7.6 m) tall. Associated and understory species vary, depending upon stand structure and location. Low-elevation stands have understory species such as Eastwood manzanita, chamise, *Ceanothus greggii* ssp. *perpelexans*, *Calamagrostis densa*, *Salvia sonomensis*, and *Yucca whipplei*. At higher elevations, other species such as *Rhamnus californica* ssp. *tomentosus*, *Viola lobata*, and *Ceanothus foliosus* become common constituents. Occasionally, saplings of conifers such as incense-cedar, white fir, and sugar pine are found in high-elevation stands. They are derived from individual mature trees growing on the adjacent N.-facing slopes outside of the RNA.



Figure 101—King Creek, one of the large old Cuyamaca cypress growing along the West Fork within a foot of the stream channel in King Creek RNA. Basal diameter is about 28 inches (71 cm). (1990)

Plant Diversity

The flora is diverse, with 204 taxa known from the RNA.

Conflicting Impacts

Most of the impacts are associated with fire management and have already been discussed. There may have been some cutting of trees in the past for fence posts and firewood. A dirt road comes close to one stand, and others are reachable by four-wheel-drive tracks. A portion of the Cuyamaca cypress stands lies on the adjacent Rancho Cuyamaca State Park. The RNA and State Park need to manage Cuyamaca cypress cooperatively.

50. L. E. Horton (Stone Corral-Josephine Peridotite) (Keeler-Wolf 1986d)

Location

L. E. Horton recommended RNA is on the Six Rivers National Forest. It is only 4 miles (6 km) S. of the Oregon border and about 6 miles (10 km) NW. of Gasquet. It includes portions of sects. 24, 25, 26, 35, and 36 T18N, R1E and sects. 19 and 30 T18N, R2E MDM (41°56'N., 124°01'W.), USGS High Plateau and High Divide quads (*fig. 102*). Ecological subsection – Gasquet Mountain Ultramafics (M261Ab).

Target Element

Darlingtonia californica (California pitcher plant) Bog

Distinctive Features

Rare Plants: This area contains a higher percentage of rare plants than any other established or recommended/candidate RNA in California. A total of 40 taxa (25 percent of the known flora of the area) are on CNPS lists. These include the following:

List 1B: *Arabis macdonaldiana* (also Federally- and State-listed endangered species)

List 2: *Arabis aculeolata*, *Castilleja elata*, *Calamagrostis crassiglumis*, *Eriogonum pendulum*, *Pinguicula macroceras*, *Senecio macounii*

List 3: *Aster paludicola*, *Gentiana setigera*

List 4: *Angelica arguta*, *Antennaria suffrutescens*, *Arnica spathulata*, *Aster brickelloides*, *Darlingtonia californica*, *Epilobium rigidum*, *Eriogonum ternatum*, *Gentiana affinis*, *Haplopappus racemosus* ssp. *congestus*, *Horkelia sericata*, *Iris innominata*, *Lathyrus delnorticus*, *Lilium bolanderi*, *L. vollmeri*, *Lomatium howellii*, *L. tracyi*, *Monardella purpurea*, *Poa piperi*, *Salix delnortensis*, *S. tracyi*, *Sanicula peckiana*, *Sedum laxum* ssp. *flavidum*, *Tauschia glauca*, *Trillium rivale*, *Vancouveria chrysantha*, *Veratrum insolitum*

Considered, but rejected due to taxonomic questions: *Arctostaphylos cinerea*, *A. parviflora*, *Juniperus communis* ssp. *jackii*

Considered, but rejected due to commonness: *Arctostaphylos intricata*, *Viola cuneata*

In addition to the species on the CNPS lists, a form of beach pine (*Pinus contorta* ssp.) may also be considered rare. The pine has been referred to as endemic to the ultramafic terrain of Del Norte County by Griffin and Critchfield (1976).

Klamath Mountains Serpentine Endemics: A total of 53 taxa, or 33 percent of the known flora of the study area, are Klamath endemics. It is likely that almost all of these species will prove to be serpentine endemics or indicator species (*sensu* Kruckeberg 1984) — a remarkably high percentage of endemics. Another RNA, Frenzel Creek, is in an area known for its high endemism to the central Coast Ranges (Stebbins and Major 1965), yet only 17 percent of its flora is endemic to that area.

The *Darlingtonia* Bog: The extensive bogs in the N. portion of the area represent the best-developed *Darlingtonia* bog habitat in the California RNA system (*fig. 103*). Although California pitcher plant is widespread in N. California, the flora of the coastal type, of which this area is representative, is different from the

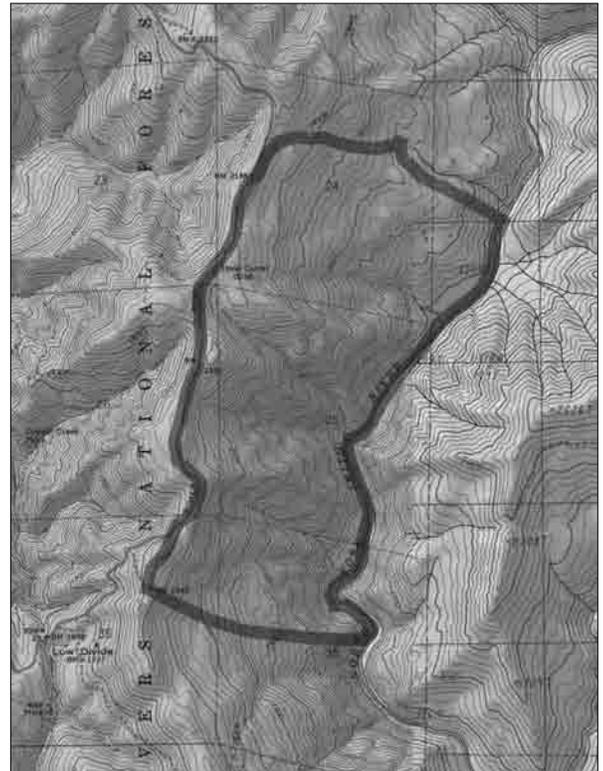


Figure 102—L.E. Horton
rRNA

inland higher-elevation types, which occur in several other Forest Service RNAs or Botanical Areas (e.g., Cedar Basin recommended RNA and Mount Eddy RNA).

Port Orford-Cedar (*Chamaecyparis lawsoniana*): This species also occurs in several other RNAs. Stands of POC in this area are neither as dense nor as large as in some other areas (e.g., Adorni RNA, Cedar Basin recommended RNA, Upper Goose Creek candidate RNA). They represent a different association type listed from the Siskiyou Mountain region by Atzet and Wheeler (1984). They also represent the oldest trees and highest volume forest in the study area. Some of the individuals are clonal, a feature which has occasionally been reported from other Port Orford-cedar stands with very wet substrates. This population has not been infected with root rot (*Phytophthora lateralis*).



Figure 103—L.E. Horton, dense aggregation of *Darlingtonia californica* and bog forest in L.E. Horton rRNA. (1985)

Physical Characteristics

The study area covers 1305 acres (528 ha) of E.-facing slopes above the North Fork of the Smith River. Terrain is steep and rugged in most of the S. and central portions, but it becomes more gradual in the N. where the *Darlingtonia* bogs occur. Elevations range from about 600 ft (183 m) along the Smith River to 2400 ft (732 m) at the summit of the ridge near Stone Corral. The area is underlain by the lower or mid-Jurassic Josephine Peridotite Body, which stretches for 93 miles (150 km) along the W. border of the Klamath Mountains ecological section. Most of the rock is serpentinized peridotite with small inclusions of gabbro. Soils are generally shallow and poorly developed except in the wet bog area. They are typically poor in calcium and extremely high in magnesium. Precipitation totals are among the highest in the state, averaging 115-125 inches (2921-3175 mm) per year. Temperatures are moderate, with some snow falling in winter and frequent summer fog at lower elevations.

Association Types

Portions of the dwarf forest, bog forest, Jeffrey pine (*Pinus jeffreyi*) woodland, and Douglas-fir (*Pseudotsuga menziesii*) forest were sampled using 10-m by 10-m quadrats. The remaining vegetation is described qualitatively.

Dwarf Forest (no Holland equivalent, perhaps part of 84160): 815 acres (330 ha). The stunted, compact nature of many of the trees and shrubs of this association and the presence of several typically high montane taxa give this low-elevation forest a peculiar subalpine quality. This forest is best developed on the relatively gentle (10-30°) upper slopes.

Ten plots were sampled. The forest is nearly continuous and dense (1960 stems/ha), dominated by spindly trees (total basal area cover 9.5 m²/ha) of beach pine (*Pinus contorta* ssp.), knobcone pine (*P. attenuata*), western white pine (*P. monticola*), and Douglas-fir. The canopy is broken occasionally by small herbaceous openings on more steeply sloping, rocky sites. The density (trees/ha), relative cover, and importance values are given below, following the dominants: beach pine (1040, 30 percent, 101), knobcone pine (490, 20 percent, 74), western white pine (250, 30 percent, 66), Douglas-fir (160, 20 percent, 51), Jeffrey pine (10, 1 percent, 4), Port Orford-cedar (10, trace percent, 3.4).

Dominant trees are no larger than 11 inches (28 cm) dbh and are typically western white pine. Beach and knobcone pines are typically no larger than 5 inches (13 cm) dbh. The numerous small knobcone and beach pines average 40 years old; the sampled dominant western white pines are 86-104 years old. The oldest tree sampled in this forest is a 20-inch (51-cm) dbh Douglas-fir with an age of 209 years. Disease (blister rust, dwarf mistletoe, and other fungus) is extremely common in all trees and appears to be the principal cause of early death in these trees. Recent fire has not been widespread. A small fire burned about 5 acres (2 ha) in 1981 and killed all dominant trees.

Shrubs may cover more than 50 percent of the area. The most significant species are *Lithocarpus densiflorus* var. *echinoides*, *Quercus vaccinifolia*, *Rhamnus californica*, *Arctostaphylos nevadensis*, and *Umbellularia californica*. All of these species resprout after fire. The herb layer is well developed, consisting of at least 41 taxa. Such species as *Xerophyllum tenax*, *Festuca californica*, *Stipa lemmonii*, *Agrostis hallii*, and *Poa piperi* may locally cover up to 35 percent.

Lower Dwarf Forest (no Holland equivalent, perhaps partially 37600): 393 acres (159 ha). Below about 1200 ft (366 m) in the steep inner canyon of the North Fork of the Smith River, beach pine drops out and the density of western white pine and knobcone pine decreases. Densities of Douglas-fir and incense-cedar (*Libocedrus decurrens*) increase. Tree densities are lower than at higher elevations. Shrub cover also changes from the upper-elevation dwarf forest, with such species as *Arctostaphylos cinerea* and *Garrya buxifolia* increasing in cover while *Lithocarpus densiflorus* var. *echinoides* and *Quercus vaccinifolia* decrease. Other shrub species particular to this association include *Eriogonum pendulum*, *Eriodictyon californica*, *Arctostaphylos parviflora*, and *A. intricata*.

The herbaceous component also differs from the dwarf forest of higher elevations. It includes as important members *Phlox speciosa*, *Penstemon azureus*, *Chrysopsis oregona*, *Sedum laxum* ssp. *flavidum*, *Selaginella wallacei*, *Toxicodendron diversilobum*, *Arabis aculeolata*, *Lomatium tracyi*, *Stipa lemmonii*, *Phacelia nemoralis*, and *Arenaria* sp.

Bog Forest (51120, 82500): 48 acres (19 ha). In this area a forest dominated by Port Orford-cedar (POC) alternates with hillside bogs dominated by California pitcher plant. Both forest and bog are related in the area, hence the combined name of this association. The association occurs on gentle (5-15°) E.-facing slopes. Ten plots were sampled. The average tree-stem density is 1350/ha. POC strongly dominates, with density (per ha), relative cover, and importance value as follows: 510, 79 percent, 149. Other trees, with their corresponding figures in parentheses, are western white pine (420, 17 percent, 77), beach pine (340, 3 percent, 54), knobcone pine (70, 1 percent, 16), and Douglas-fir (10, trace percent, 4). Total basal area cover averages 58 m²/ha. All of the large POC have fire scars. One specimen, 146 years old, has light fire charring. The oldest is a 31-inch (79-cm) dbh individual that is 282 years old. Several large trees, 39-48 inches (1-1.2 m) dbh, are probably 350-400 years old.

Ledum glandulosum and *Rhododendron occidentale* are the principal shrubs indicative of this association (mean cover on 10 plots: 8.5 and 5.5 percent, respectively). However, a number of other shrubs (12 species in the sample) are shared with the surrounding dwarf forest. Of particular importance is *Lithocarpus densiflorus* var. *echinoides*, which averages 11 percent cover.

The most distinctive element of the bog forest flora is the herbaceous component. About 53 percent of the 38 species encountered on the sample plots are locally restricted to this association. The dominant herbaceous species include *Darlingtonia californica*, *Scirpus criniger*, *Carex serratodens*, *Sanguisorba microcephala*, and *Nartheceum californicum*. These and other characteristic species such as *Aster paludicola*, *Rudbeckia californica* var. *glauca*, *Deschampsia caespitosa*

ssp. beringensis, *Calamagrostis nutkaensis*, and *Juncus orthophyllus* tend to dominate the wetter portions of this association (often concave slopes with small rivulets) to the exclusion of woody species.

Canyon Forest (81100 ±): 25 acres (10 ha). This association is similar to the classic mixed evergreen forest in that it is dominated by tanoak (*Lithocarpus densiflorus*), Pacific madrone (*Arbutus menziesii*), and canyon live oak (*Quercus chrysolepis*). However, the scattered canopy of Douglas-fir typical of most mixed evergreen forests is here augmented with western white pine, POC, and incense-cedar. This forest occupies ravines with permanent or intermittent stream channels; it is a more mesic environment than the surrounding dwarf forest. The dominant broad leaf sclerophylls form a dense canopy, with stems averaging about 10 inches (25 cm) dbh. The largest tree seen anywhere in the study area was a western white pine in this association; it measured 45 inches (114 cm) dbh.

Understory species are shared with dwarf and lower-dwarf forest and include *Garrya buxifolia*, *Lithocarpus densiflorus* var. *echinoides*, *Quercus vaccinifolia*, *Rhamnus californica*, and *Vaccinium ovatum*. *Berberis piperiana* is the only shrub apparently restricted to this type.

Jeffrey Pine Woodland (84171): 11 acres (5 ha). A small portion of the upper elevation near Stone Corral supports an open woodland of Jeffrey pine. This is a relatively young forest with dominant Jeffrey pines averaging about 20-22 m tall, 51 cm dbh, and 100 years old. Growth rates vary considerably depending on substrate; those on or near gabbro grow faster and taller than those on peridotite. Three plots were sampled in this association. Total tree density averages 730/ha, and total basal area cover averages 75 m²/ha. The only other tree species, western white pine, is an insignificant member.

Shrub cover is much lower than in adjacent dwarf forest. Eight species are in the sample, with *Arctostaphylos nevadensis* dominating (mean cover, 16 percent). Of the 19 species of herbs noted in the sample, the highest cover is provided by the grass *Festuca californica* which may cover up to 40 percent of the plots. Other frequent species include *Erigeron foliosus* ssp. *confinis*, *Achillea millefolium*, *Hastingsia serpentinicola* (recently described by Becking 1989), *Haplopappus racemosus* ssp. *congestus*, *Calystegia occidentalis*, *Trifolium oreganum*, and *Horkelia sericata*.

Douglas-Fir Forest (82420): 8 acres (3 ha). A small pocket of relatively lush young Douglas-fir forest occurs on gabbro near the Stone Corral Jeffrey pine woodland. The forest is locally dense (2150 trees/ha) with relatively high basal area cover (112 m²/ha). Typical dominant Douglas-firs are 50-60 cm dbh, 26 m tall, and 95-111 years old. Also occurring are trees of POC, Pacific madrone, tanoak, and canyon live oak. The shrub and herb layers are depauperate, with only six species of shrubs and seven herbs tallied on two plots. *Gaultheria shallon*, *Polystichum munitum*, and a thick carpet of moss are the most important understory members. The young age of the trees and the multiple stems of the sclerophylls suggest a crown fire somewhat more than 100 years ago.

Plant Diversity

One hundred sixty-two taxa are listed.

Conflicting Impacts

The N. portion of the area has been subjected to exploratory chromite and nickel mining over the past 10 years. This has resulted in a small network of bulldozer tracks and pits (up to 6 m deep). The impact of these excavations on the rare flora is not particularly severe because of the even dispersion of most of these species throughout the area of affected dwarf forest. Since it was proposed as a RNA, the area has not been affected by any additional mining. The rough nature

of the tractor trails precludes vehicular access into the heart of the area. Dirt roads bound the W. and N. of the area. These may possibly act as vectors for transporting POC root rot into the area.

51. Last Chance Meadow (Ball 1976, DeDecker 1975a, Inyo National Forest 1982a)

Location

This established RNA is located on the Inyo National Forest. It lies on the E. side of the crest of the S. Sierra Nevada about 13 miles (21 km) SW. of Lone Pine. It lies within portions of sects. 13, 14, 23, and 24 T17S, R35E MDBM (36°27'N., 118°9'W.), USGS Cirque Peak quad (*fig. 104*). Ecological subsection – Glaciated Batholith (M261Eo).

Target Element

Foxtail Pine (*Pinus balfouriana*)

Distinctive Features

Foxtail Pine Forests: Foxtail pine is a principal dominant of the S. Sierra subalpine forests, yet little ecological information exists for these forests. Factors limiting growth, structure, productivity, and distribution of the S. Sierra stands are not clearly understood, nor is the role of fire, nor the explanation for the extremely sparse understory characteristic of the type. The extensive stands at this RNA, over a variety of site conditions, could also prove useful in a comparative study with the N. California populations of foxtail pine represented at Crater Creek cRNA, Mount Eddy RNA, and Sugar Creek cRNA. The information gathered in this survey and by the Laboratory of Tree-Ring Research (cited in ecological survey) on growth of foxtail pine suggests that local dominants typically exceed 600 years, attaining ages of 1000-1500 years (*fig. 105*). The ease of access (edge of RNA only 0.5 mile [0.8 km] from paved road) also will facilitate and encourage research on this typically rather inaccessible forest type.

Stream Study: The inclusion of the entire upper portion of a small, permanent stream drainage makes the RNA useful for watershed-related studies.

Rare and Unusual Plants: Two species, *Frasera tubulosa* and *Ivesia campestris*, are listed as rare on the survey list. However, both of these species are now considered by CNPS as too common (*appendix 1*) to warrant special consideration. *Sarcodes sanguinea*, although not rare, grows in an unusual situation in the very low duff-understory of the foxtail pine forest.

Physical Characteristics

The RNA covers 660 acres (267 ha); however, the study area covers 1769 acres (716 ha), which spreads over portions of three ridges and includes an entire small drainage-head between the ridges. Land varies in elevation from about 9700 to 11,060 ft (2957-3371 m). Significant facets of the area are exposed to all major azimuth angles, but the majority face N. and S. Slope angles vary from 75° on the E. escarpment to virtually level on the meadows in the SW. portion. Average N. slopes are about 25°, whereas average S. slopes are about 15°.

Rocks are entirely Mesozoic granitics. Soils are poorly developed in most of the area, consisting of decomposed granite or scree, depending on slope. Organically rich meadow soils lie over a thin layer of alluvium in a small area of

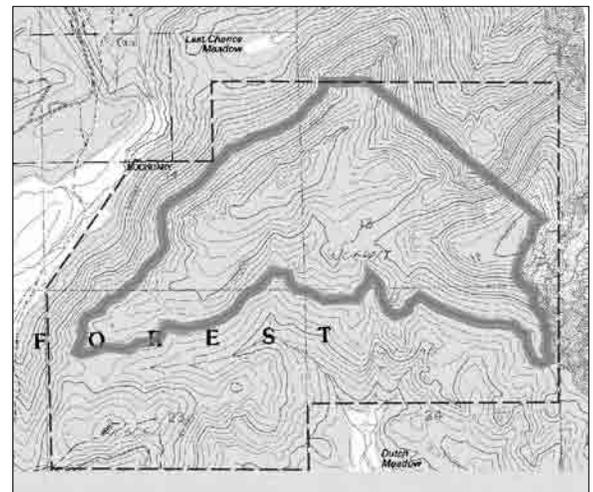


Figure 104—Last Chance Meadow RNA

Dashed line = Ecological study area;
Solid gray line = RNA Boundary

the SW. portion. The area probably receives average annual precipitation between 20 and 30 inches (508-762 mm), with snow accounting for the vast majority. Snow depth on April 1 in this area averages 25-50 inches (64-127 cm).

Association Types

Fourteen plots of unlisted area were sampled in the subalpine forest; acreage for associations is not given.

Subalpine Forest (86100, 86300, 86700): This vegetation has been grouped into four types: mixed forest dominated by lodgepole pine (*Pinus contorta* ssp. *murrayana*) with foxtail pine subdominant; mixed forest dominated by foxtail pine with lodgepole pine subdominant; mixed forest codominated by limber pine (*Pinus flexilis*) and foxtail pine; and monospecific forest of foxtail pine. These types are not discussed individually.

Lodgepole pine is most common along water courses and at lower elevations, whereas foxtail pine cover is negatively correlated with lodgepole pine cover. Limber pine tends to increase in basal area at higher altitudes (e.g., on ridge S. of Last Chance Meadow), while



Figure 105—Last Chance Meadow, granitic outcrop surrounded by wind-eroded 800 to 1500-year old foxtail pine in the Last Chance Meadow RNA. (L. Johnson 1974)

there is a general reduction in basal area of all species as the highest elevations of this ridge are approached. On the S.-facing slope of this ridge, foxtail pine occurs in high cover. In the SE. quarter of sect. 13 on a boulder-strewn plateau, foxtail pine attains high basal area cover in pure stands. Reproduction throughout the subalpine forest is good for all three main species. Based on 14 sampled sites, basal area cover for the three major tree species are (average, with range and sample size): foxtail pine 36 (1-56, n=14) m²/ha; lodgepole pine 9 (0.25-28.5, n=12) m²/ha; and limber pine 4.1 (0.5-10, n=5) m²/ha. Total basal area for the plots averages 43.4 (11-54.25) m²/ha.

In general, the shrub and herb layers are extremely sparse (<25 plants/100 m²), particularly in the pure foxtail pine areas. The most conspicuous species include *Selaginella watsonii* and several species of *Eriogonum*.

Meadow (45210, 45220): Although not specifically discussed, numerous species (at least 36) derived from the species list are typical meadow plants of the high S. Sierra Nevada. These taxa may be divided into moist, wet, and meadow-riparian situations.

Plant Diversity

Seventy-one taxa are listed.

Conflicting Impacts

There has been some grazing by domestic livestock in the meadow area. However, the principal impact comes from recreationists, mainly hikers using the Pacific Crest Trail, which passes along the S. border of the area. As of 1976, an undesignated trail that traverses the meadowy SW. portion of the RNA was experiencing increasing use.

Note: for Limekiln Creek, see Cone Peak Gradient #19

52. Long Canyon (Keeler-Wolf 1990b)

Location

This candidate RNA (cRNA) lies within the Greenhorn Ranger District on the Sequoia National Forest. Its boundaries include sections 3, 4, 9, 10, 15, and 16 of T27S, R34E (35°36'N., 118°20'W.), USGS Woolstalf Creek quad (fig. 106). Ecological subsection – Tehachapi-Piute Mountains (M261Es) and Southern Granitic Foothills (M261Fd).

Target Element

California Juniper (*Juniperus californica*), Single-Leaf Pinyon Pine (*Pinus monophylla*), and Piute Cypress (*Cupressus nevadensis*, Jepson [Hickman 1993]: *Cupressus arizonica* ssp. *nevadensis*) for the S. Sierra Nevada ecological section

Distinctive Features

Topographic complexity and elevational and substrate diversity contribute to the diverse habitats in the cRNA, which supports a relatively rich flora for this xeric site.

Piute cypress and desert chaparral are the only stands of this vegetation presently represented in the RNA system. The Piute cypress stands are found in only approximately 10 sites within the Kern River drainage. The stands present in the cRNA represent one of the easternmost populations of this localized species.

Rare Plants: The cRNA contains 5 CNPS listed species. The Piute cypress is a CNPS List 1B species. *Delphinium purpusii* (List 4) is found in shady rock crevices, particularly on the marble outcrop along the E. boundary. *Dudleya calcicola* (List 4) occurs on granitics, marble, and schist and is widespread throughout the lower and middle elevations in rock outcrops. *Eriogonum breedlovei* var. *breedlovei* (List 1B) and *Navarretia setiloba* (List 1B) also may be in the area.

Rare Fauna: The golden eagle (*Aquila chrysaetos*) and the gray vireo (*Vireo vicinior*), both listed as species of special concern by the State of California, are found in the cRNA.

A prominent band of marble runs up the E. boundary ridge from the NE. corner of the cRNA to approximately 6350 ft (1953 m) elevation. This outcrop supports a number of interesting plants characteristic of limestone substrates such as *Forsellesia nevadensis*, *Cryptantha confertiflora*, *Cheilanthes jonesii*, *Delphinium purpusii*, and *Dudleya calycina*.

Fire: Fire has contributed to the variation in age of many of the stands in the cRNA. Over half the area dominated by cypress burned in 1984. Most of the remaining cypress dates back to a fire around 1954, while a few older survivors exist in protected areas. Portions of the pinyon forest of upper elevation also burned in 1984 and exhibit an interesting mixture of cismontane and montane successional species. Other portions of the pinyon forest appear to have burned about 40 years ago. The 1984 fire also reduced the California juniper vegetation to only a small population on the marble outcrop of the NE. boundary and a few small scattered groves in the low elevations of the bajada slope. Much of the variation on the desert chaparral comes from the effects of the 1984 fire.

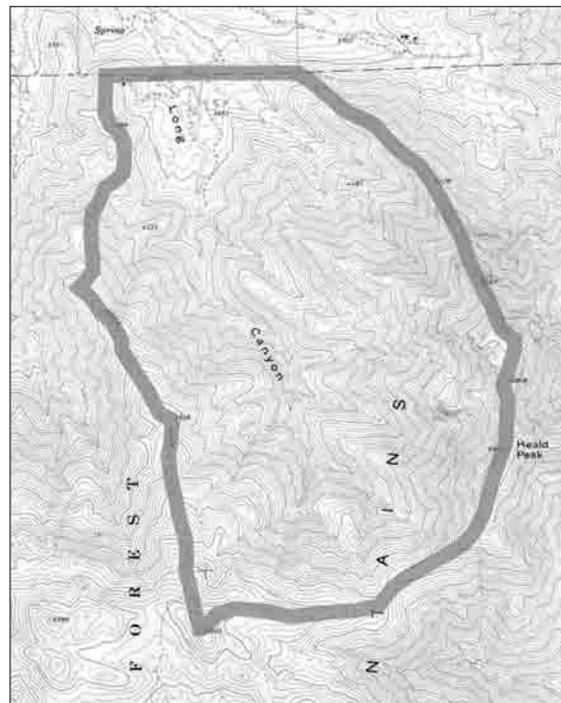


Figure 106— Long Canyon cRNA

Physical Characteristics

The area covers 2389 acres (967 ha) with an elevation range of 3550-6901 ft (1082-2103 m). The cRNA lies at the NE. end of the Piute Mountains and is highly varied topographically and geologically. It is a dry area with substantial desert influence, exhibiting a rapid W.-to-E. gradation from cismontane to desert vegetation.

The cRNA is geologically diverse, dominated by pre-Cenozoic metasedimentary rocks including schists, phyllite, and marbles in the N. and W. parts. Mesozoic granitic (part of the Sierra Nevada Batholith) rock dominates on the SW. and E. parts.

The soils of the cRNA are broken down into three main complexes. The Livermore family – Rock outcrop complex is the most extensive; it is a dark brown, cobbly, and stony sandy loam about 18 inches (46 cm) thick. The next most extensive soil is the Rock outcrop – Tollhouse complex, which is a shallow (17 inches [43cm]), brown, coarse, sandy loam over highly weathered granitic rock. The final soil type is the Xerofluvents – Xerothents association. Soils of this group are deep, gravelly, cobbly, and stony sandy loam and sandy loam occurring on the bajada slope at the N. end of the RNA. Rock outcrops also exist on the NE. boundary (marble outcrop).

No weather stations exist within the cRNA. The Piutes rise abruptly from the Kern River valley, and, consequently, temperature and precipitation change rapidly with elevation in the cRNA. The area falls between a Mediterranean climate and a steppe climate. The closest climate data are from Wofford Heights, approximately 9 miles (14.5 km) NW. of the SW. edge of the cRNA, and at an elevation of 2625 ft (800 m), which is about 2575 ft (785 m) lower than the cRNA. It is likely that precipitation for the upper elevations in the cRNA averages about 16 inches (406 mm) per year, while the lowest elevations average about 8 inches (203 mm) per year. No temperature data are available. It is estimated that the frost-free period ranges from 240 days at lower elevations to 180 days at upper elevations. There are probably 30-90 days when the maximum temperature exceeds 90 °F (32 °C).

Association Types

Desert Chaparral (37400): 1042 acres (422 ha). Desert chaparral vegetation contains a mixture of cismontane chaparral shrubs and cool or hot desert species; it is the most widespread vegetation type in the cRNA. It exhibits great variation, not only in successional state, but also as a result of slope exposure, elevation, and geological substrate.

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

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

Pinyon Forest (72210): 525 acres (213 ha). This association occupies the higher elevation, N.-facing slopes (fig. 107). It also occurs sporadically in sheltered canyons. It is dominated by single-leaf pinyon pine (occurring almost exclusively at the higher elevations) and codominates with canyon live oak (*Quercus chrysolepis*) and foothill pine at lower elevations. At the highest elevations, pinyon has an average density of 235 trees/acre (580 trees/ha); most of the trees here appear to be less than 200 years old. Sapling and seedling density is low (12/acre [30/ha]). Understory cover is low with *Ribes velutinum* var. *glanduliferum*, *Ephedra viridis*, *Galium munzii*, and *Phlox diffusasubcarinata* being most common.

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

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

The burned portion of the pinyon forest on the NW.-facing slope of Heald Peak contains no pinyon seedlings or saplings and an uncharacteristic assemblage of herbs such as *Phacelia fremontii*, *Eriophyllum abiguum*, *Phacelia egena*, and *Layia glandulosa*.

Annual Grassland (42200): 492 acres (199 ha). This association type occupies xeric, S.-facing slopes up to 5600 ft (1701 m). The substrate is generally rocky and not very deep. The most widespread dominant species are *Avena fatua*, *Bromus rubens*, and *B. tectorum*. Several native perennial grasses also occur scattered. They are *Sitanion hystrix*, *Poa scabrella*, *Stipa coronata*, and *Melica imperfecta*. Woody perennial species occurring include *Yucca whipplei* ssp. *caespitosa*, *Ephedra viridis*, *Eriogonum fasciculatum*, *Fremontodendron californicum*, *Ceanothus greggi* ssp. *vestitus*, *Keckliella breviflorus*, *Mimulus longiflorus* ssp. *calycinnus*, *Encelia virginianus*, *Lotus scoparius*, and *Eriophyllum confertiflorum*.

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

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

Foothill Pine Woodland (71300): 115 acres (47 ha). This association is found on the alluvial deposits of the bajada slope at the mouth of Long Canyon and is a mixture of cismontane and transmontane species. The dominate foothill pines are relatively small – average height is about 20 ft (6 m) – and young, appearing to have burned within the past 35-40 years. The canopy is open, with 10-30 percent cover. The shrub cover is dominated by California juniper, *Ceanothus leucodermis*, *C. greggii* ssp. *vestitus*, and *Fremontodendron californicum*. The understory averages about 60 percent cover and includes *Haplopappus linearifolius*, *Lepidospartum squamatum*, *Artemisia tridentata*, *Eriogonum fasciculatum* ssp. *poliofolium*, *Chrysothamnus nausiosus*, and *Sencio douglasii*.

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

Shin Oak Brush (37541): 89 acres (56 ha). Shin oak dominates a small area of high elevation, NW.-facing granitic slopes. It is a clonal resprouter and tends to occur in large, dense patches. In addition to the dominant shin oak, *Garrya*



Figure 107—Long Canyon, view of west-facing pinyon pine forest on upper slopes of Heald Peak in Long Canyon cRNA. (1989)

flavescens ssp. *pallida*, *Ceanothus greggii* ssp. *vestitus*, and *Fremontodendron californicum* also are found in the canopy layer. The understory includes *Symphoricarpos parishii*, *Solanum xantii*, and *Ribes roezlii*. Annual and perennial herbs include *Phacelia mohavensis*, *P. davidsonii*, *Mimulus fremontii*, *Senecio breweri*, and *Zigadenus exalticus*.

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

Jeffrey Pine Forest (85100): 55 acres (22 ha). This association type is restricted to two stands, one recently burned and one unburned. Both stands occupy N.-facing exposures on granitic soils. The larger stand suffered a crown fire in 1984 that killed all the trees. This stand currently supports low resprouts (3 ft [1 m]) of Jeffrey pine (*Pinus jeffreyi*), California black oak, and canyon oak. The understory is dominated by resprouts of shin oak and *Symphoricarpos parishii* along with *Solanum xantii* seedlings. The herbaceous vegetation is well developed and includes *Lupinus albicaulis* var. *shastensis*, *Silene verecunda* ssp. *platyota*, *Lithophragma parviflora*, *Cystopteris fragilis*, and *Arabis repanda*.

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

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

Piute Cypress Forest (83330): 20 acres (8 ha). This association type is made up of two stands occupying slopes ranging from due N. to due E. The stands are underlain by schistose metamorphics and separated by a SE.-facing band of annual grassland. The majority of the N. stand burned in 1984, while the smaller S. stand was last burned in the late 1940s. Cypress seedlings were present on all plots and ranged from densities of 7-73 seedlings/100-m² plot. In addition to the cypress, 30 species of plants were noted on the burned plots. *Ceanothus greggii* ssp. *vestitus* seedlings and resprouts of *Fremontodendron californicum* were the most common. Total ground cover on the burned plots ranged from 30 to 60 percent.

The trees in the unburned stand vary in size from broad and tall at lower elevations, to stunted at higher elevations. Cone size varies also and is directly correlated with the size of the tree. Tree density on the unburned plots was 6-61 trees/100 m², and tree size was 1-2 inches (2.5-5 cm) dbh, 8-10 ft (2.5-3 m) tall. The understory is composed of only half the species (15) as in the burned stand; it is dominated by *Ceanothus greggii* ssp. *vestitus*.

California Juniper Scrub (72400): 12 acres (5 ha). The 1984 fire destroyed many of the best stands of California juniper in the cRNA. Before the fire, juniper ranged up to the summit of the W. ridge and throughout the desert chaparral and annual grassland. The only area where extensive California juniper remains is along the marble outcrop (cover between 10-30 percent). It is also found scattered at lower elevations on the bajada slope near the N. boundary and along the W. boundary ridge. The most common understory species are *Stipa speciosa*, *Yucca whipplei* ssp. *caespitosa*, and *Haplopappus linearifolius*.

White Alder Riparian Forest (61510): 15 acres (6 ha). This association is restricted to narrow strips of permanently moist areas along the Long Canyon

streambed. The white alders (*Alnus rhombifolia*) are small (not more than 20 ft [6 m] tall) and short lived due to fluctuating water availability. Associated species include *Salix lasiolepis* var. *bracelinae*, *Populus fremontii*, *Ribes nevadense*, *Mimulus guttatus*, *M. cardinalis*, *Nasturtium officinale*, *Juncus xiphioides*, and *J. macrophyllus*.

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

Plant Diversity

Two hundred forty-five species of vascular plants are listed.

Conflicting Impacts

Despite proximity to human development, the cRNA has experienced little impact. One dirt road enters the cRNA in the N. region. A few campsites and a cluster of old bee boxes (no longer in use) are associated with the road. The westernmost branch of the road ends at a mining excavation in metamorphic rock, but appears not to be in use. Dirt bikes and other off-highway vehicles appear to have used the road and the main trail.

Cattle grazing is limited to the annual grassland with little or no impact on the shrubs of the adjacent foothill pine woodland or the vegetation along the streambed. The few cattle seen were near the N. boundary where a fence delineates the RNA. However, the current condition of the fence allows the cattle to easily cross.

53. Lyon Peak/Needle Lake (Nachlinger 1988b, Martin 1991a)

Location

This established RNA is on the Tahoe National Forest, Placer County. It lies in the Truckee District approximately 9.5 miles (15 km) SE. of Soda Springs and 9.5 miles (15 km) SW. of Truckee. Its boundaries include sections 22, 27, 28, and 34 of T16N, R15E MDBM (39°13'N., 120°18'W.), USGS Granite Chief quad (fig. 108). Ecological subsection – Upper Batholith and Volcanic Flows (M261Eh).

Target Element

Mountain Hemlock (*Tsuga mertensiana*)

Distinctive Features

The mountain hemlock stands of the RNA feature a diversity of stand size and age structures encompassing most, if not all, of the major types throughout the Lake Tahoe region. In addition to the mountain hemlock, other undisturbed plant communities such as shrub lands, meadows, fell-fields, and a subalpine lake are also present.

Rare Plants: No Federally-listed endangered or rare plants are known to occur in the area; however, two CNPS sensitive species occur within the watershed of the RNA. *Silene invisa* (CNPS List 4) and *Veronica cusickii* (CNPS List 4) are found at mid-level elevations in the drainage flowing N. from Lyon Peak. Potential habitat for these species occurs just N. of the RNA boundary.

Rare Fauna: The northern goshawk (*Accipiter gentilis*, California species of special concern, Forest Service-listed sensitive species) and marten (*Martes americana*, Forest Service-listed sensitive species), as well as the golden eagle (*Aquila chrysaetos*, California State species of special concern), have been

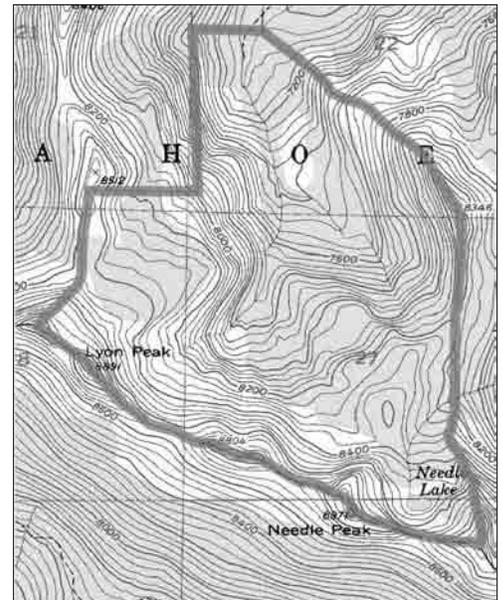


Figure 108—Lyon Peak/Needle Lake RNA

observed within the RNA. Additionally, the State-listed threatened species wolverine (*Gulo gulo*) has been observed on properties adjacent to the RNA. Potential habitat for the Sierra Nevada red fox (*Vulpes vulpes necator*), another State-listed threatened species and Forest Service-listed sensitive species, also exists on the RNA.

Archeological: Many projectile points and other cultural artifacts from native people, the Washoe and Nisenan (Maidu), have been discovered within the RNA. Prehistoric rock-art sites of the headwaters basin have been recorded in the vicinity, although these are outside the RNA boundaries.

Physical Characteristics

The area covers about 700 acres (283 ha) at 7040-8971 ft (2145-2735 m). The RNA encompasses the uppermost reaches of the N. Fork of the American River immediately adjacent to the main Sierra Nevada crest. The higher elevations of the RNA include isolated peaks, rock walls, small cirques, talus slopes, and rocky basins, as well as the distinctive Lyon Peak/Needle Peak ridgeline. Needle Lake, a subalpine lake sculpted from glacier ice, is just below Needle Peak. A full range of slope aspects is present, but the most common are W., NW., N., NE., and E.

Two rock types predominate in the RNA. Jurassic-Cretaceous granitics (Granite Chief area), and Pliocene andesitic volcanics (Lyon Peak and Needle Peak areas).

Although no comprehensive soil survey has been conducted for the RNA, the Tahoe National Forest has conducted a reconnaissance-level survey of the area. Thirteen soil mapping units can be found within the RNA. They are: Aquolls and Borolls (0-5 percent slopes), Rock outcrop-granitic, Meiss-Gullied land-Rock outcrop complex (30-75 percent slopes), Meiss-Rock outcrop complex (30-75 percent slopes), Meiss-Waca-Rock outcrop complex (30-50 percent slope), Meiss-Waca-Cryumbrepts (2-30 percent slope), Meiss-Waca-Cryumbrepts (30-75 percent slopes), Rock outcrop-granitic-Tinker Cryumbrepts (30-75 percent slopes), Rubble land-Rock outcrop complex, Tinker-Rock outcrop-Granitic Cryumbrepts (2-30 percent slopes), Tinker-Rock outcrop-Granitic Cryumbrepts (30-75 percent slopes), Rock outcrop-volcanic, and Ledford Variant-Rock outcrop complex (30-75 percent slopes).

No climate data exist specifically for the RNA. General climate in the region is Mediterranean. The nearest weather stations are at the Central Sierra Snow Laboratory in Soda Springs (6890 ft [2100 m]), 9 miles (14 km) from the RNA, with an average annual precipitation of 62.6 inches (1592 mm) (no temperature data) and at the Squaw Valley Fire Department (6240 ft [1902 m]), 5 miles (8 km) E. of the RNA where the average annual precipitation is 60 inches (1538 mm) (no temperature data). Both stations are lower in elevation than the RNA, and thus probably have drier, warmer climates. A botanical researcher familiar with the area (Grove 1978) estimated mean annual precipitation at Lyon Peak to be 79 inches (2000 mm), and mean annual temperature to be 38 °F (3.1 °C).

Association Types

Mountain Hemlock Forest (White Bark Pine-Mountain Hemlock Forest) (86210): 370 acres (150 ha). Mountain hemlock forests account for the greatest vegetation cover within the RNA, and they tend to dominate the upper elevations of the RNA (*fig. 109*). On gentle, protected slopes, the forests are open with well-spaced, old growth individuals with *Evernia* growing on the trunks. Steeper slopes support stands of smaller, tightly clumped trees and are often pistol-butted on the steepest slopes, indicating snow creep. The most exposed sites at tree line support groves of stunted, and sometimes krummholz, tree forms.

Density and basal area for the climax forests average 530-571 stems/acre (1310-1410 stems/ha) and 340-462 ft²/acre (78-106 m²/ha).

Other conifers commonly present are red fir (*Abies magnifica*), white bark pine (*Pinus albicaulis*), western white pine (*Pinus monticola*), and Sierra lodgepole pine (*Pinus contorta* var. *murrayana*). Under-story vegetation is usually depauperate, except in moist openings or along minor stream courses, and includes *Arabis platysperma* var. *howellii*, *Carex rossii*, *C. luzualefilia*, *Juncus parryi*, *Ligusticum grayi*, *Lupinus lyallii*, *Luzula divaricata*, and *Phyllodoce breweri*.

Acreages of the following four types (37530, 37550, 45220, 86100) are combined with that of mountain hemlock forest type.

Montane Ceanothus Chaparral (37530): This is a minor plant community type dominated by *Ceanothus velutinus*. It is found on relatively moist substrates in openings of the upper montane coniferous forest, most often as a snowbank community in hollows and avalanche paths. This community forms dense stands about 5 ft (1.5 m) tall. Associates include *Amelanchier pallida*, *Ceanothus integerrimus*, *Chrysolepis sempervirens*, *Prunus emarginata*, and *Quercus vaccinifolia*.

Bush Chinquapin Chaparral (37550): This is a minor plant community type dominated by *Chrysolepis sempervirens*. It is found typically on drier, rocky slopes and in openings. It forms fairly dense thickets about 3 ft (1 m) tall. Associates include *Arctostaphylos nevadensis*, *A. patula*, *Ceanothus velutinus*, *Prunus emarginata*, and *Quercus vaccinifolia*.

Dry Subalpine Meadow (45220): This is a minor community type found at edges of the mountain hemlock forest where grasses, sedges, and forbs form a low, fairly open vegetation. Common species include *Achillea lanulosa*, *Bromus marginatus*, *Calyptridium umbellatum*, *Carex athrostachya*, *C. exserta*, *C. stramineiformis*, *Erigeron peregrinus* ssp. *callianthemus*, *Penstemon oreocharis*, *Stipa occidentalis*, *Taraxacum officinale*, and *Trisetum spicatum*.

Lodgepole Pine Forest (86100): This forest type does not form pure stands on the RNA. It is a minor community type in ecotonal situations on rocky, well-drained soils between Jeffrey pine-fir and mountain hemlock forests. The lodgepole pines are generally dense, slender trees about 100 ft (30 m) tall. The understory is sparse and includes *Arctostaphylos nevadensis*, *Chrysopsis breweri*, *Pedicularis semibarbata*, and *Phyllodoce breweri*.

Jeffrey Pine-Fir Forest (85210): 180 acres (73 ha). This is the dominant plant community at middle elevations on coarse textured, well drained rocky soils. It comprises the upper montane coniferous forest zone within the RNA. Jeffrey pine (*Pinus jeffreyi*) dominates drier, higher elevations, while red fir dominates moister sites. White fir (*Abies concolor*) is more common at lower elevations. Other conifers present, generally at upper boundaries, include western white pine and lodgepole pine. On drier sites, the understory is typically sparse, with scattered evergreens such as *Arctostaphylos patula* and *Ceanothus cordulatus*. Red-fir-dominated forests are denser, and the understory is broad-leaved, with shrubs such as *Ribes* and *Symphoricarpos*.



Figure 109—Lyon Peak/Needle Lake, view of the mountain hemlock forest in upper elevations of the Lyon Peak/Needle Lake RNA. (around 1987/88)

The following three types (63500, 45100, 45210) cover 65 acres (25 ha).

Montane Riparian Scrub (63500): This association type is found lining drainages throughout the area and in close association with montane meadows. The canopies are open to closed and often form streamside thickets. Several species of *Salix* dominate the riparian areas including *S. eastwoodiae*, *S. jepsonii*, *S. lemonii*, and *S. orestera*. *Alnus tenuifolia* is a common codominant, and *Cornus stolonifera* is often present at lower elevations. The understory is sparse, except where adequate sunshine penetrates the canopy. Understory species include *Cardamine breweri*, *Carex scopulorum*, *Dodecatheon jeffreyi*, *Glyceria elata*, *Juncus chlorocephalus*, *Lupinus polyphyllus* ssp. *superbus*, and *Poa pratensis*.

Montane Meadow (45100): Montane meadows are found on flat depressions where the groundwater table is shallow. A diverse flora of herbaceous plants dominates, but woody shrubs, including *Salix*, are often present. The dense vegetation is usually less than 3 ft (1 m) tall. Common species include *Agrostis variabilis*, *Calamagrostis canadensis*, *Carex aquatilis*, *C. nigricans*, *C. rostrata*, *Castilleja miniata*, *Erigeron coulteri*, *Hordeum brachyantherum*, *Mimulus guttatus*, *Muhlenbergia filiformis*, *Poa pratensis*, *Scirpus congdonii*, *Senecio triangularis*, *Sphenosciadium capitellatum*, *Stellaria longipes*, *Trifolium longipes*, and *Veratrum californicum*.

Wet Subalpine Meadow (45210): This association is restricted mostly to the margins of streams, forming stringer meadows within mountain hemlock forests. The short herbaceous vegetation usually provides 100 percent cover. Dominant species include *Aster alpigenus* ssp. *andersonii*, *Carex rostrata*, *C. scopulorum*, *Deschampsia cespitosa*, *Dodecatheon alpinum* ssp. *majus*, *Eleocharis pauciflora*, *Gentiana simplex*, *Juncus orthophyllus*, *Minulus primuloides*, *Pedicularis groenlandica*, *Phleum alpinum*, *Potentilla breweri*, and *Ranunculus alismaefolius* var. *alismellus*.

Sierra Nevada Fell-Field/Alpine Talus and Scree Slope (91120/91200): 85 acres (35 ha). The fell-field community occurs along principal ridgelines at the highest elevations or between mountain hemlock stands near the tree line. Slopes are often gentle but occasionally steep. Common species include *Carex spectabilis*, *Cassiope mertensiana*, *Haplopappus acaulis*, *Kalmia polifolia* var. *microphylla*, *Leptodactylon pungens* ssp. *pulchriflorum*, *Penstemon newberryi*, *Phoenicaulis cheiranthoides*, and *Primula suffrutescens*.

Although no truly alpine habitats occur within the RNA, talus and scree slope plant communities have developed as a minor community type in certain areas. In the RNA it occurs scattered on the rocky, well-drained, high flanks of Lyon Peak and Needle Peak. Common species include *Carex spectabilis*, *Epilobium obcordatum*, *Eriogonum ovalifolium* var. *nivale*, *Haplopappus macronema*, *Oxyria digyna*, *Saxifraga tolmiei*, and *Sitanion hystrix*.

Grove (1978) describes plant associations for the fell-field and talus and scree slope areas. They are *Leptodactylon pungens* ssp. *pulchriflorum*-*Sitanion hystrix* and *Eriogonum umbellatum* ssp. *polyanthum*-*Phoenicaulis cheiranthoides* for the fell-field and *Phoenicaulis-Haplopappus acaulis* for the scree-slope plant community.

Plant Diversity

Three hundred eighty-seven species of vascular plants are listed.

Conflicting Impacts

The RNA is near pristine and rather isolated. It is surrounded on all sides by either Federally and State wilderness areas and reserves, or private lands managed in a manner compatible with protection and research.

The Pacific Crest Trail provides access into the upper basin of the N. Fork of the American River; however, traffic is relatively light. Needle Lake is an

occasional overnight camping spot for hikers in the area. Overall, recreational use is light except near Needle Lake and probably poses no serious impacts to the RNA.

The Squaw Valley ski area abuts the upper watershed of the N. Fork of the American River, but the boundary is clear and little ski traffic extends into the N. Fork basin.

54. Manzanita Creek (Trelorita) (Taylor and Teare 1979b, Cheng 1996a)

Location

Manzanita Creek RNA is on the Shasta-Trinity National Forest. The S. end of the RNA lies about 1 mile (1.6 km) E. of Big Bar along State Route 299. The area includes all or portions of 14 sects. of T34N, R12W MDBM (40°48'N., 123°14'W.), USGS Helena, DeLoma, and Big Bar quads (*fig. 110*). Ecological subsections – Trinity Mountain-Hayfork (M261Ar) and North Trinity Mountain (M261Aq).

Target Element

Ponderosa Pine-Douglas-Fir (*Pinus ponderosa*-*Pseudotsuga menziesii*)

Distinctive Features

Large Pristine Watershed: This area contains the entire watershed of Manzanita Creek. There is a gauging station at the mouth of the creek, which would be useful for watershed and ecosystem studies. The entire area is relatively undisturbed by human activity. Old trails provide access to much of the area. Because of the area's size and topographic relief, at least nine SAF forest types are included. After extensive sampling of the area, 17 plant associations were recognized. These include riparian types as well as a series of forest types from foothill pine (*Pinus sabiniana*) to montane white fir (*Abies concolor*).

Rare Plants: *Lewisia cotyledon* var. *heckneri*, a diagnostic member of the high ridgetop flora, is a member of CNPS List 1B.

Fire History: Fire has been the primary disturbance factor in the area. It has contributed to the diversity of plant communities, seral stages, and forest age classes. Records show there was one major fire in 1878, one between 1917 and 1927, 11 from 1927 to 1936, one around 1953, one small controlled burning in 1978-79, and one major fire in 1985, when 54 percent of the RNA (3950 acres [1599 ha]) burned.

Physical Characteristics

The area of established RNA is 7250 acres (2935 ha). Elevations range from 1200 ft (365 m) at Big Bar to 5916 ft (1803 m) atop Twin Sisters Mountain. Manzanita Creek flows to the S. with the prominent Treloar and Manzanita ridges bounding the W. and E. sides of the drainage, respectively. Slopes are generally steep (20-40°) with small terraces at lower elevations and relatively broad ridgetops.

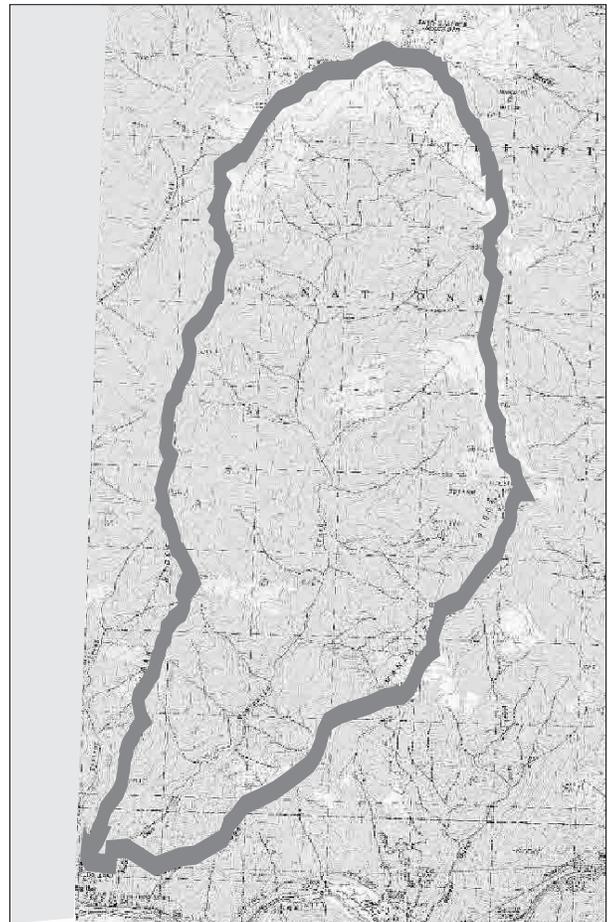


Figure 110—Manzanita Creek RNA

Manzanita Creek is a perennial stream with several minor ephemeral tributaries. The average gradient of Manzanita Creek is 296 ft/mile (56 m/km). Several springs occur in the drainage.

The area is underlain by Pre-Cretaceous metamorphic rocks (primarily noncalcareous). A fault cuts across the upper part of the drainage separating the metasediments from metavolcanics of the same approximate age in the upper basin. There are slivers of serpentized rock along this fault line. Soils are assumed to be Sheetiron-Josephine, Dubakella-Neuns, and Henneke-Stonyford complexes. Annual precipitation at Big Bar is 40 inches (1018 mm); mean annual temperature is 56 °F (13.4 °C). Temperatures are substantially lower and precipitation is substantially higher at the highest elevations.

Association Types

Vegetation was sampled extensively. In addition to 70 releves where density, cover, and other characteristics were estimated, twenty-six 314-m² plots were sampled to obtain density and cover data. Association tables were constructed from the releve data, resulting in the following classification. Acreages are based on the establishment record (Cheng 1996a). Six major alliances are defined and broken into associations.

White Alder-*Peltiphyllum peltatum* Alliance: 376 acres (152 ha)

White Alder-Miner's Dogwood (*Alnus rhombifolia*-*Cornus sessilis*) Association (61510): This riparian association occurs along Manzanita Creek and on the lower reaches of its tributaries with year-round flow. Other trees include Oregon ash (*Fraxinus latifolia*) and bigleaf maple (*Acer macrophyllum*). Pacific yew (*Taxus brevifolia*) is occasional along with Douglas-fir and canyon live oak (*Quercus chrysolepis*). Shrubs are diverse and include *Acer circinatum*, *Corylus cornuta* ssp. *californica*, *Symphoricarpos mollis*, *Crataegus douglasii*, *Rhamnus purshiana*, *Philadelphus lewisii* ssp. *gordanianus*, and *Ribes roezlii*. *Lonicera hispidula*, *Rubus leucodermis*, *R. procerus*, and *Vitis californica* festoon the trees and shrubs in sunnier areas. Herbs are few and large including *Aralia californica*.

White Alder-Creek Dogwood (*Alnus rhombifolia*-*Cornus stolonifera*) Association (61510): This is the upper elevation equivalent of the previous association. It occurs generally above 4000 ft (1200 m). Creek dogwood, *Rhododendron occidentale*, and the willow *Salix commutata* dominate under a scattered canopy of white alder. Shrubs are rare and herb cover is high, often dominated by *Carex amplifolia* and *Torreyochloa* (*Puccinellia*) *pauciflora*.

Foothill Pine Alliance: 118 acres (48 ha)

Foothill Pine-*Cercis occidentalis* Association (71322): This association occupies the lower S. and E.-facing steep, rocky slopes. It includes a canopy of scattered (119 stems/ha) foothill pine (basal area 21.5 m²/ha), canyon live oak, and Oregon white oak (*Quercus garryana*) with chaparral shrubs such as *Ceanothus cuneatus*, *Cercis occidentalis*, and *Toxicodendron diversilobum*. Annual herbs are important, but not identified.

Ceanothus cuneatus Association (37810): This chaparral association occurs on rocky, xeric slopes at low elevations. It is patchy in distribution. The dominant is the only important shrub. Annual herbs are dense, but not discussed in the ecological survey.

Douglas-Fir Alliance: 6035 acres (2443 ha)

Oregon White Oak Association (71110): 1037 acres (420 ha). Many understory taxa are shared among these next three associations. Douglas-fir is the principal invader of seral forms of this association. The nonseral form occupies steep, rocky but mesic slopes. This type has a dense canopy of Oregon white oak with a very sparse shrub layer. Herbaceous cover is principally the native grass *Bromus marginatus*.

Douglas-Fir-Canyon Live Oak Association (81100): 1871 acres (757 ha). This is the most widespread association type in the study area. It occurs at lower elevations on N. slopes but ranges to S. slopes at mid- to upper elevations. Douglas-fir forms an open canopy over a subcanopy of dense canyon live oak. Bigleaf maple and Pacific madrone (*Arbutus menziesii*) are important codominants. Douglas-fir averages 20.4 m²/ha basal area and 254 stems/ha. Canyon live oak averages 9.2 m²/ha basal area and 593 stems/ha.

Ponderosa Pine-California Black Oak (*Pinus ponderosa-Quercus kelloggii*) Association (84110, 84131): 3127 acres (1266 ha). This distinct association is less mesic than the previous one. Open park-like stands of ponderosa pine and sugar pine (*Pinus lambertiana*) form a high canopy over large, scattered California black oak. Ponderosa pine averages 62.5 m²/ha basal area, Douglas-fir averages 34.8 m²/ha, and sugar pine 18.7 m²/ha. Densities of these species are 190, 55, and 310/ha, respectively. Dense reproduction of Douglas-fir occurs in areas that have been spared recent fire. Following crown fire, *Ceanothus integerrimus* is the pioneer shrub. Stands with various successional states occur, indicating a clear trend toward Douglas-fir-canyon live oak forest with infrequent fire.

White Fir Alliance: 350 acres (142 ha)

Douglas-Fir-Pacific Dogwood (*Cornus nuttallii*) Association (82420): 85 acres (34 ha). This association occurs on the most mesic, lower-elevation sites. White fir dominated forest replaces it at upper (cooler) elevations.

Douglas-fir forms a dense closed canopy averaging 67 m²/ha basal area and 106 stems/ha. White fir is codominant, averaging 19.6 m²/ha basal area and 403 stems/ha. Pacific dogwood and bigleaf maple form a subcanopy. The shrub and herb layers are well developed and include *Symphoricarpos mollis*, *Toxicodendron diversilobum*, *Polystichum munitum* var. *imbricans*, and *Rosa pisocarpa*.

White Fir-Douglas-Fir Association (84240): This is a minor transitional association between Douglas-fir and white fir dominance. Two plots indicate an average basal area of 50 m²/ha and 33 m²/ha for white fir and Douglas-fir, respectively.

White Fir-*Acer glabrum* Association (84240): This is the dominant climax vegetation on upper mesic slopes. White fir dominates, with an average basal area of 90 m²/ha. *Acer glabrum* forms a low subcanopy along with *Sorbus scopulina*. A diverse shrub layer includes *Sambucus melanocarpa* and *Ribes nevadense*. The herb layer is also well developed and diverse with such species as *Castilleja miniata*, *Actaea rubra* ssp. *arguta*, *Agastache urticifolia*, *Chamaenerion (Epilobium) angustifolium*, and so forth. Following fire, *Quercus vaccinifolia* or knobcone pine, or both, establish. Succession leads to stands in the white fir-Douglas-fir association or white fir association, followed by the establishment of the white fir-mountain maple association.

White Fir Association (84240): This association is seral after crown fire in the former association type. A typical stand has dense, even-aged white fir over dead or senescent *Quercus vaccinifolia*. The understory is sparse or absent.

Knobcone Pine-*Quercus vaccinifolia* Association (83210): 81 acres (33 ha). This association develops on steep slopes at mid-elevation after intense fire. It is seral to the white fir-dominated forests. Knobcone pine forms a dense, even-aged



Figure 111—Manzanita Creek, view of the southerly face of Twin Sisters Mountain. *Quercus vaccinifolia* dominated vegetation shown in the lower portion is seral to forest, while the open stand above is non-seral and supports dense *Cercoparpus betuloides* var. *macrourus*. (1979)

canopy averaging 34 m²/ha basal area and 594 stems/ha. *Quercus vaccinifolia* forms a dense shrub understory. *Pedicularis densiflora* and *Apocynum pumilum* are among the few herbs.

Salix jepsonii-*Paxistima myrsinites* Association (63500): 184 acres (74 ha). This distinctive minor association occurs in ravines and N.-facing hollows at upper elevations. Its successional status is unclear. Typical stands have a scattered overstory of white fir over a tall-shrub canopy of *Salix jepsonii*, *Euonymus occidentalis*, *Rhamnus purshianus*, *Acer glabrum*, *Amelanchier pallida*, and *Ribes nevadense*. *Paxistima myrsinites* is a conspicuous, small shrub. Herbs such as *Elymus glaucus*, *Trientalis latifolia*, *Disporum hookeri* ssp. *trachyandrum*, *Smilacina racemosa* var. *amplexicaulis*, *Ligusticum californicum*, *Eupatorium occidentale*, *Campanula prenanthoides*, and *Adenocaulon bicolor* line the rocky ravine bottoms.

***Quercus vaccinifolia* Alliance:** This alliance is not listed in the establishment record.

Cercocarpus betuloides var. *macrourus* Association (37510): This vegetation occurs on the steepest slopes at the head of the drainage. On rocky sites it is climax, but it is seral after intense fires on deeper soils, succeeding to white fir-dominated forests (fig. 111). The most conspicuous species of the seral type are the shrubs *Quercus vaccinifolia*, *Garrya fremontii*, *Arctostaphylos patula*, *Prunus emarginata*, *Ceanothus integerrimus*, and *C. velutinus*. The nonseral ridgetop phase is dominated by *Cercocarpus betuloides*, *Quercus vaccinifolia*, and *Q. garryana* var. *breweri*.

***Holodiscus microphyllus* Alliance:** 371 acres (150 ha)

Holodiscus microphyllus-*Eriogonum compositum* Association (no Holland equivalent): This association occurs on flat and rolling rock outcrops at the head of the drainage. The vegetation is sparse, with scattered large *Holodiscus microphyllus* shrubs and clumps of *Eriogonum compositum*.

Holodiscus microphyllus-*Silene grayi* Association (no Holland equivalent): This vegetation occurs on the highest xeric, rocky summit of Twin Sisters Mountain. Along with the two species defining this association are the herbs *Luina hypoleuca* and *Galium grayanum*.

Holodiscus microphyllus-*Lewisia cotyledon* var. *heckneri* Association (no Holland equivalent): This association is restricted to near-vertical cliff faces. *Selaginella wallacei*, *Pellaea brachyptera*, and the two previously named species occur in the small crevices and ledges of the rocks.

Plant Diversity

Two hundred forty-nine taxa are listed.

Conflicting Impacts

Recreational use (hunting and off highway vehicles) and grazing occur in the RNA, but the current usage does not conflict with the objectives of this RNA.

55. Mayfield (Imper 1991b)

Location

This candidate RNA is on the Lassen National Forest in Siskiyou County. It is approximately 37 air miles (60 km) due E. of Mount Shasta and about 27 miles (43 km) N. of Fall River Mills. The cRNA lies within the Hat Creek Ranger District. Its boundaries include parts of sections 10, 11, 12, 14, and 15 of T40N, R3E MDM (41°19'N., 122°36'W.), USGS Hambone quad (fig. 112). Ecological subsection – Medicine Lake Lava Flows (M261Dh).

Target Element

Knobcone Pine (*Pinus attenuata*)

Distinctive Features

The cRNA, which includes some of the most extensive knobcone pine forest known in the E. portion of its range in California, is located on an extensive lava flow that originates in the Medicine Lake Highlands, 18 miles (29 km) N. The volcanic substrate and the absence of any permanent surface water have contributed to the uniquely depauperate and uniform flora of the area.



Figure 112—Mayfield cRNA

Rare Plants: No Federally-, State- or Forest Service-listed sensitive plants species are known to occur in the area. On the basis of habitat and range distribution, the following rare species could occur: *Calochortus longibarbat* (CNPS List 1B), *Orcuttia tenuis* (CNPS List 1B), *Gratiola heterosepala* (CNPS List 1B), *Asplenium septentrionale* (CNPS List 2), *Trillium ovatum* ssp. *oettingeri* (CNPS List 4), and *Fritillaria eastwoodiae* (CNPS List 1B). Two species endemic to the basalt flows of the Modoc Plateau (not listed by CNPS) are *Agastache parvifolia* and *Penstemon deustus* ssp. *heterander* (Jepson [Hickman 1993]: *Penstemon deustus* var. *pedicellatus*).

Fauna: The cRNA does not support much wildlife because there is no permanent water source nearby. No sensitive species have been reported for the area, although a golden eagle (*Aquila chrysaetos*, California species of special concern) area is located immediately E. of the cRNA and the Townsend's big-eared bat (*Plecotus townsendii*, California species of special concern) is suspected within the cRNA. Other sensitive species that could be in the vicinity include wolverine (*Gulo gulo*, State-listed threatened species), fisher (*Martes pennanti*, Forest Service-listed sensitive species), marten (*Martes americana*, Forest Service-listed sensitive species), Swainson's hawk (*Buteo swainsoni*, State-listed threatened), Sierra Nevada snowshoe hare (*Lepus americanus tahoensis*, California State species of special concern), and spotted bat (*Euderma maculatum*, California State species of special concern).

Geology: The geology within the cRNA is volcanic, recent basalt (USGS Alturus Sheet). The lava flow is approximately 4 miles (6 km) wide in this vicinity. The age of the flow is believed to be less than a few thousand years.

The lava rock itself is relatively unweathered and varies in color from black to dark red. Lava morphology of the cRNA ranges from lava tubes and ridges to ropy lava. The difference in lava morphology and perhaps chemistry appears to have had a direct influence on the present vegetation pattern.

Fire History: Numerous spot fires caused by lightning have burned near the cRNA, but none actually within the cRNA. It appears that no significant fire has occurred in the cRNA since about 1910. Current California Department of Forestry policy is to control fires in this area.

Preponderance of Disease: The cRNA exhibits severe, widespread infection of knobcone and ponderosa pine (*Pinus ponderosa*) by western dwarf mistletoe (*Aceuthobium campylopodum*) and to a lesser extent, infection of western juniper (*Juniperus occidentalis*) by American mistletoe (*Phorodendron bolleanum*). Because of their relatively old age and the effects of drought, knobcone pines have been particularly susceptible to infection and mortality. As the infection by the mistletoe persists, the knobcone pine forest will continue to be converted to chaparral.

Physical Characteristics

The area covers 1000 acres (404 ha). Elevation over the entire cRNA varies less than 20 ft (6 m) from 3880 ft (1183 m). Low elevations are associated with the bottom of collapsed lava tubes, sinkholes, and other localized, low flats (covered by knobcone pine forest). Slopes are gentle to flat. Fissures up to 20 ft (6 m) deep occur in the W. portion of the area associated with a reticulated system of lava tubes running NW. to SE.

The area is mapped as lava flow in the Forest Soil Survey (Kliewer 1983) with 10 percent Lithic Xerochrepts and Lithic Xerumbrepts. Soils are generally shallow, sandy loams restricted to pockets or localized low areas of rock, and they are well to excessively drained. In some areas, a layer of gray ash occurs on top of the bedrock.

Precipitation and temperature are typical of the eastside pine type in NE. California. Precipitation averages about 25 inches (63 cm) annually, with about 70 percent falling as snow. Temperatures range from about 105 to -30 °F (41 to -34 °C), with an estimated 100 frost-free days per year.

Association Types

Vegetation is typical of the volcanic substrate and shows little variation over the landscape. There are four recognized community types, which overlap considerably in species composition and physical habitat characteristics.

Knobcone Pine Forest (83210): 320 acres (129 ha). The knobcone pine forest is the second most abundant vegetation in the area. However, it is in decline due to the combined effects of drought and mistletoe infection and currently restricted to isolated stands of 40 acres (16 ha) or less. As little as 15-20 years ago, this forest probably comprised 60-70 percent of the area. The healthier, older stands (up to 120 years old) are confined to the low areas (lava tube sinkholes), where better soil conditions appear to have increased the vitality of these pines (*fig. 113*).

Stands consist of pure knobcone pine up to 6 inches (15 cm) dbh, 40 ft (12 m) in height, and 65-80 years old. Average stand density is 700 live stems/acre (1729/ha). Up to 50 percent of some stands are composed of standing dead trees. No regeneration of knobcone pine was observed.

The understory shrub layer averages 55 percent cover, with *Arctostaphylos patula* reaching up to 90 percent cover in some areas. Other associated species include *Ceanothus prostratus*, *Rhamnus californica*, *Purshia tridentata*, *Cercocarpus ledifolius*, *Penstemon deustus*, *Arabis holboellii*, *Streptanthus tortuosa*, *Elymus sitanion*, and *Vulpia microstachys*. A few species that distinguish this forest from the eastside ponderosa pine forest include *Ribes roezelii*, *Ceanothus velutinus*, and *Epilobium minutum*.

Montane Manzanita Chaparral (37520): 465 acres (188 ha). The majority of the montane manzanita chaparral was once knobcone pine forest. It currently occupies broad lava flats set above the remaining knobcone stands. Western juniper is the current dominant live tree, but it has very low density and cover. Small sand or mud flats are scattered in the open areas, often with dense stands of *Allium campanulatum* and *Antennaria geyeri*.

The shrub layer is better developed than in the knobcone and eastside ponderosa pine types, with a cover ranging 50 percent or more. *Arctostaphylos patula* is the most important shrub. Other associated species include *Ceanothus prostratus*, *Purshia tridentata*, *Rhamnus californica*, *Cercocarpus ledifolius*, *Penstemon deustus*, *Arabis holboellii*, *Castilleja applegatei*, *Streptanthus tortuosa*, *Elymus sitanion*, *Madia minima*, *Calyptridium umbellatum*, *Horkelia tridentata*, *Potentilla glandulosa*, and *Erigeron pumilus*. A lone *Artemisia tridentata* seedling and a few *Cercis occidentalis* also were found. The chaparral contains the only introduced species noted in the cRNA: *Agoseris grandiflora*, *A. heterophylla*, and *Tragopogon dubious*.

Eastside Ponderosa Pine Forest (84220): 155 acres (62 ha). This association type occurs on relatively flat, poorly fractured ropy lava or on uniform-sized gravel/cobble substrate with soils confined to depressions in the lava surface. The overstory is open and consists of uneven-aged ponderosa pine and western juniper, and even-aged knobcone pine. The ponderosa pine are usually less than 24 inches (61 cm) dbh, but range to 36 inches (92 cm) dbh and 95 ft (29 m) tall. Tree density averages 240 trees/acre (593/ha). Ponderosa pine and western juniper that were 350 years or older (associated with sinkholes) were found in the RNA, and both are reproducing well in this type.

The understory shrub cover averages 30 percent and includes *Arctostaphylos patula*, *Purshia tridentata*, *Ceanothus prostratus*, *Rhamnus californica*, *Cercocarpus ledifolius*, and *Prunus emarginata*. Species that distinguish this forest from the knobcone pine forest include *Eriophyllum lanatum*, *Eriogonum umbellatum*, *Madia minima*, *Carex rossii*, *Poa sandbergii*, and *Zigadenus paniculatus*.

Temporary ponding (i.e., in sinkholes) occurs due to melting snow and rainstorms. *Deschampsia danthonioides*, *Danthonia unispicata*, and *Lotus purshianus* are associated with these pools.

Lava Flow Scrub (no Holland equivalent): 60 acres (24 ha). This association type is affiliated with the roughest, most topographically varied lava substrate in the area. It is associated with the network of lava tubes, sinkholes, and ridges that stem from the NW. portion of the area. Most lava tubes are 10-20 ft (3-6 m) deep and less than 25 ft (8 m) wide. Giant sinkholes are spaced periodically from the NW. to the SW. portions of the cRNA, measuring up to 150 ft (46 m) across and more than 30 ft (9 m) deep. Raised flow areas rise as much as 20 ft (6 m) above the surrounding surface.

Vegetation on this substrate is the most distinctive of the cRNA, with many species either restricted to this substrate, or reaching greatest importance. Trees are typically absent, although an occasional ponderosa pine or western juniper occurs on some of the flows. Dense cover of *Prunus virginiana* and *P. emarginata* often occur at the base of the ridges, and rings of knobcone pine can be found surrounding raised lava areas. Shrub cover is relatively high.



Figure 113—Mayfield, one of the healthiest knobcone pine forests present in the Mayfield cRNA. (1990)

Species reaching greatest importance include *Cercocarpus ledifolius*, *Prunus virginiana*, *P. emarginata*, *Chrysothamnus nauseosus*, and *Woodsia scopulina*. Species primarily restricted to basalt flows of NE. California include *Rubus leucodermis*, *Amelanchier alnifolia*, *Chamaebatiaria millefolium*, *Agastache parvifolia*, *Scrophularia lanceolata*, and *Penstemon deustus* ssp. *heterander*. Notably absent from this community are *Arctostaphylos patula* and *Ceanothus prostratus*. There is almost no species overlap between this and similar nearby forest located off the recent lava flow.

Plant Diversity

Seventy-five species of vascular plants are listed.

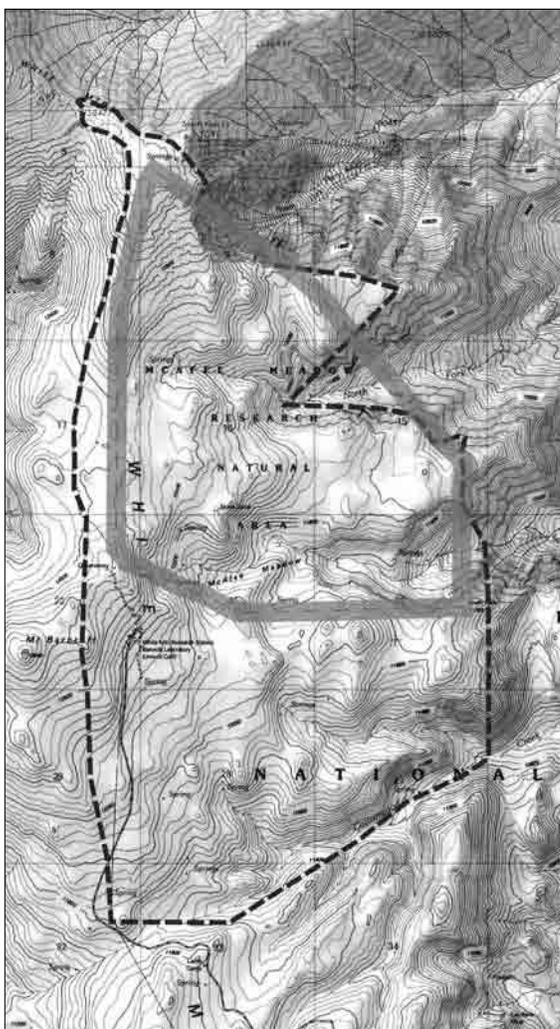
Conflicting Impacts

Recreational use of the cRNA is minimal. A management strategy should be written that provides for prescribed burning of the area and control of the mistletoe infection if the knobcone pine and other tree species are to be protected.

56. McAfee (White Mountain Summit) (Taylor 1976, Travers 1993)

Figure 114—McAfee rRNA

Dashed line = Ecological study area
Solid gray line = RNA Boundary



Location

This recommended RNA (rRNA) is on the Inyo National Forest. The study area lies within T4S, R34E MDBM and includes portions of sects. 8, 9, 10, 15, 16, 17, 20, 21, and 22 (37°35'N., 118°15'W.), USGS Mount Barcroft and White Mountain Peak 15' quad (fig. 114). Ecological subsection – White Mountains (341Dj).

Target Element

Alpine Fell-Field

Distinctive Features

Previous Alpine Research: The summit plateau of the White Mountains contains the largest continuous area of alpine steppe vegetation in California and the Great Basin. It is also the most accessible large alpine area in California. The area is well studied and has been used as a high altitude research center since the early 1950s. Many important physiological experiments have been conducted at the two laboratories (Barcroft and White Mountain) within the area, although detailed ecological surveys of the vegetation are lacking.

Alpine Geomorphology: Several types of frost patterning occur in the area. These include frost polygons and congeliturbation. Unlike many areas with relictual patterned ground (e.g., Devil's Garden), these geomorphic processes are still active as a result of the cold climate. Solifluction lobes are also present, but they are relatively rare. Two plant associations are restricted to areas where these processes occur.

Rare Plants: *Heuchera duranii* (CNPS 1B), *Polemonium chartaceum* (CNPS 1B), *Astragalus kentrophyta* ssp. *danaus* (CNPS 4), *Lomatium foeniculaceum* ssp. *inyoense* (CNPS 4), *Carex eleocharis* (CNPS 2), *Pinus longaeva* (CNPS 4).

Physical Characteristics

The study area covers 6400 acres (2590 ha), which is much larger than the proposed area for RNA establishment in the

forest plan (2030 acres [822 ha]). Elevations range from 11,600 to 14,300 ft (3536-4358 m). White Mountain Peak is the highest point at the N. end of the area and is steep-sloped with active talus. A major ridge, extending from the peak of White Mountain and running S., lies on the W. border of the RNA. To the E. of the ridge, the area is cut into three plateaus by the North and South Forks of McAfee Creek, which form steep canyons.

In general, the whole area appears rocky with shallow and poorly developed soil. In the SE. corner the soil is dolomite in origin and has a striking white color. Climate is severe, cold, and dry with strong winds.

Parent rocks are Reed Dolomite (Precambrian), Campito formation (sandstones and hornfels), Barcroft Pluton (granodiorite), and undifferentiated metavolcanic (underlying White Mountain Peak). Soils are shallow and poorly developed.

Association Types

Taylor (1976) defined seven plant communities within the study area. However, Travers (1993) classified the vegetation into nine communities.

Dolomite Barrens (91140)

Phlox condensata-*Ivesia shockleyi*: This is the only plant community found on dolomite barrens. It is distributed on the easternmost portions of two ridges in the S. part of the study area. *Phlox condensata* and *Ivesia shockleyi* dominate on both S. and N. aspects of these ridges. In mesic depressions *I. shockleyi*'s frequency decreases; it is replaced by *Chrysothamnus parryi*. Twenty-six plant species are found in this community, including *Astragalus kentrophyta* and *Eriogonum gracilipes*.

Alpine Grassland Steppe (91140)

Koeleria macrantha: This is the largest grassland plant community in the study area; it is generally found at the lower elevations associated with the S. two-thirds of the study area. The dominant species, *K. macrantha*, is also very common in other shrubland communities but with less relative percentage cover. This community is characterized by intermediate soil moisture level. In regions with increased wetness, *Ivesia lycopodioides* dominates. In drier regions, *Trifolium andersonii* takes over as the dominant species. Nineteen species are found in this community.

Ivesia lycopodioides: This community is distributed as small patches scattered throughout the area in mesic regions. It prevails in sloped, mesic regions below snowmelts throughout the central portion of the study area. Generally these wet areas are N.- or E.-aspect slopes where snow patches persist. This plant community also dominates in natural seeps, giving way to *Carex-Deschampsia* in regions with standing surface water. In total, 22 species are identified in this community. *Antennaria rosea* is the codominant species.

Carex sp.-*Eriogonum ovalifolium*: This community distributes on the plateau SW. of White Mountain Peak, which is exposed and windswept. It is characterized by almost pure *Carex incurviformis* interspersed with *Eriogonum ovalifolium*. Species diversity is low and most of the dicot species observed in other plant communities are absent. *Koeleria* is also absent from this community.

Trifolium andersonii: This community is distributed on the tops of plateaus, W. of the *Carex* sp.-*Eriogonum ovalifolium* community and at the easternmost end of the plateau in the central portions of the study area. These areas are flat and relatively dry, shielded

Figure 115—McAfee, McAfee Meadow, where the dominant species are *Deschampsia cespitosa*, *Carex incurviformis*, and *Carex heteroneura*. (S. Cheng 2000)



by ridges to the W. Species composition is very similar to the *Artemisia* communities below 12,000 ft (3657 m) but without the shrubs. *Trifolium andersonii* and *Carex incurviformis* are the two most common species. Associated species are mixtures of *Elymus elymoides* and *Achnatherum occidentale*. *Koeleria macrantha* is present but in much lower frequency than in other grasslands. Twelve species are listed in this plant community.

Shrubland (35220)

Artemisia arbuscula: This community is widespread in the S. portions of the study area. It is found only at relatively low elevations (below 12,000 ft [3567 m]) and confined mainly to areas of Campito sandstone. Patches of *Carex-Deschampsia* can be found in level mesic areas within this community. The three most common species found here are *Trifolium andersonii*, *Linanthus nuttallii*, and *Koeleria macrantha*. Seventeen species are found in this community, among them *Heuchera duranii*, a CNPS-listed rare plant.

Chrysothamnus parryi: This community dominates at rocky transition zones between steep scree slopes and relatively level grasslands. One exception is the northernmost plateau, which is completely covered by *Chrysothamnus parryi* shrubs. *Chrysothamnus parryi*, *Carex incurviformis*, and *Koeleria macrantha* are the three most common species found in this community. Because this community generally occurs at the edge of scree slopes, many of the species found here are shared with scree slope community, including *Ribes viscosissimum*. Seventeen species are identified in this plant community.

Sedge Meadow (45210)

Carex sp.-Deschampsia sp.: This community has the highest percentage of cover and lowest species diversity (nine species) in the RNA. It is also the wettest of all the communities in the study area (fig. 115). Found in wet areas predominantly in the S. (lower elevation) two-thirds of the study area, this community is interspersed with dry, elevated areas of plant communities dominated by *Artemisia*, *Koeleria*, and *Ivesia*. In almost all cases the community is found in association with pooling or flowing surface water from seeps. *Carex sp.* forms a dense sod, and *Deschampsia sp.* indicates standing water during the growing season. The largest area, McAfee Meadow, is along the South Fork of McAfee Creek.

Scree Slopes (91200)

Ribes viscosissimum: The granitic pluton is characterized by outcrops of scree, generally at the tops of steep ridges. These areas are almost completely devoid of vegetation, except *Ribes viscosissimum*. Scree slopes are composed of unstable collections of wither shale or granitic rocks. Higher-elevation (>13,500 ft [4115 m]) examples of this community on the summit of White Mountain Peak (mesozoic metavolcanic rock) are dominated also by *Polemonium chartaceum*, *Erigeron vagus*, and *Anelsonia eurycarpa*. DeDecker (Travers 1993) listed 14 species during her 1960 visit to the SE. corner of White Mountain Peak.

Plant Diversity

Fifty-one species are identified by Travers. An additional 10 can be found in DeDecker's 1960 list (Travers 1993).

Conflicting Impacts

Heavy manipulative research use (i.e., research activities modify the natural condition of the subjects) exists in White Mountain Laboratory of the University of California upslope and adjacent to the rRNA, although little use of the rRNA occurs yet. No grazing is allotted in this area.

Note: for Merced River, see Bishop Creek Ponderosa Pine, #9

57. Millard Canyon (Keeler-Wolf 1988a, 1991f)

Location

This established RNA is on the San Bernardino National Forest about 9 miles (14.5 km) NE. of Banning in extreme N. Riverside County. The area lies within portions of sects. 2, 3, 10, and 11 T2S, R2E SBBM (34°01'N., 116°45'W.), USGS San Gorgonio Mountain quad (fig. 116). Ecological subsection – San Gorgonio Mountains (M262Bg).

Target Element

Interior Live Oak (*Quercus wislizenii*)

Distinctive Features

Interior Live Oak: Interior live oak is a widespread foothill species endemic to cismontane California. It is represented elsewhere most extensively on the Indian Creek RNA where it is typically shrubby. At Millard Canyon this species occurs primarily as a woodland or low forest in the relatively flat, alluvium-filled valleys (fig. 117). It also occurs as a shrub in the chaparral on steep, exposed slopes. The variety of situations in which this species is represented locally will provide a number of topics for researchers interested in this little-studied species.

Bigcone Douglas-Fir (*Pseudotsuga macrocarpa*)-Canyon Live Oak (*Quercus chrysolepis*) Forest: This association is endemic to S. cismontane California, and it is one of the associations least commonly affected by fire in this area. It occupies N.-facing slopes and has substantial variation in density and frequency of bigcone Douglas-fir, reflecting variation in fire history and moisture availability. This vegetation should provide an important comparison to the more coastal, high-density type of this association represented at the Falls Creek and Fern Canyon RNAs.

Rare Plants: Two taxa known from the RNA are listed by CNPS. These are *Heuchera parishii* (List 4) and *Streptanthus bernardinus* (List 1B). Both species are endemic to the San Bernardino Mountains.

Wildlife Values: The dense interior live oak woodland in the valleys provides food and shelter for numerous birds and small mammals. A breeding-bird census in this habitat records 128 individuals/10 ha. The most abundant species are rufous-sided towhee (*Pipilo erythrophthalalmus*), wrentit (*Chamaea fasciata*), and black-headed grosbeak (*Pheuticus melanocephalus*), all with densities of 1 to 2/ha. There is also a high density of dusky-footed woodrat (*Neotoma fuscipes*) housed in this association. Bear Wallow Spring, in the S. part of the RNA, has been developed for wildlife (with a cement trough) and is regularly used by black bear (*Ursus americanus*) and other species.

Physical Characteristics

The study area covers 793 acres (321 ha). Elevations range from approximately 4500 to 6970 ft (1372-2125 m). Topography is highly varied from the three gently sloping, relatively broad valley bottoms to the extremely steep and rocky escarpment at the N. end. The area contains three separate subdrainages of the Middle Branch of Millard Canyon with the valley bottoms sloping to the SW. Slopes face primarily NW. and SE.

Ridges are typically sharp and topped with crumbly outcrops of Precambrian igneous and metamorphic rocks (gneiss and schist). Many of these rocks are intruded and altered by Mesozoic granitics. Soils are mapped in three units: Lithic Xerothents-Springdale family-Rubble Land association, 50-100

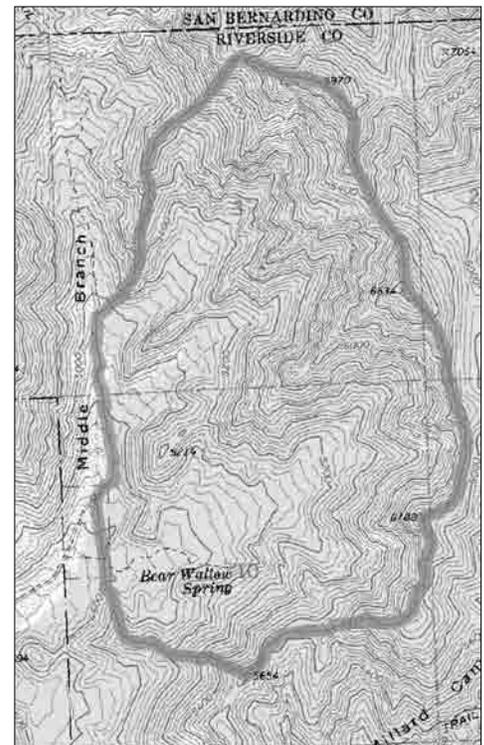


Figure 116—Millard Canyon RNA

percent slopes; Lithic Xerothents-Rock Outcrop complex 50-100 percent slopes; and Soboba-Avawatz-Morical dry families. The latter type is characteristic of the deep alluvium of the valleys. The area is estimated to average 25-30 inches (635-762 mm) of precipitation per year. Mean annual temperature at the mid-elevations is about 52 °F (11 °C). Prevailing W. winds have shaped the vegetation of the upper slopes.

Association Types

Vegetation sampling is limited to the interior live oak woodland and the bigcone Douglas-fir-canyon live oak forest where ten 10- by 10-m quadrats were established in each association. Other associations are described qualitatively.



Figure 117—Millard Canyon, ecotone of canyon live oak and interior live oak forests at north-facing slope base in Millard Canyon RNA. (1987)

than 6.5 ft (2 m) tall/ha. Mean canopy cover is 74 percent, and basal cover is about 32.8 m²/ha. Canyon live oak has a relative density of 89 percent; however, bigcone Douglas-fir makes up 43 percent of the basal area. High stem density of canyon live oak results from the preponderance of multiple-stemmed individuals, reflecting past fires. Tree reproduction is relatively low and dominated by canyon live oak. The understory is generally sparse, with locally abundant herbs and grasses in scattered small openings. *Melica aristata* is most common, with an average cover of 12 percent. Another fairly common species is *Silene lemmonii* (22 species are listed from the sample).

A small area of about 4 acres (1.5 ha) surrounding Bear Wallow Spring is considered a semi-riparian phase of this association. The moist, shady conditions around the spring, coupled with an absence of fire, have combined to produce a tall, well-developed forest of bigcone Douglas-fir (up to 5.7 ft [1.73 m] dbh and 121 ft [37 m] tall), canyon live oak (up to 3.3 ft [1 m] dbh), incense-cedar (up to 4.6 ft [1.4 m] dbh), bigleaf maple, and California sycamore. The understory in the immediate vicinity of the spring is dominated by *Potentilla glandulosa*, *Aquilegia formosa*, and *Ribes nevadense* (Holland 45400). However, once away from the spring, the understory is sparse with much duff, only occasional herbs such as *Polystichum munitum*, and scattered tree seedlings and saplings.

On the S.-facing slopes at upper elevations canyon live oak forms continuous or broken stands depending on slope rockiness and steepness (122

Canyon Live Oak-Bigcone Douglas-Fir (81320, 84150, 45400): 477 acres (193 ha). This association occurs in three phases: a low- to mid-elevation mesic NW.- to NE.-facing type with variable mixtures of bigcone Douglas-fir over a dense canopy of canyon live oak (*Quercus chrysolepis*); a semi-riparian, very mesic phase, with the above-mentioned two species as well as incense-cedar (*Libocedrus decurrens*), bigleaf maple (*Acer macrophyllum*), and California sycamore (*Platanus racemosa*); and an upper elevation S.- to SW.-facing type dominated solely by canyon live oak.

Vegetation sampling was conducted in only the first described phase (351 acres, 142 ha). This steeply sloping forest is relatively dense, averaging 1810 trees more

acres, 49 ha). These stands are typically wind-sculpted dwarfs no taller than 20 ft (6 m) with average dbh of 10 inches (25 cm). The understory of these stands is sparse.

Interior Live Oak Woodland (37A00, 71150, 81330): 128 acres (52 ha). In general, the best developed of the interior live oak vegetation has a woodland aspect, with scattered small openings between clumps of small trees. However, there is some variation in the stature of tree clumps, the associated shrub and herbaceous species, and the density of stands. Although the northernmost valley has a significant admixture of canyon live oak, the remaining two are strongly dominated by interior live oak, largely to the exclusion of other trees. Only occasional young individuals of white fir (*Abies concolor*), bigcone Douglas-fir, incense-cedar, and Coulter pine (*Pinus coulteri*) rise above the short canopy of the oaks.

All of the trees aged in this association have stems younger than 75 years old, reflecting the date of the last extensive fire (1911). Average tree-stem density is 1300/ha. Frequency for interior live oak is 100 percent on 10 plots, and basal area cover averages 16 m²/ha. Sapling density for interior live oak averages 260/ha and seedling density 90/ha. Estimated mean canopy cover is 65 percent. The number of shrub species encountered is 13. Twenty-one herbs are noted. The most important subordinate species are *Rhamnus californica*, *Lonicera interrupta*, *Rhus trilobata*, *Eriodictyon californicum*, *Vulpia (Festuca) myuros*, and *Bromus tectorum*. A small subset of herbs does not occur in chaparral or sage scrub. These include *Bloomeria crocea*, *Brodiaea pulchella*, *Microseris linearifolia*, *Melica imperfecta*, *Lupinus adsurgens*, and *Bromus diandrus*.

Chaparral (37110, 37200, 37520): 106 acres (43 ha). Chaparral typically occurs as small islands or in impure mixtures with sage scrub, interior live oak woodland, canyon live oak forest, and mixed conifer forest. Four main subtypes are distinguishable.

- Chamise chaparral dominated by *Adenostoma fasciculatum* is the most xeric subtype. It occurs as small, nearly pure patches on W.- and SW.-facing slopes. There is virtually no herb layer.
- The next subtype (37110) is mixed chaparral. It occurs on low and middle elevations on W.- and SW.-facing slopes. Dominants vary and include shrubby interior live oak, *Arctostaphylos glandulosa*, and *Ceanothus leucodermis*. Lesser species include *Cercocarpus betuloides*, *Arctostaphylos pringlei* var. *drupacea*, *Dendromecon rigida*, *Prunus ilicifolia*, and *Yucca whipplei* ssp. *parishii*.
- The third subtype (no Holland equivalent) is strongly dominated by *Cercocarpus betuloides*. This species forms an open scrub along the low- and mid-elevation ridgelines. It prefers extremely rocky sites where perhaps relatively large quantities of surface water are channeled into cracks and crevices.
- The final subtype (37520) has a more montane character, occurring at the higher elevations along ridgetops above 6200 ft (1890 m). The dominant is *Arctostaphylos patula* ssp. *platyphylla*, a low nodal-rooting manzanita.

Riversidian Sage Scrub (32700): 38 acres (15 ha). This association occurs on the most xeric exposures in the study area, on relatively deep sandy soils. It occupies S.-facing exposures between 4600 and 6100 ft (1402-1959 m). On relatively gentle slopes at low elevations it intergrades with interior live oak woodland. At upper elevations it intergrades with the S.-facing phase of canyon live oak woodland. The following species are typical of this association: *Salvia apiana*, *Yucca whipplei* ssp. *parishii*, *Penstemon centranthifolius*, *Stipa coronata*, *Galium angustifolium*, *Eriogonum fasciculatum*, *Mimulus longiflorus*, *Trichostema lanatum*, *Antirrhinum*

coulterianum, *Bromus rubens*, *Castilleja foliolosa*, *Cordylanthus filifolius*, *Corethrogyne filaginifolia*, *Cryptantha muricata*, *C. simulans*, *Eriophyllum confertiflorum*, *Gilia diegensis*, *Lotus strigosus* var. *hirtellus*, and *Stipa speciosa*.

At the upper elevations there is a transition with canyon oak and mixed chaparral associations and several montane species such as *Leptodactylon pungens*, and *Lupinus excubitus* var. *austromontanus* occur along with such upper-elevation chaparral species as *Arctostaphylos pringlei* var. *drupacea*.

Transitional Mixed Conifer Forest (84230, 84140): 28 acres (11 ha). This forest occupies upper N.- to W.-facing slopes. It is an extension of the canyon live oak-bigcone Douglas-fir forest with the addition of sugar pine (*Pinus lambertiana*), Coulter pine, and white fir. Elevations are not high enough locally to provide conditions that are favorable for strong dominance by conifers; at best, this forest is codominated by canyon live oak and a mixture of conifers. This association is analogous to the transitional S. California mixed evergreen forest of Falls Canyon RNA. The canopy of conifers is varied, from Coulter pine on W.-facing slopes to a sparse mixture of bigcone Douglas-fir, sugar pine, and white fir on steep NW.-facing slopes to a more dense mixture of white fir and sugar pine on N.-facing slopes.

The understory is usually sparse with scattered shrubs of *Arctostaphylos patula* ssp. *platyphylla*, *Cercocarpus ledifolius*, and the herbs *Heuchera parishii*, *Claytonia spathulata* var. *tenuifolia*, *Sarcodes sanguinea*, *Hieracium horridum*, *Allium monticola*, *Streptanthus bernardinus*, and *Pedicularis semibarbata*.

Occasional ridgetop openings in this association house a richer herbaceous flora including *Eriogonum wrightii*, *Lupinus excubitus* var. *austromontanus*, *Linanthus breviculus*, *Gayophytum* sp., *Poa* sp., *Penstemon grinnelli*, *Solidago californicum*, *Chrysothamnus nausiosus* ssp. *bernardinus*, *Chaenactis santolinoides*, *C. glabriscula* var. *curta*, and *Bromus marginatus*.

Rock Outcrop (no Holland equivalent): 20 ha (8 ha). Between the scattered small trees of canyon live oak and *Cercocarpus* spp., much of the steep escarpment at the N. end of the area as well as other smaller outcrops is vegetated with a light cover of small rupicolous shrubs and herbs. These include *Dudleya abramsii*, *Selaginella bigelovii*, *Eriogonum saxatile*, *Haplopappus cuneatus*, and *Arabis sparsiflora* var. *arcuata*.

Plant Diversity

One hundred sixty-three taxa are listed.

Conflicting Impacts

Few exist. The area is within a 1984 addition to the San Geronio Wilderness, but rugged topography and dense vegetation preclude recreational interest. A short trail to Bear Wallow Spring is the only easy recreational entry route into the area, and it is not well traveled.

58. Moses Mountain (Keeler-Wolf 1989a, 1989I)

Location

This established RNA is on the Sequoia National Forest in Tulare County. It lies within the Golden Trout Wilderness, which is part of the Tule River Ranger District. Its boundaries include portions of sects. 12, 13, and 24 T19S, R30E and sects. 7, 18, and 19 T19S, R31E MDBM (36°17'N., 118°39'W.), USGS Moses Mountain quad (fig. 118). Ecological subsection – Upper Batholith (M261Eq).

Target Element

Giant Sequoia (*Sequoiadendron giganteum*)

Distinctive Features

Giant Sequoia: Moses Mountain RNA contains an excellent representation of giant sequoia with white fir (*Abies concolor*) and red fir (*A. magnifica*) dominated forests (fig. 119). The area lies largely within the Golden Trout Wilderness and has not been impacted significantly by human activities. A unique feature of the groves is that each is well-stocked with giant sequoia under 250 years old. Another unusual feature is the presence of 10- to 200-year-old trees extending beyond the edge of the main groves. The presence of young trees in the groves and in the outlying areas allows the long-term status of the groves to be monitored. A number of specimen trees with diameters greater than 16 ft (4.9 m) dbh are also present. The largest is about 21 ft (6.4 m) dbh; it has an estimated age of 2500 years.

Well-Developed Riparian and Meadow Zones: At least 220 taxa of vascular plants are found within the RNA, including 26 taxa that reach the S. limits of their range in Tulare County and at least 6 endemics to the S. Sierra Nevada. A diverse assemblage of riparian plants is associated with the streamside of the N. fork of the Middle Fork of the Tule River. A rich flora of hydrophilic species is associated with seeps and meadows within the area.

Fauna: The RNA, by virtue of its proximity to large expanses of wilderness in both the Golden Trout Wilderness and the Sequoia National Park Wilderness, contains good habitat for a number of large, rare vertebrates. Black bear (*Ursus americanus*), mountain lion (*Felis concolor*), blue grouse (*Dendragapus obscurus*), mule deer (*Odocoileus hemionus*), and golden eagle (*Aquila chrysaetos*, State-listed species of special concern) have been seen or evidence of their presence detected in the area. The State-listed threatened species wolverine (*Gulo gulo*) and Forest Service-listed sensitive species fisher (*Martes pennanti*) are known from the area and may occur within the RNA. The Forest Service-listed sensitive species marten (*Martes americana*) and Federally- and State-listed endangered species peregrine falcon (*Falco peregrinus anatum*) might be present. The Moses Mountain population of pika (*Ochotona princeps*) may be the southernmost population in the Sierra Nevada.

Rare Plants: The RNA contains the largest population (more than five million plants) of the CNPS List 1B and Forest Service-listed sensitive species *Erythronium pusaterii*, the Kaweah fawn lily. This species is an endemic, localized to Tulare County.

Physical Characteristics

The Moses Mountain RNA covers 960 acres (389 ha) on the W. slope of the S. Sierra Nevada. The topography drops precipitously to the W. of the RNA to the

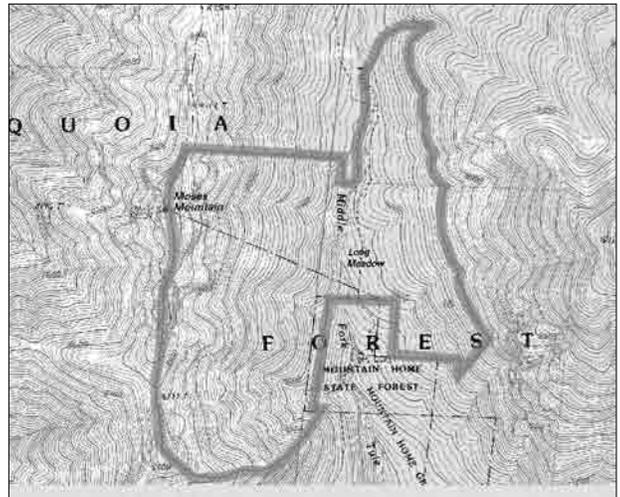


Figure 118—Moses Mountain RNA

Tulare Basin. The area is underlain by a portion of the huge Sierra Nevada Batholith, which is composed of Mesozoic granitic rocks. These rocks occur as boulders along the river and as local outcrops at lower elevations, but they are most abundant on the upper slopes of Moses Mountain where the mountain forms the impressive E.-facing escarpment. A second type is pre-Cenozoic metasedimentary rock, primarily shistose with a fair amount of visible mica. These rocks are likely to be Paleozoic; some are conspicuous in small outcrops along the W. side of the N. fork of the Middle Fork of the Tule River.

Soils in the area may be divided into two mapping units. Forested and valley segments of the RNA are underlain by the Woolstaf-Hotaw Variant-Rock outcrop complex, 50-75° slopes. These are typically deep, well-drained, and formed from metasediments. The other mapping unit is Rock outcrop which covers the steep upper slopes. These areas are typically granitic, but local metasediment outcrops occur.

Temperatures are relatively low and frequent records of frost in late June and even July indicate a short growing season. Highest summer temperatures

recorded over a 12-year period were less than 90 °F (32 °C), and winter temperatures probably drop below 0 °F (-17.7 °C) at upper elevations of the RNA. Precipitation at Moses Mountain is greatest during January and February whereas summer months are relatively dry. Compared to the central Sierra Nevada, the area probably receives somewhat more summer precipitation from thunderstorms. The upper elevations average 50-70 inches (1270-1906 mm) of snow on April 1 whereas the lower elevations of the RNA average 36-45 inches (914-1143 mm).

Association Types

Mixed Montane Chaparral (37510): 45 acres (18 ha). Small patches of mixed montane chaparral are interspersed

with white and red fir forest in openings created by avalanches or by shallow rocky soil. A disclimax community maintained by regular avalanches is particularly evident on the mid-slopes of Moses Mountain at the interface between talus, outcrop, and red fir forest. Conifer saplings and trees taller than about 2 m are rare. Dominant shrub species in this association are *Chrysolepis sempervirens*, *Arctostaphylos patula*, *Prunus emarginata*, *Ceanothus cordulatus*, and *Holodiscus microphyllus*. In some areas at lower elevations (at the base of long avalanche chutes) California black oak (*Quercus kelloggii*) dominates in a scrubby form up to 4 m in height.

Wet Montane Meadow (45110): 7 acres (3 ha). Long Meadow occupies the upper margin of an old stream terrace about 20 ft (6 m) above the present streambed of the N. fork of the Middle Fork of the Tule River. Seeps emerge above the riverbed and trickle down, saturating a swath up to 100 ft (30 m) wide and 300 ft (91 m) long throughout most summers. The heads of the seeps are dominated by willows and other riparian scrub species, but the majority of the saturated area is herb-dominated. Besides Long Meadow, two other wet meadows occur on steep slopes and are associated with permanent springs. The most conspicuous wet meadow species include *Aster occidentalis*, *Carex* spp., *Oxypolis occidentalis*, *Deschampsia elongata*, *Dodecatheon jeffreyi*, *Epilobium brevistylum*,



Figure 119—Moses Mountain, the understory of a portion of the southwest-facing grove in Moses Mountain RNA. Note general lack of herbs and shrubs and scattered young white fir. (1987)

Habenaria dilitata var. *leucostachys*, *Helenium bigelovii*, *Juncus macandrus*, *Mimulus primuloides*, *Parnassia palustris* ssp. *californica*, *Perideridia bolanderi*, *Polygonum bistortoides*, *Potentilla drummondii*, *P. gracilis* ssp. *nuttallii*, *Senecio clarkianus*, *Sidalcea oregana* ssp. *spicata*, *Sisyrinchium elmeri*, *Veratrum californicum*, and *Viola adunca*.

Dry Montane Meadow (45120): Trace. This association most commonly forms a border around the wet meadows. It is vernal moist, but dries by midsummer. Soil is typically shallow and rocky. Most dry meadows in the area are being colonized by red and white fir saplings, usually younger than 70 years. Occasionally, dry meadow vegetation occurs in small glades in white fir forest in the valley bottom. Dry meadow species include: *Gilia leptalea*, *Linanthus ciliatus*, *Rumex angiocarpus*, *Bromus laevipes*, *Calochortus venustus*, *Collinsia parviflora*, *Madia elegans*, *Orthocarpus hispidus*, *Polygonum douglasii*, *Taraxacum officinale*, *Trifolium repens*, *Mimulus floribundus*, *Perideridia parishii*, *Viola adunca*, and *Stipa californica*.

Montane Riparian Scrub (63500): 20 acres (8 ha). This diverse association occurs along several seeps and rivulets descending the slopes of Moses and Maggie Mountains and also forms a border along much of the N. fork of the Middle Fork of the Tule River within the RNA. It is dominated by hydrophilic shrubs such as: *Alnus tenuifolia*, *Ribes nevadense*, *Salix caudata* var. *bryantiana*, *S. melanopsis*, *Lonicera involucrata*, and *Cornus stolonifera*. The herbaceous component includes *Lilium kelleyanum*, *L. parvum*, *Aconitum columbianum*, *Delphinium polycladon*, *Dicentra formosa*, *Aquilegia formosa* ssp. *truncata*, *Epilobium glaberrimum*, *Galium trifidum* var. *pusillum*, *Glyceria elata*, *Heracleum lanatum*, *Montia chamissoi*, and *Stachys albens*.

Sierran Mixed Coniferous Forest (84230): 59 acres (24 ha). This widespread forest type occurs only at lower elevations and on relatively xeric exposures. The dominant species on SW.-facing slopes of the SE. side of the RNA is white fir, with sugar pine (*Pinus lambertiana*) and incense-cedar (*Libocedrus decurrens*) as subdominants. Higher up on rockier slopes, Jeffrey pine (*Pinus jeffreyi*) and small, shrubby California black oak (*Quercus kelloggii*) dominate the canopy and understory. Jeffrey pine dominates on a SE.-facing slope on schist in an open forest with little understory. The largest Jeffrey pine are more than 300 years old, and most bear fire scars from repeated ground fires.

Sierran White Fir Forest (84240): 240 acres (97 ha). This forest type is widespread at mid-elevations of the RNA on both E.- and W.-facing slopes. Trees are generally rather small in stature except for irregular patches and isolated individuals of larger and older trees. These appear to be survivors of a large crown fire that probably swept through the area in the 1870s. Understory is typically sparse due to heavy duff and shade. Openings are dominated by *Pteridium aquilinum* ssp. *pubescens*, *Symphoricarpos parishii*, *Monardella odoratissima*, *Viola lobata*, *Delphinium pratense*, *Hackelia mundula*, *Montia perfoliata*, *Hieracium albiflorum*, and *H. horridum*.

Big Tree Forest (84250): 70 acres (28 ha). Three groves of giant sequoia occur within the RNA. The largest is part of an even larger grove centered in the Redwood Crossing area along the S. end of the RNA. It includes about 40 mature giant sequoias over 8.2 ft (2.5 m) dbh. The second is a relatively small grove of about 15 mature trees in the lower river valley near Long Meadow. The third and smallest grove occupies the mid E.-facing slopes of Moses Mountain and contains eight mature trees.

This forest, the target element for the RNA, is strongly dominated by giant sequoia, not only basally but also in density and total importance value. The high densities of giant sequoia are largely due to the excellent representation of

younger age classes, both in the groves and on their peripheries. Reproduction of these trees at the RNA is largely in distinct groups, suggesting that fire and, to a lesser extent, occasional avalanches have provided the disturbance necessary for giant sequoia reproduction. The occurrence of numerous ground fires in the giant sequoia groves is clearly indicated by the large fire scars on virtually all mature trees. Isolated juveniles, either younger than the youngest major cohort or in-between cohorts, may be associated with flooding disturbance along the N. fork of the Middle Fork of the Tule River.

Seedlings of any conifer are rare in the midst of all giant sequoia groves in the RNA, and the understory vegetation is generally sparse. Typical understory species at the higher elevation and more mesic E.-facing sites include: *Symphoricarpos parishii*, *Osmorhiza chilensis*, *Pteridium aquilinum* var. *pubescens*, *Chrysopsis breweri*, *Lilium kelleyanum*, *Ribes roezlii*, *Lupinus polyphyllus* ssp. *supurbus*, and *Smilacina racemosa* ssp. *amplexicaulis*. At the lower elevations are bush chinquapin, California hazelnut (*Corylus cornuta* ssp. *californica*), snowbush, *Pyrola picta*, *Draperia systyla*, *Potentilla glandulosa* ssp. *nevadensis*, *Chamaebatia foliosa*, *Galium sparsiflorum*, and *Carex multicaulis*. In several localities are small springs where a subset of shade-tolerant riparian meadow species occur. Of particular importance are *Carex fracta*, *Glyceria striata*, *Aquilegia formosa*, and *Habenaria dilitata* ssp. *leucostachys*. As is typical for giant sequoia groves, these species at Moses Mountain appear to be strongly tied to abundant groundwater.

Red Fir Forest (85310): 222 acres (90 ha). This forest type occupies the upper forested slopes of Moses Mountain and the valley bottom above 7000 ft (2134 m). It is dominated by red fir but may have a large component of white fir and Jeffrey pine at lower elevations and western white pine (*Pinus monticola*) on the highest E.-facing slopes. The forests may be dense with little understory. Or, as a result of rocky substrate and occasional avalanche damage, they may be open, with a moderately dense understory of mountain chaparral or more mesophilic species such as *Acer glabrum* var. *torreyi*. The majority of trees in denser stands are under 120 years old, but at upper elevations or on rocky sites, where protection from fire may be better, are numerous large trees up to 6.5 ft (2 m) dbh.

Alpine Talus and Scree Slope (91200): 297 acres (120 ha). The large expanses of open granitic slabs, innumerable crevices, and decomposed granite benches on the upper slopes of Moses Mountain support an extensive community of plants similar to those of higher alpine environments. Hydric species occur along moist-to-wet cracks and intermittent rivulets, while xeric types occur on the exposed sunny substrates. Species of the xeric type include: *Sedum obtusatum*, *Holodiscus microphyllus*, *Arctostaphylos nevadensis*, *Calyptridium umbellatum*, *Cheilanthes gracillima*, *Dudleya cymosa*, *Eriophyllum confertiflorum*, *Eriogonum saxatile*, *Lomatium torreyi*, *Melica stricta*, *Pellaea breweri*, *Penstemon newberryi*, *Poa incurva*, *Pteryxia teribenthina*, *Selaginella watsonii*, and *Zuaschneria latifolia*. Wet-area species include *Acer glabrum* ssp. *torreyi*, *Triteleia dudleyi*, *Cryptogramma acrostichoides*, *Erythronium pusaterii*, *Heuchera rubescens*, *Juncus parryi*, *Luzula divaricata*, *Silene sargentii*, *Smilacina racemosa* ssp. *glauca*, and *Zigadenus exaltatus*.

Plant Diversity

Two hundred thirty-one taxa are listed.

Conflicting Impacts

Despite heavy use of a trail through the area and several regularly used campsites, human impact on most of the area is slight. Areas around campsites are regularly lightly grazed by pack animals, but heavy trampling is restricted to immediate areas of trails and campsites.

59. Mount Eddy (Whipple and Cope 1979, Cheng 1996b)

Location

This established RNA is on the Shasta-Trinity National Forest about 8 miles (15 km) W. of Mount Shasta City (the boundary is different from the ecological survey area). It lies within portions of sect. 24 T40N, R6W and sect. 18 T40N, R5W MDBM (41°20'N., 122°30'W.), USGS Mount Eddy quad (fig. 120). Ecological subsections – Upper Scott Mountains (M261Aj).

Target Element

Foxtail Pine (*Pinus balfouriana*)

Distinctive Features

Rare Flora: Eight CNPS listed species are found in the study area: *Darlingtonia californica* (List 4; clumps at 7400 ft [2256 m] may be the highest elevation for the species), *Veronica copelandii* (List 4), *Eriogonum alpinum* (List 1B), *E. siskiyouense* (List 4), *Draba aureola* (List 1B), *Cryptantha subretusa* (List 2), *Campanula scabrella* (List 4), and *Thelypodium brachycarpum* (List 4). Six CNPS listed species are found in the established RNA: *Eriogonum alpinum* (List 1B), *E. siskiyouense* (List 4), *E. umbellatum* var. *humistratum* (List 4), *Draba aureola* (List 1B), *D. howellii* ssp. *carosula* (List 1B), and *Campanula scabrella* (List 4). An additional species, *Lupinus lapidicola* (List 4), occurs just E. of the RNA boundary.

Extensive Foxtail Pine Forest: The 268 acres (108 ha) of foxtail pine forest included in the RNA are an excellent example of the Klamath Mountains ecological section type of this forest (fig. 121).

Physical Characteristics

The study area covers about 940 acres (380 ha), and the established RNA is 890 acres (360 ha). Mount Eddy, at 9025 ft (2751 m), is the highest peak in the Klamath Mountains ecological section. The area includes a ridge extending S. from the summit, one trending SW., and a lower ridge S. of the Deadfall Lakes. It also includes the majority of the Deadfall Lakes basin. The lowest elevation in the study area is about 7200 ft (2195 m), and in the RNA, 6320 ft (1926 m). W.- and S.-facing slopes predominate, varying from 20 to 50 percent.

The area is underlain by the Trinity Ultramafic Pluton. Rock is primarily peridotite in varying degrees of serpentinization. Pleistocene glaciation is evident, particularly in the Deadfall Lakes drainage. Soils are typically thin, gravelly, and unstable. Throughout the region, surface rock covers 50-75 percent of the ground.

Climate is relatively dry by Klamath montane standards, with the Deadfall Lakes snow course averaging 33 inches (84 cm) of water (40 percent moisture content) on April 1. Estimates from Rantz (1972) suggest total precipitation between 50 and 60 inches (1270-1524 mm). Mean daily temperatures extrapolated from Mount Shasta City would be 24 °F (-4 °C) in January and 59 °F (15 °C) in July at the lower elevations of the area.

Association Types

Data is provided from 20 releves and eighteen 0.1-acre (0.04-ha) plots each in the western white pine (*Pinus monticola*) forest and foxtail pine forest.

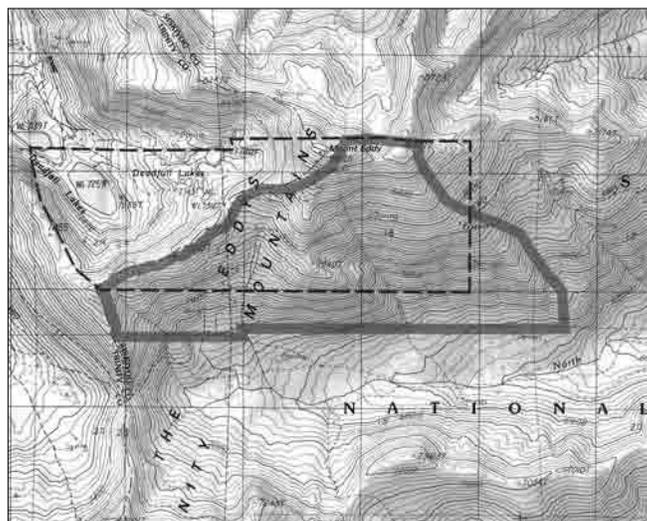


Figure 120—Mount Eddy RNA

Dashed line = Ecological study area;
Solid gray line = RNA Boundary

Western White Pine/*Angelica arguta* (84160, 45100, 45210, 51120): 480 acres (194 ha) in the study area, 432 acres (175 ha) in the RNA. This association occurs at the



Figure 121—Mount Eddy, old growth foxtail pine in Mt. Eddy RNA. (1976)

lowest elevations of the area. It is typically an open forest (20 percent cover) dominated by western white pine with white fir (*Abies concolor*) as an important subdominant. Whitebark pine (*Pinus albicaulis*) is also a regular constituent at the upper elevational limits of this type. Results from plots sampled in this type indicate a density of 109 trees/ha and a total basal area of 31.8 m²/ha with *P. monticola* comprising 85 percent relative density. Based on 10 cored *P. monticola*, the age-height curve ascends gradually, with dominant trees about 70-80 ft (21-24 m) tall and 300-400 years old.

Typically, the understory covers no more than 15 percent and is dominated by *Arctostaphylos nevadensis* and *Quercus vaccinifolia*. On more xeric, higher elevation, S.-facing slopes (unsampled), the understory may reach 65 percent. Other unsampled understory species include *Cercocarpus ledifolius* and locally dominant (on N. slopes) species: *Artemisia*

tridentata, *Lonicera conjugialis*, *Lupinus croceus*, and *Bromus marginatus*.

The meadow, streamside, and lakeside vegetation is also grouped within this forest type. *Dodecatheon alpinum*, *Caltha howellii*, *Helenium bigelovii*, *Darlingtonia californica*, *Veronica copelandii*, and several *Carex* and *Heleocharis* species dominate the meadows. In addition to these species, streamsidings and lakesides also have *Potentilla fruticosa* and lodgepole pine (*Pinus contorta* ssp. *murrayana*). The total number of herbs listed on relevés is 40. Those with the highest presence include *Anemone drummondii*, *Crepis pleurocarpa*, *Arenaria nuttallii*, *Polygonum davisiae*, *Hydrophyllum occidentale*, *Monardella odoratissima*, *Senecio integerrimus*, *Achillea lanulosa*, *Phlox diffusa*, and *Erysimum perenne*.

Foxtail Pine/*Anemone drummondii* (86300): 240 acres (97 ha) in the study area, 268 acres (108 ha) in the RNA. This is the other forest in the area; it occurs at elevations above 7800-8000 ft (2377-2438 m). This association is even more open than the previous one, with average canopy cover about 18 percent. Foxtail pine is the only tree present in 50 percent of the samples and the major component of all relevés. Foxtail pine strongly dominates the sample. The total basal area for this type is 42.5 m²/ha, and the total density is 108 trees/ha. The age-height relationship for 10 *P. balfouriana* trees in this forest is more curvilinear than for *P. monticola*, with rapid vertical growth taking place in the first 100-150 years and leveling off at about 30-40 ft (9-12 m) after about 200 years. The oldest tree sampled is 330 years. Scattered individuals of *Pinus albicaulis* with occasional *P. monticola* at lower elevations are the only trees other than *P. balfouriana*.

Shrub understory ranges from practically nil at upper elevations to about 25 percent at the lower levels of this type. *Anemone drummondii* is virtually ubiquitous; 33 other herbs also are listed on the relevés, including *Phlox diffusa*, *Achillea lanulosa*, *Eriogonum umbellatum*, *Astragalus whitneyi*, *Poa pringlei*, *Arenaria nuttallii*, *Erysimum perenne*, and *Polygonum davisiae*.

***Penstemon procerus*/*Potentilla glandulosa* (91200):** 220 acres (89 ha) in the study area, 169 acres (68 ha) in the RNA. This herb-dominated association occurs on the summit ridges. It has been divided into two phases. The *Lesquerella occidentalis* phase is the highest elevation form; it occurs between 8500 and 9000 ft (2591-2743 m). It contains more *L. occidentalis*, *Poa pringlei*, *Erigeron compositus*,

Hulsea nana, *Potentilla fruticosa*, and *Ivesia gordonii* than the other phase. The *Eriogonum siskiyouense* phase occurs at elevations between 7900 and 8100 ft (2408-2469 m) on the S. slopes of the ridge above Deadfall Lakes. It contains more *Crepis pleurocarpa*, *Phlox diffusa*, *Sedum lanceolatum*, *Arenaria congesta*, and *Eriogonum siskiyouense* than the *Lesquerella* phase. Typical cover on the rocky slopes of this type is about 25 percent.

Rock Outcrop: 21 acres (9 ha)

Plant Diversity

Two hundred eighty-nine taxa are listed.

Conflicting Impacts

The area is relatively heavily used by recreationists. The trail to the summit is heavily used, and the lakes and meadows of the lower elevations are under relatively heavy impact (including some off-road vehicle use in recent years).

60. Mount Pleasant (Keeler-Wolf and Keeler-Wolf 1981, Keeler-Wolf 1989m)

Location

This established RNA is on the Plumas National Forest, Plumas County. It is 5 miles (8 km) N. of the resort area along the S. shore of Bucks Lake. It lies within portions of sects. 2, 10, 11, 14, 15, and 22 of T24N, R7E MDBM (39°57'N., 121°10'W.), USGS Bucks Lake quad (fig. 122). Ecological subsection – Greenville-Graeagle (M261Ed) and Bucks Lake (M261Ee).

Target Elements

Red Fir (*Abies magnifica*)

Distinctive Features

Compared to other surveyed Sierra Nevada red fir candidate RNAs (Green Island Lake cRNA, Onion Creek study area, Merced River cRNA, Teakettle Creek study area), Mount Pleasant has the following distinctions:

Red fir is overwhelmingly the dominant tree throughout forested portions. Red fir is reproducing in many different cover and stand types including S. and W. aspects rare or absent at other sites. Growth rates appear to be very rapid on SW. exposures; the RNA may have one of the most quickly maturing and reproducing red fir forests known.

The local mode of red fir reproduction differs from the standard type for the species (e.g., continual versus the typical pulse type, as described in Rundel and others [1977]). There is regular reseeding and a high percentage of uneven-age classes throughout the area in different stands. Continual reestablishment may result from high annual precipitation providing mesic conditions necessary for optimum germination and growth of seedlings.

All trees are short-cone bract *A. magnifica*, but only about 30 miles (48 km) N., most red fir is exserted-bract *A. magnifica* var. *shastensis*.

Mount Pleasant is the only red fir RNA with a well-represented bog flora, rare in the Sierra Nevada (see Grass Lake RNA).

Mount Pleasant is the only red fir RNA completely on granitic rock, the most widespread rock in the higher Sierra Nevada.

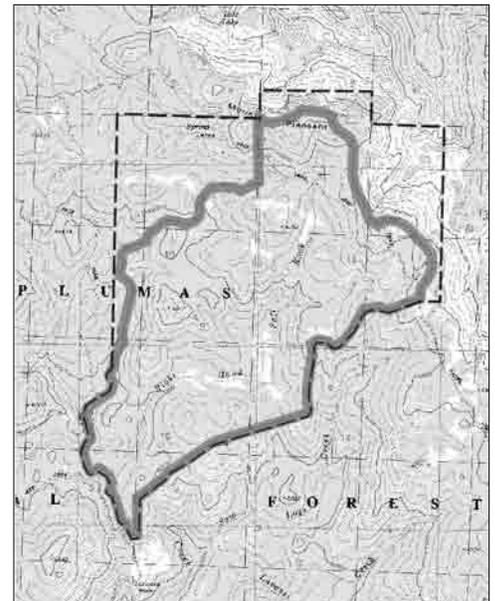


Figure 122—Mount Pleasant RNA

Dashed line = Ecological study area
Solid gray line = RNA Boundary

Rare Plants: *Penstemon neotericus* (CNPS List 4), *Sparganium minimum* (CNPS List 3)

Physical Characteristics

The area studied in the ecological survey is about 1785 acres (722 ha); however, the established RNA is 1416 acres (573 ha). Elevations range from 5800 to 7120 ft (1768-2170 m). Slope aspect is primarily SW. with a gentle gradient to the summit of Mount Pleasant. The survey also encompasses portions of the steep, glaciated NE.-facing escarpment of the mountain (not within the established RNA).

The principal rock type is granodiorite. Near the summit area are small andesitic dikes. The climate is montane Californian with exceptionally high winter precipitation. Mean April 1 snow depth at the snowcourse at the edge of the area (5910 ft, 1801 m) is 95 inches (241 cm). Mean winter snow depth may be more than 144 inches (366 cm) at the higher elevations. Estimated mean annual precipitation is 85-90 inches (2159-2286 mm) (Rantz 1972).

Association Types

A total of fifteen 0.1-ha plots were sampled in the red fir forest.

Red Fir Forest (85310, 84240): 1094 acres (443 ha). Red fir forests range from sheltered 175-ft (53-m) tall groves of 60- to 70-inches (1.5- to 1.8-m) dbh trees with little understory to open park-like stands with well-developed shrubby to herbaceous understories. Over the elevation gradient, red fir occurs as a codominant with white fir (*Abies concolor*) at low elevations, forms extensive monospecific forests throughout the mid-elevations, and codominates with western white pine (*Pinus monticola*) and locally with mountain hemlock (*Tsuga mertensiana*) at the highest elevations. Tree densities on the plots vary from 200 to 720/ha (mean 381), seedlings and saplings (all individuals <6 ft, or 1.8 m) range from 100 to 6030/ha, and basal area cover ranges from 32 to 189 m²/ha (mean, 98 m²/ha). Herb and shrub cover vary greatly from open to closed stands.

Three main subtypes of *A. magnifica* forest are identified: a relatively xeric, shallow-soil, open forest characterized by the presence of mountain chaparral shrubs (five shrub and six herb species characteristic); an

open forest with poor shrub layer but dense herbs (22 species characteristic) in the *Monardella-Chrysopsis* union of Oosting and Billings (1943); and a closed forest with no shrub layer and sparse herbs (15 species listed) ranging from shade-tolerant meadow border species to more xerophilic ericaceous interior forest species (fig. 123).

Mountain Riparian (63500): 109 acres (44 ha). This association is dominated by *Alnus tenuifolia* with *Salix orestera* and *S. caudata*. Other woody species include *Sorbus californicus*, *Cornus stolonifera*, *Sambucus microbotrys*, *Salix ligulifolia*, *Spiraea douglasii*, *Lonicera conjugialis*, *Leucothoe davisiae*, and *Kalmia polifolia* var. *microphylla*. There are many hydrophilic herbs and grasses, including *Aconitum columbianum*, *Athyrium felix-femina*, *Boykinia major*, *Circaea alpina* var. *pacifica*, *Epilobium angustifolium*, *Lilium pardalinum*, *Mitella breweri*, *Thalictrum fendleri*, and *Viola glabella* (23 species listed as characteristic).



Figure 123—Mount Pleasant, a complex of wet and moist meadow habitat surrounded by montane riparian thicket and dense red fir forest in Mount Pleasant RNA. (1981)

A distinctive phase on the NE. escarpment is dominated by *Salix orestera* with *Rhamnus alnifolia*, aspen (*Populus tremuloides*), *Sorbus californica*, *Spiraea douglasii*, and *Athyrium alpestre* var. *americana*.

Rock Outcrops (91200): 125 acres (51 ha), not included in the RNA. Mostly on NE.-facing granitic escarpment, this association includes a shrub-dominated mesophilic subtype with *Acer glabrum* var. *torreyi*, *Ribes nevadense*, *Spiraea densiflora*, *Heuchera rubescens* var. *glandulosa*, *Juncus nevadensis*, *Luzula divaricata*, *Phyllodoce breweri*, *Poa hanseni*, *Primula suffrutescens*, *Saxifraga bryophora*, and *Silene douglasii*. There is also a xeric subtype with *Sedum obtusatum* ssp. *boreale*, *Zauschneria californica* ssp. *latifolia*, *Penstemon newberryi*, *P. deustus*, *Cheilanthes gracillima*, *Eriogonum lobbii*, *Streptanthus tortuosus* var. *orbicularis*, and *Arenaria nuttallii* ssp. *fragilis*.

Mountain Chaparral (37510, 37542, 37520): 85 acres (34 ha). This association is primarily an edaphic climax in this area, occurring on rocky ridgetops or escarpments. Dominants vary with *Quercus vaccinifolia*, *Chrysolepis sempervirens*, and *Ceanothus velutinus* on relatively mesic or deeper soils. *Arctostaphylos nevadensis* and *A. patula* commonly dominate on shallowest or driest exposures. There are few herbs.

Meadow (45110, 45210): 55 acres (22 ha). Three subtypes occur, varying from wet to moist. Thirty-six species are listed as typical for the wet subtype, including *Cardamine breweri*, *Carex jonesii*, *C. nervina*, *Deschampsia caespitosa*, *Epilobium hornemannii*, *Glyceria elata*, *Habenaria dilitata* var. *leucostachys*, *H. sparsiflora*, *Juncus nevadensis*, *Luzula subcongesta*, *Saxifraga oregana*, *Sphenosciadium capitellatum*, and *Viola adunca*.

The moist subtype is more extensive, with 22 typical species including *Achillea lanulosa*, *Aster elatus*, *Delphinium depauperatum*, *Deschampsia danthonoides*, *Gilia capillaris*, *Lewisia nevadensis*, *Ligusticum grayi*, *Mimulus breweri*, *Penstemon oreocharis*, *Perideridia parishii*, and *Veratrum californicum*.

The moist, NE.-facing granite bench subtype has 14 species not present in other subtypes, including *Agrostis variabilis*, *Arnica diversifolia*, *Aster campestris* var. *bloomeri*, *Carex spectabilis*, *Phacelia procera*, *Phyllodoce breweri*, *Poa epilis*, *Potentilla drummondii*, and *Saxifraga bryophora*. It bears some similarities to subalpine meadows (Holland 45210).

Dry Meadow (45120): 10 acres (4 ha). This is a minor association within the red fir zone at the head of valleys above meadows and riparian scrub, often on N. or NW. exposures. The soil is deep decomposed granite. Late snowmelt and well-drained soil here may preclude establishment of forest. Herbs include *Astragalus bolanderi*, *Calyptridium umbellatum*, *Castilleja paynae*, *Eriogonum umbellatum* var. *polyanthum*, *E. ursinum*, *Haplopappus bloomeri*, *Lupinus obtusilobus*, *Penstemon laetus* ssp. *leptosepalus*, and *Phlox diffusa*.

Bog-Fen (51110, 51200): 20 acres (8 ha). Two subtypes occur: submerged and raised. Submerged bog species include *Menyanthes trifoliata*, *Sparganium minimum*, *Potamogeton natans*, *Nuphar polysepalum*, *Heleocharis acicularis* var. *bella*, *H. montevidensis*, *Carex rostrata*, and *C. limosa*. Raised bog species include *Sphagnum* sp., *Drosera rotundifolia*, *Mimulus primuloides* var. *pilosellus*, *Castilleja lemmonii*, *Pedicularis attolens*, *Aster alpigenus* ssp. *andersonii*, *Carex angustior*, *C. gymnoclada*, *C. senta*, *Camassia leichtlinii* ssp. *suksdorfii*, *Poa palustris*, *Polygonum bistortoides*, *Viola macloskeyi*, *Vaccinium occidentale*, and *Kalmia polifolia* var. *microphylla*.

Lodgepole Pine (*Pinus contorta* ssp. *murrayana*) Forest (86100): 43 acres (17 ha). This association forms narrow border groves along larger meadows and stream courses. Regeneration is healthy, with several age classes; some trees are

up to 45 inches (1.1 m) dbh and 135 ft (41 m) tall. Some areas of dead snags suggest water level fluctuations or infestations of needle miners. The understory is a subset of adjacent meadow and riparian associations.

Plant Diversity

Two hundred forty-five species of vascular plants are listed for the area.

Conflicting Impacts

Cattle grazing has been a consistent pressure on the area for many years. By the end of the summer, grazing exerts a strong visual impact on the vegetation of the bog, meadow, and riparian areas. There is evidence of increased erosion and habitat degradation in hydric associations. The area is now part of Bucks Lake Wilderness. About 2 miles (3.2 km) of a lightly used portion of the Pacific Crest Trail traverses the upper elevations.

Note: for Mount Shasta Mudflow, see Shasta Mudflow, #77

Note: for Mountaineer Creek, see South Mountaineer Creek, #83

61. Mud Lake (Mud Lake - Wheeler Peak) (Keeler-Wolf 1985b, Keeler-Wolf 1989n)

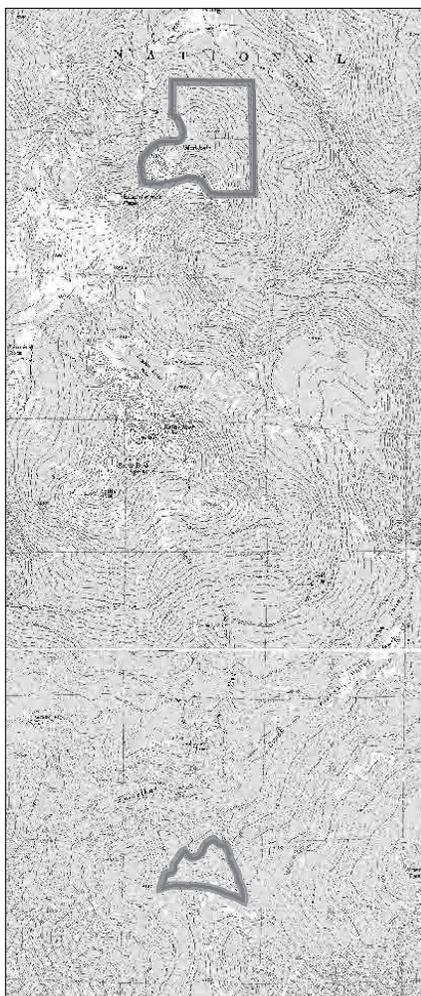


Figure 124—Mud Lake RNA

Location

This established RNA is on the Plumas National Forest. It is divided into two units: Mud Lake and Wheeler Peak. Both areas lie about 13 miles (21 km) E. of Greenville. The first unit is within sects. 23 and 26 T27N, R11E MDBM (40°10'N., 120°42'W.); the second unit is about 5 miles (8 km) S., lying entirely within sect. 23 T26N, R11E MDBM (40°06'N., 122°42'W.), USGS Kettle Rock and Genesee Valley quads (*fig. 124*). Ecological subsection – Diamond Mountains-Crystal Peak (M261Ea) and Fredonyer Butte-Grizzly Peak (M261Eb).

Target Element

Baker (Modoc) Cypress (*Cupressus bakeri*)

Distinctive Features

Baker Cypress: The two stands of this species within this RNA are unique for several reasons: They are the only stands of this species in Plumas County, marking the southernmost range limit for this species. Second, no other stands of any species of cypress in the State are known above 6000 ft (1829 m), and none are farther from the coast. Both of these stands are above 6500 ft (1981 m) and about 175 miles (282 km) from the nearest point along the coast. Thus, these stands are probably subjected to more snowfall and colder temperatures than any cypresses in the State or the world.

These stands are about 76 miles (122 km) from the nearest Baker cypress in Shasta County. The cool climate and isolation have undoubtedly influenced the genetic composition of these stands, and research is currently being done to determine their taxonomic position (C. Millar personal communication 1989).

The S. unit (Wheeler Peak) contains several large cypress individuals with dbh larger than 1 m. One of these, the largest known

Baker cypress (4.7 ft [1.42 m] dbh, 71 ft [21.6 m] tall) (fig. 125), may be well more than 300 years old. These large trees occur at the edges of dense monospecific cypress stands just N. of a largely unvegetated, rounded ridgetop.

The number of large individuals at Wheeler Peak contrasts sharply with the situation at the N. unit (Mud Lake). At Mud Lake, trees occur in dense spindly stands less than 100 years old or as senescent individuals scattered in a dense, young forest of white fir (*Abies concolor*). The oldest tree is less than 150 years and most are under 90, indicating an extensive crown fire 90 or more years ago. The competition for light between Baker cypress and white fir at Mud Lake has produced some of the tallest known Baker cypress (about 92 ft, 28 m).

Biogeographic Significance: This area represents the NE. extension of the N. Sierra Nevada (Sierra Nevada ecological section) and is only a few miles from the edge of the N. end of Great Basin. This cold desert influence is apparent on the xeric ridgetops of both units, where vegetation is dominated by typical Great Basin species (e.g., *Artemisia tridentata*, *Purshia glandulosa*, *Wyethia mollis*). Species associated with these ridgetops include several other Great Basin forms such as *Bromus richardsonii*, *Penstemon speciosus*, *Thelypodium flexuosum*, *Poa nevadensis*, and *Stipa williamsii*, which are atypical of the W. side of the Sierra-Cascades Divide.

Rare Plants: Baker cypress (*Cupressus bakeri* ssp. *bakeri*) is a member of CNPS List 4.

Physical Characteristics

The Mud Lake unit covers 307 acres (124 ha), and the Wheeler Peak unit covers 73 acres (30 ha). Elevations at Mud Lake range from 6160 to 7320 ft (1878-2231 m). Elevations at Wheeler Peak range from 6080 to 6560 ft (1853-2000 m). The Mud Lake unit occupies the NE. slope of Eisenheimer Peak and includes a small glacial cirque containing the shallow 2.5-acre (1-ha) Mud Lake. The Wheeler Peak unit occupies the N.-facing slope of a spur ridge running W. from Wheeler Peak. Both areas have slopes averaging 25-35 degrees.

Rocks at both units are Tertiary volcanics, primarily andesite of the Penman and Ingalls formations. The summit ridge at Wheeler Peak is capped by mudflow breccia. Soils are described as one principal mapping unit at both sites; the Inville-Woodseye-Goodlow complex covers the Mud Lake site, and the Inville-Woodseye complex covers the Wheeler Peak site. The Goodlow family is a moist soil that underlies the meadows and lake at Mud Lake. Annual precipitation is estimated at about 40 inches (1016 mm) at both sites, with the majority as snow. Drifts of more than 6 ft (2 m) occur regularly at the highest elevations. Temperatures average 27 °F (-3 °C) in January, with annual minima at or below 5 °F (-15 °C). The July mean is about 61 °F (16 °C).

Association Types

Mixed conifer and cypress stands were sampled using nineteen 100-m² plots. The remaining vegetation is qualitatively described.

Mixed Conifer Forest (84230, 84240): 307 acres (124 ha). Both units contain large areas of this forest type. The majority of the Mud Lake forest is dominated by white fir (*Abies concolor*) with the major subdominants Baker cypress and red fir (*Abies magnifica*), whereas the Wheeler Peak forest is more mixed, with white fir, sugar pine (*Pinus lambertiana*), Jeffrey pine (*P. jeffreyi*), incense-cedar (*Libocedrus decurrens*), and Douglas-fir (*Pseudotsuga menziesii*) co-dominating.



Figure 125—Mud Lake, champion Baker cypress at Wheeler Peak site. This tree is 22 m (71 ft) tall and has a dbh of 142 cm (56 inches). (1984)

Thirteen 10- by 10-m plots were sampled in the Mud Lake forest. Most of these are in the young forest strongly dominated by white fir. Trees in this forest average only 6 inches (15 cm) dbh (maximum about 20 inches, 51 cm). Canopy height is 89-100 ft (27-30 m) in the areas with deepest soil. Tree density is high (3340/ha), with white fir accounting for 77 percent of the stems. Basal area cover is correspondingly low, averaging 77 m²/ha, with white fir accounting for 69 percent of the total. Baker cypress accounts for 16 percent of the stems and 20 percent of the cover. Portions of this association at the lower elevations at Mud Lake and most of it at Wheeler Peak contain large mature trees with dbh up to 5 ft (1.5 m) and heights of 161 ft (49 m).

The understory of the dense, young forest is sparse, with occasional shade-tolerant herbs such as *Chimaphila umbellata*, *C. menziesii*, *Pyrola picta*, and *Corallorhiza maculata*. The more open, mature forests have occasional shrubs of *Ceanothus prostratus*, *Symphoricarpos acutus*, *S. vaccinioides*, *Ribes roezlii*, *Amelanchier pallida*, and *Arctostaphylos patula*.

Mountain Chaparral (37510): 24 acres (10 ha). This association occurs at both units. Much of the Mud Lake chaparral is being invaded by young white and red firs. The most extensive remaining areas are on the N. side of the main ridge. Here, thickets border on sagebrush scrub and are mixed with young red and white firs and the uppermost cypress groves. *Arctostaphylos nevadensis* dominates the rocky margins, whereas taller *A. patula*, *Ceanothus velutinus*, *Prunus emarginata*, and *Chrysolepis sempervirens* dominate adjacent to young forest. A similar type of successional chaparral occurs at Wheeler Peak in openings on the N. side of the ridge. These openings may have been partially created by selective logging within the Wheeler Peak unit in 1957-1959.

An edaphic climax mountain chaparral occurs in the upper cirque basin of Mud Lake. The thin rocky soil is scattered with andesite boulders and supports a sparse cover of *Arctostaphylos nevadensis*, *Ceanothus velutinus*, *C. cordulatus*, *Symphoricarpos vaccinioides*, *Ribes cereum*, *Spiraea densiflora*, and *Amelanchier pallida*. Perennial herbs such as *Penstemon newberryi* and *Monardella odoratissima* ssp. *pallida* are common.

Ridgetop Scrub and Herb Association (35210): 13 acres (5 ha). This association is called "big sagebrush scrub" in the establishment record. It is dominated by a sparse to moderate cover of *Artemisia tridentata*, *Purshia tridentata*, *Chrysothamnus nausiosus* ssp. *albicaulis*, and *Haplopappus bloomeri*. Other characteristic species include *Eriogonum umbellatum*, *E. ursinum*, *E. marifolium*, *Penstemon speciosus*, *P. deustus*, *Crepis occidentalis*, and *Wyethia mollis* (31 species listed as characteristic). Certain areas of the ridgetops are vegetated with scattered Jeffrey pine and white fir. These areas tend to have higher representation of mountain chaparral shrubs such as *Ceanothus velutinus* and *Prunus emarginata*. A large-leafed form of *Ceanothus prostratus* is conspicuous at the Wheeler Peak site.

Riparian Associations (61520, 63500): 11 acres (4 ha). The Mud Lake unit has willow (*Salix ligulifolia*, *S. pseudocordata*, *S. drummondiana* var. *subcoerulea*), mountain alder (*Alnus tenuifolia*), and aspen (*Populus tremuloides*) riparian areas surrounding the lake, its outlet stream, and several seeps. The aspen type is limited to a few acres along the outlet stream. It is not well developed, with only scattered moderate-sized trees. It is closely associated with the willow-dominated riparian thickets.

The willow thickets are particularly common on the margins of the lake, but they also occur as patches along the intermittent outlet stream. Beneath them is a rich herb layer including *Mertensia ciliata*, *Bromus marginatus*, *Elymus glaucus*, *Cirsium andersonii*, *Aster occidentalis*, *A. integrifolius*, and *Senecio triangularis*.

Mountain alder is locally dominant at the S. end of the lake and also occurs in shadier areas along the outlet stream and in several seep areas surrounded by coniferous forest.

Northern Interior Cypress Forest (83220): 9 acres (4 ha). This association is considered within the mixed conifer forest in the ecological survey but treated separately in the establishment record. This classification pertains largely to the monospecific stands of Baker cypress at Wheeler Peak and to the few dense high-elevation stands at Mud Lake. The Mud Lake stands are crowded and spindly; they are becoming senescent as they are shaded out by the competing white and red firs.

In contrast, most of the stands at Wheeler Peak are isolated from surrounding mixed conifer forests and border on the open ridgetop. These stands appear to be healthy, although often dense. They are exposed to more sun and less competition than the Mud Lake stands. Densities for six plots in this forest at the Wheeler Peak site average 3100/ha, with Baker cypress comprising 44 percent of the stems and white fir (mostly pole size) comprising about 56 percent. Basal area cover averages 52 m²/ha, with Baker cypress comprising 72 percent of the cover and white fir 26 percent. The understory is poorly developed because the canopy is dense.

Red Fir Forest (85310): 6 acres (2 ha). This forest occurs at the head of the Mud Lake cirque above 7000 ft (2134 m). It is associated with the edaphic climax form of mountain chaparral and is relatively open. Some of the successional fir forest surrounding the uppermost cypress stands also may be considered of this type.

Riparian Border Forest (86100): 6 acres (2 ha). This association forms an intermittent border lying between the young mixed conifer forest and the riparian and meadow associations at the Mud Lake unit. It is dominated by lodgepole pine (*Pinus contorta* ssp. *murrayana*) with occasional aspen, red fir, white fir, Baker cypress, and Jeffrey pine intermixed. This is the most mesic situation for Baker cypress, and some of the largest and oldest individuals at the Mud Lake unit occur here (up to 76 cm dbh and 130 years old). The understory is shady and contains some of the more shade-tolerant riparian and meadow species.

Meadow (45110, 45120): 4 acres (2 ha). This association is interspersed with the riparian shrubs and trees around the lake and its outlet. Both wet and dry phases occur. A large number of herbs occur in this association (35 species listed as characteristic). Typical meadow species include *Agrostis variabilis*, *Carex heteroneura*, *C. stipata*, *Danthonia intermedia*, *Glyceria striata*, *Juncus xiphioides*, *J. nevadensis*, *Perideridia gairdneri*, *Sisyrinchium idahoense*, and *Trifolium variegatum* var. *pauciflorum*.

Montane Freshwater Marsh (52430): 3 acres (1 ha). This association is restricted to Mud Lake. This shallow lake harbors a patchy cover of shallow-rooted and floating-leaved hydrophytes including *Carex rostrata*, *Sparganium multi-pedunculatum*, and *Potamogeton natans*. *Carex rostrata* forms a dense band around the lake. This association was termed “aquatic association” in the ecological survey.

Plant Diversity

One hundred eighty-one taxa are listed in the ecological survey. An additional six species were noted in the establishment record (total 187).

Conflicting Impacts

The cypress stands at the Mud Lake unit must be rejuvenated by fire or they will soon be shaded out by the dense young white fir forest. Prescribed burning at Mud Lake will be difficult because of the dense fir forest. Wheeler Peak also will require burning to rejuvenate the cypress stands there, but this will be less difficult because of the surrounding open vegetation. Some of the Wheeler Peak unit was selectively logged between 1957 and 1959. However, the scattered cypress in this part of the area justifies its inclusion in the RNA.

Note: for Mud Lake-Wheeler Peak, see Mud Lake, #61

62. North Trinity Mountain (Sawyer 1981b)

Location

This recommended RNA is on the Six Rivers National Forest. It lies about 11 miles (18 km) NE. of the town of Hoopa, Humboldt County, in sects. 3, 4, and 5 T8N, R6E and sects. 32 and 33 T9N, R6E HBBM (41°7'N., 123°30'W.), USGS Tish Tang Point and Trinity Mtn. quads (fig. 126). Ecological subsection – North Trinity Mountain (M261Aq).



Figure 126—North Trinity Mountain rRNA

Target Element

White Fir (*Abies concolor*)

Distinctive Features

White Fir Forest: This type of forest is the major cover over large portions of the upper elevation Klamath Mountains ecological section. Although it occurs in several other candidate and established RNAs of the Klamath region (e.g., Bridge Creek, Haypress Meadows, Manzanita Creek, Peach Creek, Sugar Creek), it is not particularly well represented at those sites. The varied slope exposure and the broad elevational range within this area enable a wide representation of this important vegetation type, including some overlap with lower-elevation forests dominated by Douglas-fir (*Pseudotsuga menziesii*) and upper-elevation forests dominated by noble fir (*Abies procera*) forest.

Noble Fir Forest: Although not specifically discussed in the ecological survey, the North Trinity Mountain area has been singled out as having one of the best stands of this species in California (Sawyer and Thornburgh 1969). The area also should be known and studied for this value.

Rare Flora: One species, *Gentiana setigera*, is on List 3 of CNPS. It occurs locally in the meadows of Red Cap Hole.

Research Precedent: Because this montane forest is the most accessible to Humboldt State University, the University has already used the area for research and educational purposes.

Physical Characteristics

The study area includes about 640 acres (259 ha) of slopes drained by the South Fork of Mill Creek (study area shown is larger). Slopes range from gentle to steep and include N-, W-, and S- exposures. Terraces are minor, especially at lower elevations. Slopes in the lower W. portion are most abrupt. Elevations range from 4500 to 6362 ft (1372-1939 m).

The area is underlain by quartz diorite of the Ironside Mountain Batholith. Glacial action created Mill Creek Lakes, and the slopes behind the lake are scoured. Morainal deposits are common. Soils are likely to be of the Chawanakee (sand loams drying by midsummer) and Chiquito (shallow, on upper slopes and ridges) series, but they also include large areas of rock outcrop and coarse loamy mixed soils typical of glacial till. Snow typically lingers until July on high N. slopes. Mean annual temperatures are estimated at somewhat lower than 50 °F (10 °C), with average annual precipitation about 70 inches (1778 mm).

Association Types

Twenty-one releves and ten 0.1-acre strips were sampled in the white fir forest. Areal cover is not given for the associations.

White Fir Forest (84240): The majority of the area is classified as a part of this forest type, which is divided locally into two series. Evaluation of the samples results in the classification of the white fir forest into the white fir/*Pteridium aquilinum* and the white fir/*Quercus sadleriana* subtypes. Sampling was conducted primarily on the mid-slopes of the area. The canopy is dominated by white fir (89 percent of the 403 trees/ha). Basal area for the forest is 118 m²/ha, of which white fir makes up 73 percent. There are a few large sugar pines (*Pinus lambertiana*) that make up a moderate portion of the basal area, but the two most important subdominants are incense-cedar (*Libocedrus decurrens*) (basal area 15 m²/ha) and noble fir (12 m²/ha). Trees older than 100 years reach heights of about 120 ft (37 m).

The first subtype is an extensive closed forest with canopy and understory dominated by white fir (fig. 127). The shrub layer is not well developed, although 12 species are noted, with *Acer glabrum*, *Rubus parviflorus*, and *Symphoricarpos hesperius* most common. Some 25 herb taxa are restricted to this type, and 8 more are most common here. *Linnaea borealis* is common and suggests the mesic affinities of this forest type. Other important species include *Anemone deltoidea*, *Achlys triphylla*, *Chimaphila umbellata*, *Vancouveria hexandra*, *Rubus vitifolius*, and *Clintonia uniflora*.

The second subtype, white fir/*Quercus sadleriana*, also is dominated by white fir in both canopy and understory (reproduction), but Douglas-fir is also an important component. This type is more extensive on steeper slopes at lower elevations than the first subtype. *Quercus sadleriana* dominates the shrub layer, with few herbs in the ground layer. Nine shrubs and 20 herbs are listed for the subtype. However, none of these species except *Q. sadleriana* accounts for more than 25 percent cover. The most conspicuous herb is *Chimaphila umbellata*.

Montane Chaparral (37510): This type is termed white fir/*Quercus vaccinifolia* and is dominated by *Arctostaphylos patula* and *Quercus garryana* var. *breweri*. White fir and incense-cedar are frequent along with the shrubby sclerophylls. Only one herb is noted in the sample of this type, and it (*Apocynum androsaemifolium*) has very low cover.

Noble Fir Forest (85310): This forest type is not discussed in depth, but it does occur at the upper elevations near the top of North Trinity Mountain. It is probably similar in structure and density to other noble fir forests of the W. Klamath Mountains ecological section (see Haypress Meadows cRNA and Rock Creek Butte cRNA).

Meadows (45100): Although not specifically discussed, many of the taxa in the species list are typical meadow species; a photograph of a small meadow with such species as *Veratrum californicum* is included in the survey.

Plant Diversity

Two hundred twenty-one taxa are listed.



Figure 127—North Trinity Mountain, general structure of the white fir/*Pteridium aquilinum* type in North Trinity Mountain rRNA. (1981)

Conflicting Impacts

Some logging has taken place in the past along the W. boundary. Some trespassing cattle have grazed in the small meadows of Red Cap Hole. Some off-road-vehicle use is reported on the access trail (an old jeep road) to Mill Creek Lakes.

63. Onion Creek (Talley 1977b)

Location

This study area (dropped from RNA consideration in 1982) is on the Tahoe National Forest, Placer County. It lies about 2 miles (3 km) S. of Norden. It lies within portions of sect. 36 T17N, R14E, sects. 1 and 12 T16N, R14E, sect. 29 T17N, R15E, and sect. 32 T16N, R15E MDBM (39°19'N., 120°20'W.), USGS Norden quad (fig. 128). Ecological subsections – Upper Batholith and Volcanic Flows (M261Eh).

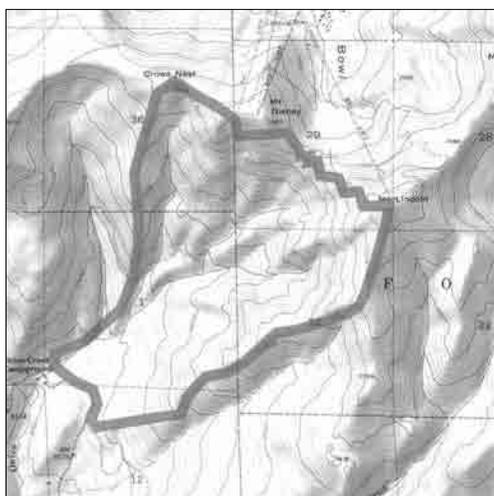


Figure 128—Onion Creek ecological survey area

Target Elements

White Fir (*Abies concolor*) and Red Fir (*Abies magnifica*)

Distinctive Features

Tree Growth: A large body of data is presented on this topic. To summarize: growth of red and white fir within closed stands is essentially equal and linear between 5 and 30 years after establishment. Fastest growth of both species occurs on gentle S.- to W.-facing aspects. Trees growing in open sites attain breast height in 15 to 30 years. Slowest red fir growth is on high, steep N.-facing slopes (70 years to breast height), and slowest white fir growth is on glacial moraines on S.-facing slopes (100 years to breast height).

Structure: Much of the present white fir forest was dominated by red fir until 150 years ago. Establishment of sugar pine (*Pinus lambertiana*) and Jeffrey pine (*P. jeffreyi*) within this white fir forest has been gap-phase. Incense-cedar (*Libocedrus decurrens*) is also largely gap-phase. Dry meadows formerly dominated by large individuals of incense-cedar are now often characterized by forests of dense, young white fir, indicating recent invasion of these habitats. Before an increase in establishment about 1750 for white fir, other gently sloping meadow borders were probably codominated by incense-cedar, white fir, sugar pine, and Jeffrey pine, forming an open mixed conifer forest.

The steady upsurge of white fir in the past 350 years coincides with increasing warmth, which was augmented by above-average precipitation 50-100 years ago. Reduction in fire frequencies may also explain the recent white fir invasion of dry meadows at elevations below 6562 ft (2000 m).

The increase in density and extent of white fir forest contrasts with the situation for red fir, which shows stability over the past 400 years. Red fir forest is regionally stable, but locally gap-phase in its reproductive strategy. In some areas where wind-throw was extensive, there are large, even-aged, and dense stands of young red fir. Western white pine (*Pinus monticola*) is much less common than red fir, but it has a similar negative log-linear relationship in size classes. In general, recent changes in densities of tree species in red fir forest will probably not result in major changes in composition of this climax forest over coming centuries. Lower-elevation sites experiencing upsurges in white fir will combine with a red fir increase within upper-elevation white fir forest to produce a broader overlap zone of red and white fir forest.

Physical Characteristics

This site encompasses 1035 acres (419 ha) between 6040 and 8382 ft (1840-2555 m) on the W. slope of the Sierra Nevada in the uppermost watershed of Onion Creek, a tributary of the North Fork of the American River. S., SW., and W.-facing slopes predominate, with slopes steepening to vertical cliffs and talus at the upper elevations.

Rocks are Miocene and Pliocene volcanic pyroclastic deposits. At Norden, 88 percent of the precipitation falls between November 1 and April 30, with 91 percent of all precipitation falling as snow. Mean annual precipitation is about 53 inches (1346 mm). Mean maximum summer temperatures are 64-75 °F (18-24 °C), whereas winter temperatures below -13 °F (-25 °C) are very rare.

Association Types

Eight 0.07-ha plots were sampled in white fir forest; nine were sampled in red fir forest.

Rock Scree, Cliff, and Talus (91200): 400 acres (162 ha). This association forms a topographic timber line above about 7220 ft (2200 m). There are occasional trees of Jeffrey pine and Sierra (western) juniper (*Juniperus occidentalis* ssp. *australis*), but the majority of the vegetation (usually <50 percent total cover) is herbaceous or shrubby. The following species are typical: *Eriogonum umbellatum* ssp. *polyanthum*, *E. lobpii*, *Artemisia tridentata*, *Arctostaphylos nevadensis*, *Ceanothus cordulatus*, *C. prostratus*, *Collinsia parviflora*, *Gayophytum ramosissimum*, *Helianthella californica*, *Monardella odoratissima*, *Phlox diffusa*, *Sitanion hystrix*, and *Wyethia mollis*.

Red Fir Forest (85310): 363 acres (147 ha). Red fir forest is restricted to higher elevations and cold air pockets where drought stress is low. Red fir is strongly dominant on N.-facing slopes above 6890 ft (2100 m) and along canyon bottoms at lower elevations. Importance values are consistently high (227±23). Density is variable, ranging from 101 to 1823 stems/ha, as is basal area (72±25 m²/ha), but cover is more stable (55±14 percent). Principal associates with red fir are western white pine (high elevations) and white fir (low elevations). Average importance value for white fir in this forest is 62 with a density of 125 stems/ha, 18 percent crown cover, and basal area of 19 m²/ha. Western white pine occurs in low density at five plots, with an average importance value of 29, a density of 34 stems/ha, crown cover of 7.2 percent, and basal area cover of 6 m²/ha. Sugar pine and Jeffrey pine also occur as isolated large individuals at lower elevations. Mountain hemlock (*Tsuga mertensiana*) occurs in the highest N.-facing slope stands.

Subordinate species (herbs and shrubs) for both red and white fir forest are similar and include *Asclepias cordifolia*, *Chimaphila umbellata*, *Corallorhiza maculata*, *Hieracium albiflorum*, *Kelloggia galioides*, *Osmorhiza chilensis*, *Phacelia hydrophylloides*, *Pedicularis semibarbata*, *Pterospora andromedea*, *Pyrola picta*, *Ribes roezlii*, and *Symphoricarpos vaccinoideis*. Species confined to low-elevation forests (believed previously to have been mixed conifer) include mesophilic taxa such as *Goodyera oblongifolia*, *Adenocaulon bicolor*, *Smilacina stellata*, and *Thalictrum fendleri*. *Arabis platysperma* and *Chrysopsis breweri* are most typical of red fir forest.

White Fir Forest (84240): 250 acres (101 ha). White fir dominates all forest sites sampled below 6400 ft (1950 m) and at higher-elevation sites with steep to moderate S. or W. aspects. Average white fir importance value is 181. Basal area is variable, averaging 91±81 m²/ha, and density averages 634 stems/ha.

Reproduction within all white fir sites is dense. White fir appears to be proliferating at the expense of sugar pine, Jeffrey pine, and incense-cedar. Invasions of incense-cedar stands by white fir are noted, but incense-cedar is still reproducing at the ecotones between forest and meadows, and in such situations it may be rapidly increasing in abundance. Jeffrey pine is not currently

reproducing within the main body of white fir forest and is generally scattered as older individuals. Sugar pine is common on gentle topography below 6560 ft (2000 m), especially around dry meadows where it may have been the principal dominant 200 years ago. At present, intermediate and young sugar pines are uncommon or absent. Red firs are abundant as saplings and seedlings in portions of the white fir forest but uncommon as mature trees below 6400 ft (1950 m). Red fir abundance within white fir forest is related to the closeness of red-fir-dominated forests.

Before the increase of white fir and red fir, a more even mixture of the principal species of the mixed conifer canopy in a semi-open forest is hypothesized for most sites on gentle topography below 6400 ft (1950 m). White fir cannot successfully compete with red fir at higher elevation primarily because of its intolerance of high winter snow packs in the sapling stage.

Huckleberry Oak Scrub (37542, 37510): 79 acres (32 ha). *Quercus vaccinifolia* forms a dense chaparral on S.-facing exposures. Other species present include *Allium campanulatum*, *Arctostaphylos nevadensis*, *A. patula*, *Carex* sp., *Calochortus leichtlinii*, *Ceanothus cordulatus*, *C. prostratus*, *Poa* sp., *Melica* sp., *Pellaea bridgesii*, and *Penstemon speciosus*. Moderate exposures of this type are being invaded by white fir and red fir with lesser numbers of Jeffrey pine and incense-cedar. Invasion fronts of white fir are typical of ecotones between fir forest and chaparral. The core of this association is resistant to invasion because long snow-free periods and resulting critically low-water potentials of summer and fall do not permit conifer establishment, and because the huckleberry oak scrub adapts to crown fires.

Dry Meadows (45100): 35 acres (14 ha). This association is characterized by an abundance of *Lotus nevadensis*, *Madia exigua*, *Poa* sp., *Trifolium* sp., *Verbascum thapsus*, *Cirsium* sp., etc. Encroachment by white fir and, to a lesser extent, Jeffrey pine has significantly reduced dry meadow habitats below 6600 ft (2012 m).

Mountain Alder Thicket (63500, 61520): This riparian scrub is restricted to seepy areas. *Alnus tenuifolia* usually dominates (75 percent cover), with scattered specimens of *Acer glabrum* var. *torreyi*, and *Salix scouleriana*. There are many mesophytic understory species (15 species listed in association table). A cluster of aspen (*Populus tremuloides*) also occurs in the ecotone between dry meadow and *Alnus* thickets. Typically, *Acer glabrum* occurs around the periphery of the *Alnus* thickets.

Plant Diversity

One hundred eight taxa are listed for all habitats, but total diversity is undoubtedly higher.

Conflicting Impacts

The area is part of the Onion Creek Experimental Forest, and as such, its candidacy as an RNA was rejected.

64. Organ Valley (Burke 1985, Martin 1990c)

Location

This established RNA is on the Cleveland National Forest and is about 8 miles N. of Ramona in San Diego County. The site includes portions of sects. 6, 7, 8, and 18 T12N, R2E SBBM (33°9'N., 116°49'W.), USGS Mesa Grande quad (fig. 129). Ecological subsection – Western Granatic Foothills (M262Bn).

Target Elements

Engelmann Oak (*Quercus engelmannii*)

Distinctive Features

Rare Flora: Several rare plant species occur in the area: *Senecio ganderi* (CNPS List 1B, State-listed rare species) and *Horkelia truncata* (CNPS List 1B) occur on Las Posas soil along the Black Mountain fuel break in the E. portion of the area. *Brodiaea orcuttii* is a member of CNPS List 1B and occurs as a member of the savanna vegetation on the central mesa. *Calamagrostis densa*, *Diplacus (Mimulus) clevelandii*, and *Monardella hypoleuca* ssp. *lanata* are members of CNPS List 4 and also occur along the E. boundary in Los Posas soil. *Thermopsis macrophylla* var. *semota* (CNPS List 1B) also is listed in the establishment record, although the location is not indicated.

Engelmann Oak: This species is an endemic to S. California, and the savanna subtype it forms in the central part of the area is considered an endangered plant association as a result of habitat alteration and destruction (Holland 1986). Engelmann oak is represented in four subtypes at Organ Valley, and it is reproducing well in all of them. Thus, the area has strategic importance as a reserve for this species.

Physical Characteristics

The area covers about 560 acres (226 ha) on the S. slope of Black Mountain. Elevations range from 2300 to 3900 ft (701-1189 m). Slopes vary from 2 percent on the small mesa in the center of the area to 35 percent on the steep chamise-covered hillsides. The site is drained by two intermittent streams. Drainage is to the W. One spring occurs within the area and another just outside it.

Rocks are gabbroic (chiefly San Marcos and Cuyamaca gabbros) and granitic (primarily undivided quartz diorite of the Southern California Batholith). Soils include four mapping units, the most extensive of which is the Las Posas stony fine sandy loam 30-65 percent slopes, followed by acid igneous rock land, Reiff fine sandy loam 5-9 percent slope, and finally by Reiff fine sandy loam 0-2 percent slope. The last unit underlies the savanna in the center of the area. Average annual precipitation is estimated at 20-25 inches (508-635 mm). Mean minimum temperatures are about 44 °F (6.7 °C) and mean maximum is about 77 °F (25 °C).

Association Types

No vegetation sampling was conducted in this survey.

Chamise Chaparral (37200): 206 acres (83 ha). This chaparral is dominated by *Adenostoma fasciculatum*. It is best developed on S.- and W.-facing slopes and ridges. *Yucca whipplei*, *Arctostaphylos glandulosa*, *Ceanothus leucodermis*, *Ceanothus foliosus*, *Eriogonum fasciculatum*, *Salvia apiana*, and *Quercus dumosa* are low-density associates.

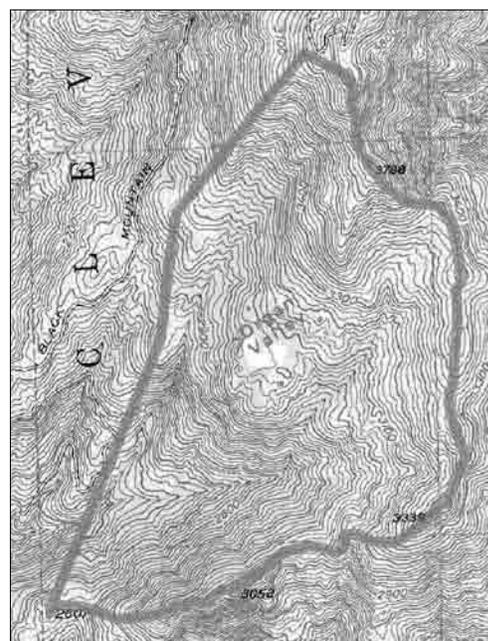


Figure 129—Organ Valley RNA.

On dry slopes with more N.-aspects, *Quercus dumosa* increases in relative cover. Also associated with this phase are *Garrya veatchii*, *Prunus ilicifolia*, *Rhus ovata*, and *Rhamnus ilicifolia*. This chamise-scrub oak vegetation covers 124 acres (50 ha), but it is classified as Mixed Chaparral in the establishment record.

On the E.- and S.-facing slopes overlying the acid igneous rock land soil series, a very dry phase of chamise chaparral occurs. About 20 percent of the cover is exposed granitic rock. Species composition is similar to the main phase of chamise chaparral, but the aspect is more xeric. All phases of chamise chaparral intergrade with both mixed chaparral and southern interior oak woodland.

Southern Interior Oak Woodlands (71160, 71181, 71182, 81310, 42110, 32700): 108 acres (44 ha). This formation is represented by three subtypes locally.

The first is the Engelmann oak savanna. This type dominates on the central mesa where Engelmann oak occurs in relatively low density, with an understory dominated by *Juncus* spp., *Stipa* spp., and *Muhlenbergia*

rigens (fig. 130). Many small annuals occur including *Silene multinerva*, *Vicia exigua*, *Arabis glauca*, *Sidalcea malvaefolium*, *Medicago polymorpha*, *Erodium cicutarium*, and *Stellaria media*.

The second subtype is characterized by an understory dominated by *Salvia apiana*, *Eriogonum fasciculatum*, and other species characteristic of inland sage scrub including *Artemisia californica*, *Bromus mollis*, and *B. rubens*. Coast live oak (*Quercus agrifolia*) shares dominance with Engelmann oak in this type, which occurs on S.-facing slopes of about 8°.

The third subtype is a mixed-dominance closed-canopy oak woodland covering. Coast live oak and Engelmann oak share dominance. *Toxicodendron diversilobum* and *Heteromeles arbutifolia* are shrubby subdominants along with *Ceanothus leucodermis*, *Rhus ovata*, *Ribes indecorum*, and *Prunus ilicifolia*. This subtype occurs on relatively mesic, moderately sloping WSW.-facing slopes. This subtype may intergrade with chamise chaparral on W.-facing slopes where a sparse oak cover overlies an understory of *Adenostoma fasciculatum*, *Thalictrum polycarpum*, *Rhus ovata*, and *Heteromeles arbutifolia*.

Regeneration of Engelmann oak is excellent within all three main subtypes.

Mixed Chaparral (37110, 37120): 198 acres (80 ha). This type covers W.-facing slopes. The principal woody species include *Arctostaphylos glandulosa*, *A. glauca*, *Quercus dumosa*, *Ceanothus leucodermis*, *C. oliganthus*, *C. integerrimus*, *C. tomentosus*, *Erigeron fasciculatum*, *Heteromeles arbutifolia*, *Rhus ovata*, *Rhus laurina*, *Clematis lasiantha*, and *Nolina parryi*. Both Engelmann and coast live oaks occur sporadically. Understory associates include *Symphoricarpos mollis*, *Cheilanthes clevelandii*, *Pellaea mucronata*, *Haplopappus squarrosus*, *Eriophyllum confertiflorum*, *Eriodictyon angustifolium*, *Antirrhinum nuttallianum*, *Thalictrum polycarpum*, and *Toxicodendron diversilobum*.

Riparian Oak Woodland (61310): 48 acres (19 ha). This mesic association occurs along the two intermittent streams and scattered sandy washes. This woodland contains the following woody species: coast live oak, Engelmann oak (in low frequency), California sycamore (*Platanus racemosa*), *Salix lasiolepis*, and

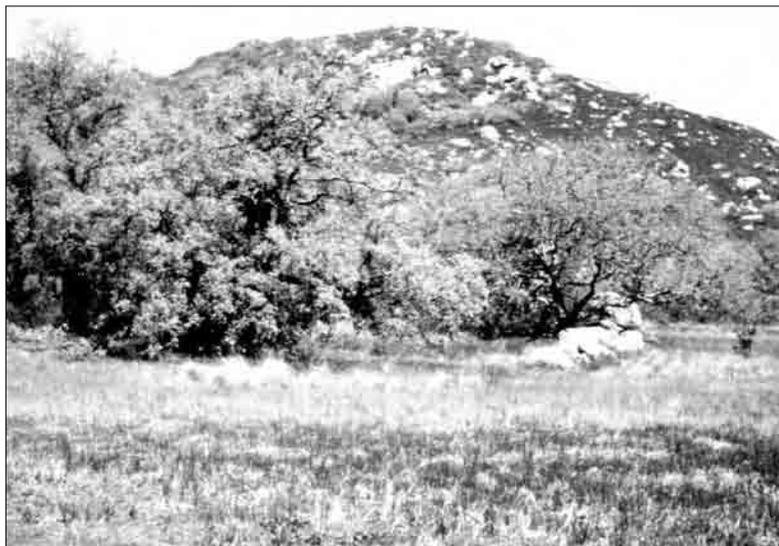


Figure 130—Organ Valley, Engelmann oak savannah in Organ Valley RNA. (around 1985)

Toxicodendron diversilobum. A rich understory includes *Keckiella cordifolia*, *Dryopteris arguta*, *Woodwardia fimbriata*, *Iris missouriensis*, *Pycnanthemum californicum*, *Lonicera subspicata*, and *Anemopsis californica*.

Plant Diversity

One hundred eighty-two taxa are listed.

Conflicting Impacts

Grazing occurred in Organ Valley until 1981. Cattle grazing in oak woodlands contributed to poor reproduction by Engelmann and coast live oaks. Fuel breaks have been used by off-road vehicles, and this has had negative impact on the sensitive plants of the N. boundary area. Three fires have occurred in portions of the area since 1913. The largest was the 1961 Black Mountain fire, which affected the N. portion of the area.

65. Peach Creek (Keeler-Wolf 1987d)

Location

This study area (dropped for RNA consideration in 1987) is on the Six Rivers National Forest about 3 miles (5 km) E. of the town of Orleans. It lies within portions of sects. 26, 27, 28, 32, 33, 34, 35 T11N, R6E and sects. 2, 3, and 4 T10N, R6E HBM (41°18'N., 123°30'W.), USGS Orleans and Orleans Mtn. quads (*fig. 131*). Ecological subsection – Lower Salmon Mountains (M261Af).

Target Element

Douglas-Fir-Tanoak-Pacific Madrone (Mixed Evergreen Forest)

Distinctive Features

Great Elevation Span: This relatively small area has an elevational difference of nearly 1 mile (1.6 km) in 3 horizontal miles (4.8 km). The diversity of slope exposures ensures a broad sample of Klamath Mountains ecological section vegetation from low to moderately high elevations, although none of these vegetation associations is particularly well represented. This is especially true for the upper-elevation noble fir (*Abies procera*) forest, montane chaparral, rock outcrop, and white fir (*Abies concolor*) forest.

Mixed Evergreen Forest Formation: The potential variety of mixed evergreen vegetation types is limited by the effects of the 1959 Peach Fire, which burned nearly all of the area (*fig. 132*). Much of the canopy was destroyed in the S.- and W.-facing exposures while the understory of N.-facing forests was virtually eliminated. Thus, much of the area is in relatively early stages of secondary succession. Unlike many areas of the W. Klamath Mountains ecological section, there is no pronounced band of giant chinquapin (*Chrysolepis chrysophylla*) subdominance on mesic N. exposures. This may be the result of fire and relatively low precipitation for this vegetation type (Keeler-Wolf 1988a).

Physical Characteristics

The area (about 2800 acres, 1133 ha) includes the upper watershed of Peach Creek, a 4-mile (6.4-km) long permanent tributary to the Klamath River.



Figure 131—Peach Creek ecological survey area

Elevations range from 700 to 5865 ft (213-1788 m). Topography is relentlessly steep, with upper slopes ranging from 50° to 90°; lower slopes average only slightly less steep. Elevation gradients of up to 3300 ft/mile (625 m/km) occur. This area lies on the W. side of the Salmon Mountains 4 miles (6 km) S. of the

junction of the Klamath River and Salmon River. The drainage is oriented W. with principal exposures being N. and S., with some W. exposures along the Salmon Divide.



Figure 132—Pearch Creek, successional resprouts of tanoak, Pacific madrone, and giant chinquapin surrounding dead and damaged Douglas-fir, the result of the 1959 fire in Pearch Creek study area. Sommes Mountain in background. (1986)

elevations may occasionally approach 100 °F (38 °C) although upper-elevation maxima may be about 85 °F (29 °C). Winter minima at highest elevations may drop to 15 °F (-9 °C).

Association Types

Mixed Evergreen Forest Formation (81100, 82420): 1972 acres (798 ha). Nine 100-m² quadrats were sampled in this vegetation zone. This general vegetation formation covers the majority of the area. It is divided into the following six associations.

Douglas-Fir (*Pseudotsuga menziesii*)-Dominated Forest (82420): 576 acres (233 ha). This association occurs largely on N.-facing slopes below 4500 ft (1372 m). It has a canopy of even-aged Douglas-fir averaging 2-3 ft (61-91 cm) dbh and 120-140 ft (37-43 m) tall, with ages between 180 and 220 years.

The most mesic of these forests have understories of *Acer circinatum*, Pacific yew (*Taxus brevifolia*), *Linnaea borealis*, and *Corylus cornuta* var. *californica*. The modal type has a dense understory dominated by spindly tan oak (*Lithocarpus densiflorus*) with *Berberis piperiana*, *Rosa gymnocarpa*, and *Smilacina racemosa* var. *amplexicaulis*. Forests on NW. exposures tend to have lower density of Douglas-fir with more xerophilic understory species such as Pacific madrone (*Arbutus menziesii*), canyon live oak (*Quercus chrysolepis*), and *Toxicodendron diversilobum* along with tanoak.

On five plots in this forest, Douglas-fir has an importance value of 155, with tanoak 97, Pacific dogwood (*Cornus nuttallii*) 32, Pacific madrone 8, and Pacific yew 8. Total basal area cover is 126 m²/ha, and total stem density is 1460/ha. Douglas-fir clearly dominates in relative cover (91 percent) while tanoak dominates in relative density (55 percent). Bigleaf maple (*Acer macrophyllum*) also occurs in this forest, although it is not represented in the sample. Understory shrubs and herbs of this association cover 25-60 percent and include *Gaultheria shallon*, *Berberis piperiana*, *Polystichum munitum*, *Rosa gymnocarpa*, *Vancouveria hexandra*, and *Disporum hookeri*.

Canyon Live Oak Woodland (81320): 488 acres (197 ha). This association, dominated by low canyon live oak, is extensive on upper S.-facing slopes. It suffers frequent fire damage, and most trees are shrubby resprouts. Very few other species occur.

Successional N.-Facing Forest (81400): 466 acres (189 ha). Fire damaged much of the vegetation of the area in 1959. When fire destroys the canopy of Douglas-fir on N.-facing slopes, tanoak resprouts dominate much of the area. Pacific madrone, canyon live oak, and occasionally giant chinquapin also occur as sprouts. Douglas-fir has densely colonized logging spurs and skid trails in a portion of the area which was logged after the 1959 fire. The remainder of the clearcut is strongly dominated by 25-year-old sprouts of tanoak.

Forests on W.- and S.-Facing Exposures (81100): 366 acres (148 ha). Douglas-fir decreases in importance on these exposures relative to ponderosa pine (*Pinus ponderosa*), Pacific madrone, and canyon live oak. On xeric S. exposures tanoak is reduced in density, but it remains important on most W.-facing exposures. This trend is present regardless of fire history. Certain W.-facing slopes contain large Douglas-fir, up to 5 ft (1.5 m) dbh, which have survived fire damage for several hundred years. This forest is the classic mixed evergreen forest with sclerophylls and conifers codominants.

Transitional Mixed Evergreen-White Fir-Douglas-Fir Forest (84240, 82420): No acreage given. This association takes in the narrow mixing zone between lower-slope Douglas-fir forest and upper-slope white fir forest. This zone generally occurs on N.-facing slopes between 3600 and 4100 ft (1097-1250 m).

Four 100-m² plots were sampled. Douglas-fir dominates the tree stratum with an importance value (IV) of 178. White fir follows (IV 67), along with Pacific yew (*Taxus brevifolia*) (IV 37) and tanoak (IV 19). Total basal area is 101 m²/ha, and total stem density is 530/ha. The understory sclerophylls are typically stunted as a result of frequent snow loading. Average ground cover is 30 percent. Shrubs and herbs are represented by 27 species in the sample. The most frequent species are *Berberis piperiana*, *Rosa gymnocarpa*, *Quercus vaccinifolia*, *Holodiscus discolor*, *Vancouveria hexandra*, *Achlys triphylla*, and *Whipplea modesta*.

Knobcone Pine (*Pinus attenuata*) Woodland (83210): 76 acres (31 ha). One dense stand of knobcone pine occurs adjacent to canyon live oak woodland on upper S.-facing slopes. It is essentially a subtype of canyon live oak woodland with little else to distinguish it floristically.

White Fir-Douglas-Fir Forest (84240): 490 acres (198 ha). Above about 4400 ft (1341 m) white fir becomes the principal reproducer. The sclerophylls characteristic of the understory and subcanopy of the lower-elevation Douglas-fir-dominated forest and transitional mixed evergreen-white fir forest drops out, and the understory is very sparse and herb dominated. Seven 100-m² plots were sampled in this type. Douglas-fir dominates the canopy (88 percent relative basal area, total 158 m²/ha), with white fir the most abundant species (67 percent relative density, total 630 trees/ha). There are very few saplings and seedlings, with an average density of only 20/ha, probably because the 1959 fire thinned the understory and subsequent reestablishment has been slow in the dense shade of the canopy.

The shrub and herb understory is poorly developed, averaging less than 15 percent cover, and represented by 11 shrub species and 25 herb species. Among the most important species are *Berberis piperiana*, *Rosa gymnocarpa*, *Symphoricarpos acutus*, *Vaccinium membranaceum*, *Disporum hookeri*, *Achlys triphylla*, *Chimaphila umbellata*, *Polystichum munitum*, *Chimaphila menziesii*, *Stellaria jamesiana*, *Arnica latifolia*, *Campanula prenanthoides*, *Vancouveria hexandra*, and *Hieracium albiflorum*.

Sugar Pine (*Pinus lambertiana*)-Douglas-Fir Forest (84110): 139 acres (56 ha). On a few W.- and NW.-facing slopes between 3800 and 4500 ft (1158-1372 m), sugar pine dominates, with Douglas-fir, white fir, and incense-cedar (*Libocedrus decurrens*) as subdominants. This forest is similar to more interior mixed conifer forests of the E. Klamath Mountains ecological section. The understory is open and sparse.

Rock Outcrop (no Holland equivalent): 81 acres (33 ha). Numerous small rock outcrops occur throughout the area; most conspicuous are those along the Salmon Divide. These outcrops include *Lewisia cotyledon*, *Streptanthus tortuosus*, *Hieracium greenii*, *Holodiscus boursieri*, *Zauschneria californica* ssp. *latifolia*, *Eriogonum lobbii*, *Brickellia greenii*, and *Sedum obtusatum* ssp. *boreale*. *Saxifraga fragarioides*, *Cheilanthes gracillima*, *Cryptogramma acrostichoides*, *Sedum purdyi*, and *Polystichum munitum* var. *imbricans* are characteristic of sheltered mesic sites. Brewer spruce is also typical of mesic upper-elevation rock outcrops, but it does not occur in high enough density to be considered a distinct vegetation type. A recently-cut tree stump with 450 annual rings and a diameter of 30 inches (76 cm, at the height 35.5 inches [90 cm] from the base) probably is the largest Brewer spruce seen in the area.

Riparian Vegetation (61510, 63500): 35 acres (14 ha). Many of the small drainages within the study area have permanent moisture. At elevations below about 3500 ft (1067 m), riparian vegetation is dominated by *Salix lasiolepis* (and other willows), white alders (*Alnus rhombifolia*), and Oregon ash (*Fraxinus latifolia*), along with understory species such as *Aralia californica*, *Rubus ursinus*, *Dicentra formosa*, and *Mimulus cardinalis*. Above about 3500 ft (1067 m) along steeper gradient rivulets, montane species such as *Alnus sinuata* dominate with understory species such as *Circaea alpina* var. *pacifica*.

Noble Fir Forest (85310): 28 acres (11 ha). This type, dominated by trees with several noble fir characteristics (with a lower number of Shasta red fir, *Abies magnifica* ssp. *shastensis*, characteristics), dominates the highest N.-facing slopes of the area. At about 5700 ft (1737 m), the forest is composed of 100- to 150-ft (31- to 46-m) tall noble fir with noble fir saplings and seedlings common in areas of light shade. Dominants are between 28 and 33 inches (71-84 cm) dbh. Western white pine (*Pinus monticola*) also occurs occasionally at the highest elevations.

At slightly lower elevations on Antenna Ridge the forest is more mixed. A sample plot in this forest at about 5600 ft (1707 m) includes a mixed canopy of noble fir, Douglas-fir, and white fir, with Douglas-fir dominant but with noble fir in highest density. There is a sparse shrub and herb understory averaging 15 percent cover. Typical understory species include *Vaccinium membranaceum*, *Rosa gymnocarpa*, *Berberis piperiana*, *Ribes sanguineum*, *Penstemon anguineus*, *Pyrola secunda*, *Arnica latifolia*, *Campanula prenanthoides*, *Hieracium albiflorum*, *Goodyera oblongifolia*, *Corallorhiza maculata*, *Chimaphila umbellata*, and *C. menziesii*.

Montane Chaparral (37510, 37542): 11 acres (4 ha). Little of this vegetation occurs in the area. A few patches exist on the upper portions of S.- and W.-facing slopes and are dominated by *Arctostaphylos nevadensis*, *A. patula*, *Prunus emarginata*, and *Holodiscus boursieri*. A slightly different type occurs on small areas of the upper, rocky NE.-facing slopes of Antenna Ridge. *Quercus vaccinifolia*, *Amelanchier pallida*, and *Arctostaphylos nevadensis* are the dominants. Herbs associated with the montane chaparral are sparse and include *Monardella odoratissima* ssp. *pallida*, *Polygonum davisiae*, *Streptanthus tortuosus*, *Lomatium macrocarpum*, and *Apocynum pumilum*.

Plant Diversity

One hundred fifty taxa are listed.

Conflicting Impacts

The previously mentioned fire, clear-cutting, and road construction within the SW. portion of the area, as well as the possibility of the construction of a small hydroelectric plant are among the real and potential conflicts. These points, in conjunction with the extremely difficult travel within the area because of the steep slopes and the successional nature of much of the vegetation, combine to make this area undesirable for scientific use. The Region 5 RNA committee elected to remove this area from further RNA consideration in 1987.

66. Peavine Point (Taylor and Randall 1977b, Martin 1991b)

Location

This established RNA is on the Eldorado National Forest, El Dorado County. It lies 2 miles (3.2 km) NE. of Pollock Pines in portions of sects. 17, 18, 19, 20, and 21 T11N, R13E and sect. 24 T11N, R13E MDMB (38°47'N., 120°35'W.), USGS Riverton and Pollock Pines quads (fig. 133). Ecological subsection – Batholith and Volcanic Flows (M261Em).

Target Elements

Pacific Ponderosa Pine (*Pinus ponderosa*) and California Black Oak (*Quercus kelloggii*)

Distinctive Features

Old-Growth Ponderosa Pine: This vegetation type is not well represented in the RNA system and is relatively scarce in the Sierra Nevada because of timber harvesting over the past 100 years. The understory of this forest has been subject to regular ground fires, typical of this association. The forest is within easy access by road.

Physical Characteristics

The area covers 1098 acres (444 ha) of the lower W. slope of the Sierra Nevada in the canyon of the South Fork of the American River. It occupies the N. and S. walls of the canyon. Elevations range from 2080 to 3854 ft (634-1175 m). S.- and N.-facing slopes are predominant and generally steep (30-40°). The river gradient in the area is about 132 ft/mile (25 m/km). One additional small, permanent stream (Soldier Creek) and an intermittent stream flow through the area.

The area is underlain by Mesozoic granodiorite, although Pliocene pyroclastics and Paleozoic metamorphics are immediately adjacent to the area. Soils fall within the Mariposa and Josephine series (both moderately deep to deep silt loams), whereas much of the steep outcrop areas are mapped as acidic rock land (poorly weathered regoliths). The area receives moderate precipitation, 28-51 inches (700-1300 mm) per year. Snow may fall regularly in winter months, but lingers on the ground only for a few days. Mean January temperature at Placerville (14 miles or 23 km W. of the area) is 40.8 °F (4.9 °C), and mean July temperature is 72.9 °F (22.7 °C).

Association Types

Ten plots were sampled.



Figure 133—Peavine Point RNA

Ponderosa Pine-*Chamaebatia foliolosa* (84210, 81340): 835 acres (338 ha). This is the most extensive type in the area. Ponderosa pine is the canopy dominant with California black oak as the major subcanopy species. In the establishment record, the black oak forest (140 acres [57 ha]) is separated from the westside ponderosa pine forest. Basal area on the sample plots averages 63.9 m²/ha with ponderosa pine comprising 78 percent of this value. Basal areas for ponderosa pine range from 15 to 97 m²/ha, with densities of 57-309 stems/ha (mean 169). Total stem density averages 239/ha. Other trees represented on the plots, in order of basal area cover, are canyon live oak (*Quercus chrysolepis*), white fir (*Abies concolor*), and California nutmeg (*Torreya californica*). Individuals of ponderosa pine are typically large with stands relatively open, but averaging high basal area. Mean dbh for sampled ponderosa pine is 23.3 inches (59.2 cm). *Chamaebatia* is the major understory species, often covering nearly 100 percent, but it is patchy. *Ceanothus integerrimus* and *Toxicodendron diversilobum* are also important understory shrubs (fig. 134). Twenty-five other herbs and shrubs are represented on the association table for this type. However, most have less than 1 percent cover. Among the most conspicuous are *Lupinus latifolius*, *Galium bolanderi*, *Aster radulinus*, and *Lathyrus nevadensis*.

Douglas-Fir-Pacific Dogwood (*Pseudotsuga menziesii*-*Cornus nuttallii*) (84230): 240 acres (97 ha). Large areas of this vegetation (on N.-facing slopes) occur on the S. side of the river. This type also occurs on the N. side of the river in small areas of N.-facing slopes near Soldier Creek. Douglas-fir is the dominant tree, with white fir and incense-cedar (*Libocedrus decurrens*) subdominant and occasional ponderosa and sugar pines as lesser associates. California black oak (*Quercus kelloggii*), canyon live oak (*Q. chrysolepis*), Pacific yew (*Taxus brevifolia*), bigleaf maple (*Acer macrophyllum*), and Pacific dogwood (*Cornus nuttallii*) are common subcanopy species.



Figure 134—Peavine Point, open *Pinus ponderosa* stand of moderate basal area in the Peavine Point RNA. Charred logs and moderately dense *Ceanothus integerrimus* are indicative of recent fire. (1976)

Canyon Live Oak-*Arctostaphylos mewukka* (81320, 37520): 20 acres (8 ha). This association is limited to rocky sites (e.g., granitic outcrops) where soil development is minimal. Canyon live oak is the principal species, often forming a partially closed canopy. *Arctostaphylos mewukka* is important only where the stand is open and canyon live oak density is low.

White Alder (*Alnus rhombifolia*)-*Peltiphyllum peltatum* (61510): 3 acres (1 ha). This association is limited to the immediate riparian area of the South Fork of the American River below the mean high-water level. White alder is the major dominant, reaching 20 inches (50 cm) dbh and 50 ft (15 m) in height. The major conifers from the surrounding associations also occur sporadically in this type. *Peltiphyllum* is the dominant herb. Other species include Pacific yew, *Boykinia elata*, *Aralia californica*, *Mimulus cardinalis*, *Athyrium filixfemina*, *Aquilegia formosa* var. *truncata*, *Corylus cornuta* var. *californica*, *Disporum hookeri* var. *trachyandrum*, *Rosa gymnocarpa*, *Adenocaulon bicolor*, and *Galium triflorum*.

Plant Diversity

One hundred fifty-three taxa are listed.

Conflicting Impacts

No potential impacts are listed. However, without natural fire in the near future, prescribed burns will be necessary to maintain the open understory of the *Pinus ponderosa* forests.

67. Preacher Meadows (Sawyer and others 1978, Cheng 1996c)

Location

This established RNA is on the Shasta-Trinity National Forest. The whole area is included within the Trinity Alps Wilderness and lies about 6 miles (10 km) W. of Trinity Center. It consists of sects. 17 and 20 T36N, R8W MDBM (40°58'N, 122°48'W), USGS Covington Mill quad (*fig. 135*). Ecological subsection – Sodic Claypan Terraces (M261A_j) and Eastern Klamath Mountains (M261A_i).

Target Element

Mixed Conifer Forest

Distinctive Features

Ultrabasic Mixed Coniferous Forest: As the predominant forest type in the area, the ultrabasic mixed coniferous forest in the RNA is typical, both in composition and quality, of forests throughout much of the ultramafic terrain at mid-elevations of the E. Klamath Mountains ecological section. Its uniformity of cover and openness are results of the overriding influence of the substrate on vegetation.

Rare Flora: Two species (*Cypripedium californicum* and *Darlingtonia californica*) are on List 4 of CNPS.

Ceanothus Diversity: The following species and apparent hybrids are listed: *Ceanothus cordulatus*, *C. cuneatus*, *C. integerrimus*, *C. prostratus*, *C. pumilus*, *C. velutinus*, *C. prostratus* x *pumilus*, *C. velutinus* x *prostratus*. This diversity of congeners may be useful for systematic and hybridization studies.

Physical Characteristics

The surveyed area covers 600 acres (243 ha), but the established RNA is 1850 acres (749 ha). Elevations range from 3800 to 5800 ft (1158-1768 m) in the study area and from 3800 to 6835 ft (1158-2083 m) in the RNA. Topography is moderate to steep (30-95 percent slopes) with SE.- and E.-facing slopes predominating and some NW.- and SW.-facing slopes. Swift Creek has carved a gorge 90 ft (27 m) deep in one area, and meadowy and forested flats and benches occur above the creek in other areas. The area is underlain by ultrabasic intrusives (primarily peridotite) with moraines and other glacial deposits occurring along the canyons and at higher elevations. Talus slopes are common. Soils are shallow, and one slide area is mentioned. Climatological records for nearby Trinity Dam indicate annual precipitation of about 38 inches (965 mm), with average annual high temperatures of 100.8 °F (38.2 °C) and lows of 15.5 °F (-9.2 °C).

Association Types

After analysis of 31 releves, the forested regions of this survey area are all classified as one type. Density and basal area cover are determined by sampling thirty 0.1-acre (0.04-ha) plots. Acreage of each type is based on ecological survey.



Figure 135—Preacher Meadows RNA

Dashed line = Ecological study area
Solid gray line = RNA Boundary

Douglas-Fir (*Pseudotsuga menziesii*)/*Quercus vaccinifolia* (84180): 540 acres (219 ha). Uniformity of composition in this forest is striking on all slope aspects and elevations sampled. Canopy cover averages 30-40 percent with Douglas-fir dominant in most of the area. A few of the highest sites have sugar pine (*Pinus lambertiana*) and white fir (*Abies concolor*) dominant with some Shasta red fir (*Abies magnifica* var. *shastensis*) and western white pine (*Pinus monticola*) (fig. 136). At lower elevations and mesic sites, incense-cedar (*Libocedrus decurrens*) codominates with Douglas-fir. Ponderosa pine (*Pinus ponderosa*) is also abundant at lower elevations, particularly on SW.-facing aspects or flats. White fir is the predominant reproducer. The high fire frequency (most dominants have scars) may be the reason for relatively low density of mature white fir.



Figure 136—Preacher Meadows, uneven-aged ponderosa pine – sugar pine – fir stand at 1463 m (4800 ft) elevation in Preacher Meadows RNA, NW1/4 sect. 17 (W. Oliver 1977)

Sampling indicates an average density of 313 trees/ha and a basal area average of 50.0 m²/ha. A high productivity bench area in the NE. corner of sect. 17 has densities of 470 trees/ha with average basal area of 99.9 m²/ha. A site index curve based on 10 Douglas-fir trees suggests modest site quality for the area.

The shrub layer is well developed, averaging 80-100 percent cover, with *Quercus vaccinifolia* comprising 95-100 percent of the shrubs. Driest sites also tend to have *Ceanothus prostratus*. Along streams, *Rhododendron occidentale* is the dominant shrub (80-100 percent relative cover) occurring with *Ribes roezlii*, *Rhamnus purshiana*, and *Spiraea densiflora*. Herbs are sparse (about 5 percent cover) throughout this association, the most common being *Polygala cornuta*.

Meadows (45100, 51120): 60 acres (24 ha). Three distinctive meadow phases occur locally:

Dry meadows occur on vernal wet sites, drying later in the season. They are characterized by *Danthonia unispicata*, *Sisyrinchium bellum*, *Lotus purshianus*, *Dichelostemma (Brodiaea) multiflorum*, and *Calochortus nudus*.

Moist meadows occur on sites that are wet through much of the season, but dry late in the summer. They include such species as *Hastingsia (Schoenolirion) alba*, *Deschampsia caespitosa*, *Helenium bigelovii*, and *Danthonia californica*.

Perennially wet meadows occur along the margins of small creeks and in seeps; they contain such species as *Darlingtonia californica*, *Mimulus guttatus*, *Juncus* spp., *Carex* spp., *Narthecium californicum*, and occasionally *Cypripedium californicum*.

Plant Diversity

One hundred sixty-four taxa are listed.

Conflicting Impacts

Although the Granite Creek and Swift Creek trails pass through the area and are well-used, most if not all recreation users are traveling upstream to higher-elevation sites in the wilderness area. There is little or no impact away from the trails in the RNA except at one small campsite at a bridge crossing in the central portion of sect. 17.

68. Raider Basin (Raider Creek) (Jensen and Schierenbeck 1989)

Location

This recommended RNA (rRNA) is located about 1.6 miles (2.5 km) NW. of Eagleville. It is in the South Warner Wilderness within the Modoc National Forest, Modoc County. Its boundaries include section 33 of T41N, R16E and sections 3, 4, 7-10, and 15-22 of T40N, R16E HBM (41°20'N., 120°09'W.), USGS Eagle Peak quad (*fig. 137*). Ecological subsection – Warner Mountains (M261Gf) and Surprise Valley (342Ba).

Target Element

White Fir Forest (*Abies concolor*)

Distinctive Features

Two major varieties of white fir have been recognized within its distribution range: *Abies concolor* var. *lowiana* (in the Sierra Nevada and NE. California) and *A. concolor* var. *concolor* (in the Rocky Mountain region). The rRNA contains large populations of relatively undisturbed examples of old-growth *Abies concolor* var. *lowiana* at the NE. extreme of its range.

Rare Fauna: Following the recommendation of an environmental assessment (Camilleri 1979), six rams and eight ewes of California bighorn sheep (*Ovis canadensis californiana*) were reintroduced into the Raider Creek Basin in 1980. However, due to an outbreak of bacterial pneumonia (*Pasteurella* sp.), transmitted from domestic livestock in 1987, all individuals are thought to have died. There have been no sightings of bighorn sheep since early 1988. The Modoc/Washoe Experiment Stewardship Committee is currently addressing another plan to reintroduce the bighorn sheep into the area.

Rare birds known to frequent the area include golden eagle (*Aquila chrysaetos*, State-listed species of special concern), bald eagle (*Haliaeetus leucocephalus*, Federally- and Stated-listed endangered species), prairie falcon (*Falco mexicanus*, Stated-listed species of special concern), and northern goshawk (*Accipiter gentilis*, Stated-listed species of special concern). Mule deer (*Odocoileus hemionus*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), and mountain lion (*Felis concolor*) also have been sighted.

Fire History: Modoc National Forest employees have no knowledge of any recent major wildfire within the rRNA. A 1990 plan included considering a series of managed fires within the South Warner Wilderness. Portions of the rRNA was included in this plan.

Physical Characteristics

The area covers 6100 acres (2440 ha) (6481 acres [2623 ha] listed in the forest plan) with an elevation of 4850-9097 ft (1480-2775 m). It comprises the upper watersheds of Raider and Hornback creeks.

The Warner Mountains contain some of the oldest volcanic rock of the Modoc Plateau (the Cedarville series), which formed in the Oligocene or early Miocene. Much of the rRNA below 5800 ft (1768 m) consists of rocky, exposed, volcanic tuff barren of vegetation.

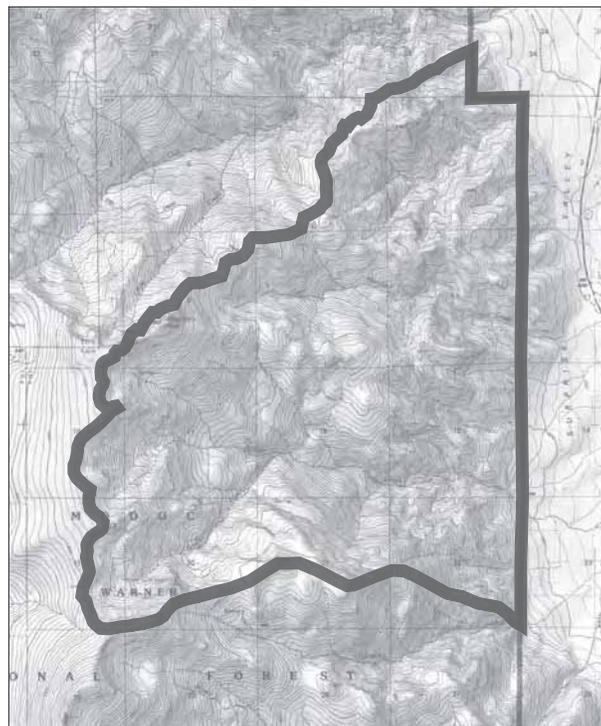


Figure 137—Raider Basin rRNA

The rRNA contains four soil associations. The Waca-Lyonman is a deep, well-drained soil which supports stands of white fir and associated conifers. The Homecamp-Newlands association is a mosaic of stony loam and dark grayish brown loam which supports big sagebrush scrub. The Hapgood-Snag association is a deep, well-drained, dark grayish brown stony-to-fine sandy loam that supports big sagebrush scrub and various bunch grasses. The remainder of the rRNA is classified as Rubbleland-Rock Outcrop.

Annual precipitation in the rRNA is approximately 20 inches (51 cm), the majority of it falling from September through mid-June in the form of snow. Thunderstorms are common during late May, June, and July. The mean temperatures are estimated to be 20 °F (-6.6 °C) in January and 60 °F (15.5 °C) in July.



Figure 138—Raider Basin, white fir forest in Raider Basin. The view is from the south boundary of RNA looking north toward Dusenbury Peak. (1988)

Association Types

Sierran White Fir Forest (84240): 1436 acres (575 ha). The absence of recent fire in the rRNA has likely contributed to the development of large, uneven-aged white fir stands (*fig. 138*), which have a closed canopy and little understory vegetation. Basal area of white fir ranges from 66.7 ft²/acre to 464.7 ft²/acre (15.3-106.6 m²/ha), and diameter ranges from 3.93 to 51.2 inches (0.1-1.3 m). Almost all of the saplings or seedlings found are white fir.

Herbaceous understory cover ranges from 0.2 to 7 percent. The most common species occurring in the understory are *Arnica cordifolia*, *Hieracium albiflorum*, *Penstemon gracilentus*, *Osmorhiza chilense*, and *Kelloggia galioides*.

Northern Juniper Woodland (72110): 364 acres (145 ha). This association type is dominated by *Juniperus occidentalis* ssp. *occidentalis*. It is found at elevations of 5400-6400 ft (1646-2012 m) on exposed slopes of the E. half of the rRNA integrating with big sagebrush scrub. Cover is fairly open, with *Artemisia tridentata* and *Purshia tridentata* as common shrub associates.

Whitebark Pine Forest (86600): 260 acres (104 ha). Nearly pure stands of whitebark pine (*Pinus albicaulis*) form pockets of open forest on N.-facing slopes at elevations above 7600 ft (2317 m). Understory vegetation is very sparse.

Mountain Mahogany Scrub (no Holland equivalent): 235 acres (94 ha). This association type occurs on dry, S.-facing slopes and exposed ridges at upper elevations of Hornback Creek basin and along the saddle E. of Dusenbury Peak. The canopy is open and dominated by *Cercocarpus ledifolius*, some individuals reaching 6.6-9.8 ft (2-3 m) high. Other common plants include *Juniperus occidentalis*, *Artemisia tridentata*, *Balsamorhiza sagittata*, *Amelanchier pallida*, *Artemisia arbuscula*, *Chrysothamnus nauseosus*, and *Ribes cereum*.

Montane Meadow (45100): 183 acres (73 ha). The meadows along the forks of the Raider and Hornback drainages are the most floristically rich in the rRNA. The meadows range in size from 2135 ft² (200 m²) to more than 62 acres (25 ha).

Quaking aspen (*Populus tremuloides*) occurs sparsely along the creeks above 7000 ft (2120 m) and at the edges of meadows. *Veratrum californicum* is the dominant species in several of the meadows. Other associates include *Agrostis exarata*, *Deschampsia caespitosa*, *Carex microptera*, *Elymus glaucus*, *Epilobium* sp.,

Frasera speciosa, *Glyceria elata*, *Hordeum brachyantherum*, *Hypericum anagalloides*, *Lupinus polyphyllus* ssp. *superbus*, *Potentilla gracilis*, *Trifolium cyanthiferum*, and *Veronica americana*.

Big Sagebrush Scrub (35210): 183 acres (73 ha). This association is the primary vegetation type at lower elevations (5971-6955 ft [1820-2120 m]) on the E. edge of the rRNA. It is also the dominant type at the lowest elevations along Raider Creek. It forms an open shrub community dominated by *Artemisia tridentata* and *Purshia tridentata*. Common grass species occurring are *Agropyron spicatum*, *Bromus tectorum*, *Festuca idahoensis*, *Stipa occidentalis*, and *Oryzopsis* spp. Most of the species in this association are also found in the understory of the Northern Juniper Woodland.

Washoe Pine-White Fir Forest (85220): 40 acres (16 ha). Washoe pine (*Pinus washoensis*) is found with white fir on the rRNA at elevations generally below 6500 ft (1981 m). Three small stands of this forest are found in the Hornback Creek drainage. Although normally an important component of high-elevation SW. and W. slopes of the Warner Mountains, it is not a common association type in the rRNA.

Subalpine Sage Scrub (35220): The highest elevations of the Raider Creek basin contain scattered examples of subalpine sage scrub. The largest stand occurs on the high ridge of the S. boundary of the rRNA and resembles an alpine fell-field. Common plants in this scrub include *Artemisia arbuscula*, *Arenaria aculeata*, *Sedum stenopetalum*, and *Eriogonum caespitosum*. This community also occurs sporadically throughout barren areas at elevations greater than 7500 ft (2286 m).

Montane Riparian Forest (81800/61530): A narrow band of riparian forest occurs along both Raider and Hornback creeks. It is dominated at upper elevations by white fir, with quaking aspen more common in the meadow areas. At elevations below 5400 ft (1636 m), the riparian vegetation is a transitional forest with Jeffrey pine (*Pinus jeffreyi*) replacing white fir. *Populus trichocarpus* dominates the canopy at the lowest portion of Raider Creek. Common shrubs include *Prunus emarginata*, *Rosa woodsii*, and *Salix scouleriana*.

Plant Diversity

One hundred seventy-seven species of vascular plants are listed.

Conflicting Impacts

The South Warner Wilderness is used for hiking, backpacking, and deer hunting. However, due to the closure of one of the main trails, the Raider Creek basin is the least accessible area within the South Warner Wilderness. The only noticeable example of recreational use of the area is the large, well-used hunter's camp adjacent to the meadow in section 17.

The Raider Creek basin was grazed by sheep (before 1943) and cattle (1943-1971), but grazing has been minimal since 1971.

Note: for Raider Creek, see Raider Basin, #68

69. Red Butte-Red Fir Ridge (Shasta Red Fir) (Imper 1988b, Cheng 1996d)

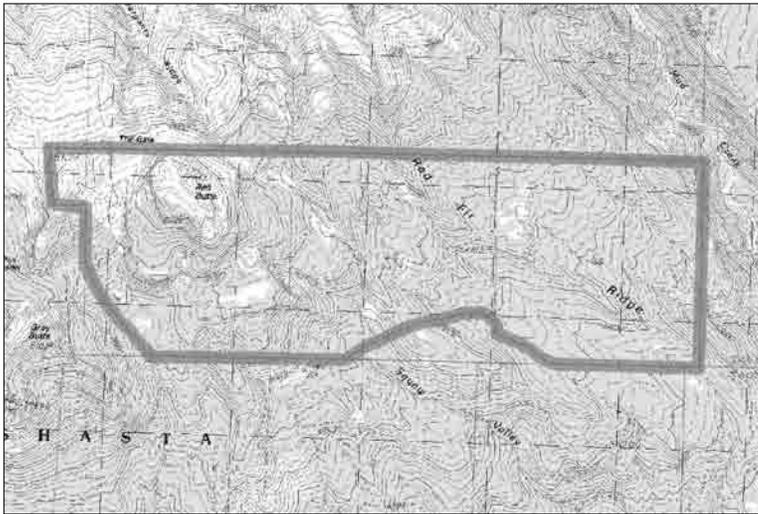


Figure 139—Red Butte-Red Fir Ridge RNA

Location

This established RNA is located on the Shasta-Trinity National Forest. The area is about 6.5 miles (10.5 km) N. of McCloud and occupies portions of sects. 33, 34, 35, and 36 T41N, R3W MDBM (41°21'N., 122°10'W.), USGS Mt. Shasta quad (fig. 139). Ecological subsection – High Cascades (M261Df).

Target Element

Red Fir (*Abies magnifica*)

Distinctive Features

Shasta Red Fir Forest: Taxonomically, the description of Shasta red fir (*Abies magnifica* var. *shastensis*), a botanical variety of red fir (*Abies magnifica*), was based on the red firs at

Mount Shasta. Despite the type location, some trees exhibit the nonexserted bract cones of typical red fir of the N. and central Sierra. Before logging, the red fir forest formed a continuous ring around the mountain. The local red fir forests are variable successional, ranging from exceptionally old (about 650 yr) to young stands, the latter stemming from past fires as well as selective logging (in one part of the area). The area's broad elevational span includes most of the local range of red fir forest. The soils are uniform throughout this range.

General Habitat Diversity: This area includes all typical plant associations on the S. side of Mount Shasta above 6500 ft (1981 m). Along with red fir, these include mountain hemlock (*Tsuga mertensiana*) and mixed subalpine forests, wet and dry meadows, and alpine and riparian vegetation. The glacier-fed wet subalpine meadow areas are the best examples of this type on the mountain. The mountain hemlock stands are perhaps the oldest (700+ yr) and best developed on the mountain.

Rare Plants: *Campanula wilkinsiana* (CNPS List 1B) is known from sites near the study area. The only plant on CNPS lists known from the RNA is *Arnica viscosa* (List 4).

Physical Characteristics

This area covers about 1640 acres (664 ha). Elevations range from 5920 to 8377 ft (1804-2533 m). The general aspect of the area is SE., although some SW. and NE. exposures exist. The W. part is dominated by Red Butte, a recent cinder cone rising 400-800 ft (122-244 m) above surrounding terrain. The E. part is dominated by Red Fir Ridge, which separates the Squaw Valley drainage on the W. from Mud Creek drainage on the E. Slopes in the E. portion are moderate but strongly dissected by NW.-SE. trending gullies up to 30 ft (9 m) deep. Parts of the Mud Creek canyon are very steep, as are the upper slopes of Red Butte.

Rocks are entirely Pleistocene andesite erupted from Mount Shasta. Soils are primarily Andic Cryumbrept-Rock outcrop complex (>90 percent of area). A small portion of the E. area is Andeptic Cryotherents with 40-100 percent slopes. These soils have a deeper A horizon than the Andic Cryumbrept-Rocks and are derived from recent deep volcanic ash deposits. Precipitation averages 60 inches (1524 mm) annually, mostly from snowfall. Normal winter snow

depth is about 8 ft (2.4 m), judged by lichen growth on trees. Temperatures in winter range from 0 to 30 °F (-18 to -1 °C), and winds may be in excess of 100 mph (161 km/hr).

Association Types

Fourteen 0.1-acre (404-m²) plots were sampled in five association types including all forested associations except for cut-over forest.

Red Fir Forest (85310): 956 acres (387 ha).

Shasta Red Fir/Slender Penstemon Forest: Stands typifying this association are pure Shasta red fir with a dense canopy and sparse understory. *Penstemon gracilentus* is often the only herb, with total understory often less than 1 percent cover. This association occurs from the lowest elevation up to about 7400 ft (2256 m). In moist areas at upper elevations, mountain hemlock becomes important and may be slowly replacing red fir as the dominant. White fir (*Abies concolor*) becomes important below about 6500 ft (1981 m). Western white pine (*Pinus monticola*) and Jeffrey pine (*Pinus jeffreyi*) are occasional at lower elevations. Other species associated with this type include *Arctostaphylos nevadensis*, *Carex rossii*, *Chimaphila menziesii*, *Corallorhiza maculata*, *Hieracium albiflorum*, *Lupinus albicaulis*, *L. obtusilobus*, *Pyrola picta*, and *Viola purpurea*.

A typical stand is even-aged (200 yr) with a closed canopy and 80 m²/ha basal area. Much of this association appears to have experienced crown fire, initiating the even-aged canopy.

Shasta Red Fir/Pinemat Manzanita Forest: This association occupies upper slopes and ridges. It has an open canopy and low basal area (<57 m²/ha). The understory is dominated by *Arctostaphylos nevadensis*. The soil is poorer and rockier than Shasta red fir/slender penstemon forest. Other species include *Carex multicaulis*, *Carex rossii*, *Monardella odoratissima* ssp. *pallida*, *Penstemon gracilentus*, and *Stipa occidentalis*. Whitebark pine (*Pinus albicaulis*) and *Holodiscus dumosus* (*microphyllus*) may occur at high elevations. This forest is not well represented in the area, and it is confined to small stands.

Typical stands of this association are uneven-aged (average canopy dominants are 290 years old) and have a low canopy dominance compared to Shasta red fir/slender penstemon forest. The successional state of these open forests is not clear.

It may be a later stage of Shasta red fir/slender penstemon forest based on fire history, or it may be controlled by microclimate (fig. 140).

Mountain Buckwheat/Western Needlegrass Dry Meadow (45120, 91220): 269 acres (109 ha). Several types of dry meadows are included in this category. They occur in both subalpine and red fir forest zones. *Polygonum newberryi* and *Stipa occidentalis* are consistent throughout. Soils vary from coarse cinders and cobbles to fine ash, and slopes range from steep to gradual. Other species include *Arctostaphylos nevadensis*, *Calyptridium umbellatum*, *Carex multicaulis*, *Eriogonum marifolium*, *E. pyrolaefolium*, *Haplopappus bloomeri*, *Lupinus albicaulis*, *Monardella odoratissima* ssp. *pallida*, *Phlox diffusa*, and *Viola purpurea*.

Several variants include the following: (1) *Anemone* scree slopes. This phase is dominated by a sparse cover of *Anemone occidentalis*, *Penstemon davidsonii*, *Streptanthus tortuosus*, *Phlox diffusa*, and *Eriogonum marifolium* (similar to Holland 91220). (2) Onion/hemlock barrens. This phase is associated with areas of snow accumulation and characterized by young mountain hemlock and *Allium*



Figure 140—Red Butte- Red Fir Ridge, Shasta red fir/slender penstemon forest in Red Butte – Red Fir Ridge RNA. (1988)

obtusum. (3) *Cycladenia* cinder barrens. Some of the red cinder slopes in sect. 34 have a sparse cover of *Cycladenia humilis*. (4) Typical dry meadow. Most of the dry meadows in the area are characterized by *Lupinus albicaulis*, *Stipa occidentalis*, *Haplopappus bloomeri*, *Viola purpurea*, *Eriogonum marifolium*, *Calyptidium umbellatum*, and *Arctostaphylos nevadensis*.

Whitebark Pine-Mountain Hemlock Forest (86210): 305 acres (123 ha).

Whitebark Pine/Rock Spiraea Woodland: This association occurs between 7600 and 8000 ft (2317-2438 m) and is the typical timberline woodland on the S. side of Mount Shasta. Canopy cover is very open (<20 percent), and basal area ranges from 9.2 to 23.0 m²/ha, with the highest cover at the lowest elevations. Stands occur on all slope aspects and are generally dominated by uneven-aged whitebark pine with some red fir and mountain hemlock. Dominant trees are more than 400 years old and taller than 49 ft (15 m). The substrate is rocky and steep. This association grades into the mountain hemlock/heather forest at lower elevations on mesic sites, into the mountain hemlock/alpine rush association on cool, but drier sites, and into the open Shasta red fir/pinemat manzanita forest on warm, xeric sites.

Species include Shasta red fir, *Arctostaphylos nevadensis*, *Chrysolepis sempervirens*, *Castilleja affinis*, *Cryptogramma acrostichoides*, *Holodiscus (microphyllus) dumosus*, *Juniperus communis*, *Pinus albicaulis*, *Penstemon davidsonii*, and *P. newberryi*.

Mountain Hemlock/Alpine Rush: This association occurs between 7300 and 7800 ft (2225-2377 m) on gentle, partially sheltered slopes. The canopy is more closed than in whitebark pine/rock spiraea woodland, but more open than in typical red fir forest. Soils are well developed with an A horizon about 13 inches (33 cm) deep. Dominant trees may be 4 ft (1.3 m) dbh and are the oldest in the study area (600-800 years). Tree height is usually under 100 ft (30 m). Mountain hemlock is dominant and climax, but ancient red firs up to 700 years old are present. Mountain hemlock reproduces well in older stands but requires shade. Red fir requires disturbance for appreciable reproduction. Fire is of minor importance.

Understory vegetation is sparse and includes *Allium obtusatum*, *Arctostaphylos nevadensis*, *Carex multicaulis*, *C. rossii*, *Eriogonum marifolium*, *Juncus parryi*, *Phyllodoce empetrifomis*, and *Viola sheltonii*.

Mountain Hemlock/Mountain Heather Forest: This association occupies relatively moist flats. It is similar to the mountain hemlock/alpine rush type, but the soil is more rocky. The canopy is also more open (about 30 percent) and contains more whitebark pine than the previous association. Basal areas average 23-55 m²/ha, with stands tending to be old (up to 650 yr). There is good regeneration of mountain hemlock. The sparse understory is dominated by scattered clumps of *Phyllodoce empetrifomis*, but it is otherwise similar to the mountain hemlock/alpine rush type. This association also follows creeks and meadows to elevations as low as 6300 ft (1920 m). There it is associated with many riparian zone species. The riparian association is not discussed, but such species as *Allium validum*, *Luzula subcongesta*, *Arnica viscosa*, *Juncus parryi*, *Carex spectabilis*, *Ligusticum grayi*, *Mitella pentandra*, and *Viola macloskeyi* are typical.

Alpine Saxifrage/Alpine Sedge Rockland (91200, 91300): 81 acres (33 ha). This association occurs in the highest and coldest parts of the area. The two characteristic species *Saxifraga tolmiei* and *Carex breweri* are scattered, with cobbles and boulders composing up to 95 percent of the surface. Slopes may be very steep. Occasional krummholz whitebark pines are present. Other species include *Agoseris glauca*, *Arabis platysperma*, *Calyptidium umbellatum*, *Cardamine bellidifolia*, *Juncus parryi*, *Penstemon davidsonii*, *Phlox diffusa*, and *Polygonum shastense*.

Greenleaf Manzanita/Pennyroyal Shrubland (37520, 37510): 17 acres (7 ha). This scrub association with its two indicators, *Arctostaphylos patula* and *Monardella odoratissima* ssp. *pallida*, is usually seral to the two red-fir associations. The conversion of this type to forest is slow, with many areas still dominated by scrub 80 years after fire. This association occurs on steep S.-facing slopes and is surrounded by dense young stands of red fir. White fir and sugar pine (*Pinus lambertiana*) are more conspicuous than in any other association. Other species include *Arctostaphylos nevadensis*, *Apocynum androsaemifolium*, *Boschniakia strobilacea*, *Carex rossii*, *Chrysolepis sempervirens*, *Ceanothus velutinus*, and *Penstemon newberryi*. A more mesic subtype atop Red Fir Ridge includes *Ribes roezlii*, *Ceanothus velutinus*, *Holodiscus discolor*, *Acer glabrum* var. *torreyi*, *Prunus emarginata*, *Potentilla glandulosa*, *Hieracium horridum*, *Phacelia mutabilis*, and *Bromus marginatus*.

Mountain Heather/Showy Sedge Wet Meadow (45100, 45210): 13 acres (5 ha). Four principal meadow areas occur in the RNA. All are associated with creeks. The dominants include dense stands of *Phyllodoce empetriiformis*, *Kalmia microphylla*, and *Vaccinium nivictum* with a number of other species including *Allium validum*, *Antennaria alpina*, *Carex spectabilis*, *Castilleja miniata*, *Luetkea pectinata*, *Saxifraga aprica*, *Sibbaldia procumbens*, and *Veratrum californicum*. The grass *Trisetum spicatum* borders one of the meadows. A subtype of wet meadow dominated by *Carex nigricans* occurs in a moist N.-facing scree area. Two temporary ponds just outside the area contain dense stands of *Muhlenbergia jonesii* with a ring of *Juncus parryi*.

Plant Diversity

Eighty-seven species are listed. Diversity of the area is notably low considering the variety of habitats.

Conflicting Impacts

The most serious impact involves a history of selective logging in the central section of the study area. The high subalpine valleys in this section are recovering very slowly from logging and will show its impact for many years. However, the integrity of the area is increased by the inclusion of these sections, which connect the two undisturbed sections, provide a useful post-logging comparison to adjacent undisturbed lands, and includes the oldest stands of hemlock and good examples of red fir/pinemat manzanita and wet meadow associations. The entire RNA is part of the Mount Shasta Wilderness and receives relatively heavy recreational use. This use may be increased if the proposed Mount Shasta ski area is developed. Access to part of the area is difficult because of gated private roads adjacent to the E. side.

70. Rock Creek Butte (Keeler-Wolf 1987e)

Location

This candidate RNA is on the Klamath National Forest along the crest of the S. Siskiyou Mountains in westernmost Siskiyou County. It is about 2 air miles (3 km) SE. of the present terminus of the E. segment of the Gasquet-Orleans (G-O) road, near the SE. boundary of the Siskiyou Wilderness, and 17 miles (27 km) NNW. of Orleans. The area lies within portions of sects. 5, 7, and 8 T13N, R8W HBM (41°33'N., 123°38'W.), USGS Chimney Rock and Dillon Mtn. quads (fig. 141). Ecological subsection – Western Jurassic (M261Aa) and Siskiyou Mountains (M261Ad).



Figure 141—Rock Creek Butte cRNA

Target Elements

Brewer Spruce (*Picea breweriana*) and Montane Chaparral

Distinctive Features

Brewer Spruce: The stands of Brewer spruce at Rock Creek Butte are extensive, covering 138 acres (56 ha) in varying densities and age classes. The largest Brewer spruces in the mesic-enriched conifer forest are giants up to 48 inches (1.22 m) dbh and 130 ft (40 m) tall. These trees are likely to be more than 400 years old. Notable also are the young Brewer spruce recolonizing areas burned 50-100 years ago on both NW. and, more surprisingly,

SE. exposures. Compared to other study areas and candidate RNAs with Brewer spruce (Haypress Meadows, Indian Creek Brewer Spruce, Pearch Creek, Sugar Creek), these stands include the largest individuals, the highest measured densities, and the highest basal area cover. The age and high cover of Brewer spruce on the NW.-facing slopes are a result of the seemingly serendipitous absence of major fires from these often gradual slopes for several hundred years.

Montane Chaparral: The stands of this vegetation are representative of both seral and semi-climax forms found throughout the Klamath Mountains ecological section. Although less extensive than in some other Klamath candidate RNAs (see Cedar Basin, Sugar Creek), the local stands are relatively diverse, both in species and in slope exposure, and compare favorably with other stands of this type.

Rare Plants: *Vaccinium coccinium* is on CNPS List 3.

Physical Characteristics

The area covers about 500 acres (203 ha) and ranges from 4000 ft to 5205 ft (1219-1586 m). It occupies the upper slopes and summits of Rock Creek Butte with principal exposures of NW. and SE. Slopes on the NW. are gradual to moderate, while those on the E. and SE. are typically steep. The main NE.- to SW.- trending ridge is higher than 5000 ft (1524 m) for more than 0.6 mile (1 km).

Rocks in the area are primarily granitic, with some approaching gabbro. Peridotite occurs in small portions of the N. summit ridge, and schistose metasedimentary rock occupies much of the SE. side of the area. Soils are generally shallow and rocky, with the best soils in NW.-facing hollows, as near Dillon Camp, and infertile, shallow types occupying the upper ridges and SE.-facing slopes. Precipitation is great, estimated at about 110 inches (2794 mm) annually. Snowfall accumulates heavily along the ridgetop, but melts rapidly at slightly lower elevations. Temperatures are moderate due to the relative proximity to the Pacific Ocean.

Association Types

Two parts of the enriched conifer forest were sampled: thirteen 100-m² plots on the lower NW. slope and ten 100-m² plots on the upper NW. slope.

Mountain Chaparral (37510, 37520, 37542, 83210): 196 acres (79 ha). Two subtypes are represented. The most extensive one is successional, dominated by *Quercus vaccinifolia*. It covers about 175 acres (71 ha) SE. of the main ridge. The cover of dense 3- to 5-ft (1- to 1.5-m) tall shrubs is relatively continuous on moderate slopes and broken with small rocky openings on steeper slopes. *Ceanothus velutinus*, *Arctostaphylos patula*, and *Garrya fremontii* are also locally common. Most areas are being invaded by conifers (largely Douglas-fir and sugar pine) about 45-55 years old, dating back to the last major fire. On xeric S.-facing slopes, conifer invasion is slower as a result of more complete destruction of the former coniferous canopy. Here knobcone pine (*Pinus attenuata*) and white fir augment the other two conifers. Brewer spruce and noble fir (*Abies procera*) are also invading this type near the summit of Rock Creek Butte. Understory species are few and widely scattered.

The second subtype is dominated by *Arctostaphylos nevadensis* and covers 21 acres (9 ha) on a few patches on the NW. side of the ridge. The substrate is generally ultramafic. Low shrubs of *Quercus vaccinifolia*, *Q. sadleriana*, *Holodiscus discolor*, and *Prunus emarginata* also occur. The more open and mesic nature of this phase allows a better development of understory herbs including *Penstemon newberryi*, *P. parvulus*, *Lomatium macrocarpum*, *Sedum laxum* ssp. *heckneri*, *Koeleria macrantha*, *Eriogonum umbellatum*, *Selaginella wallacei*, *Erigeron bloomeri* var. *nudatus*, *Lewisia cotyledon*, *Carex brevipes*, *Cryptogramma acrostichoides*, and *Sitanion jubatum*. This is a more stable phase than the *Q. vaccinifolia* subtype. The largest areas of *A. nevadensis* chaparral are not being actively invaded by conifers. However, smaller patches are associated with dense young forest dominated by noble fir and Brewer spruce and are successional.

Siskiyou Enriched Conifer Forest (85410, 85310): 185 acres (75 ha). This forest occupies the NW. and NE. sides of the main ridge and is the densest, most productive, and most extensive of the forest associations in the area. The typical phase of this forest is moderately dense (930 trees/ha), dominated by large Douglas-fir (*Pseudotsuga menziesii*) up to 6 ft (1.8 m) dbh and 170 ft (52 m) tall. Associated with these relicts of the last major disturbance 200-400 years ago are the more abundant, but smaller species: noble fir and Brewer spruce. Both species are in nearly equal abundance as trees, but noble fir is more common as saplings and seedlings. Additional species include white fir (*Abies concolor*) and sugar pine (*Pinus lambertiana*) and occasional incense-cedar (*Libocedrus decurrens*) and western white pine (*Pinus monticola*). Total basal area cover of the forest is relatively high, averaging 185 m²/ha. Douglas-fir comprises 62 percent, noble fir 16 percent, and Brewer spruce 11 percent of that value.

The understory of this forest has occasional small trees of Pacific dogwood (*Cornus nuttallii*), *Acer glabrum* var. *torreyi*, Pacific yew (*Taxus brevifolia*), and *Salix scouleriana*. The shrub layer is dense, dominated by *Quercus sadleriana* and *Vaccinium membranaceum*, with 11 other shrub taxa encountered in the sample. Herbs include 17 species with only a few such as *Chimaphila umbellata* and *Xerophyllum tenax* having more than a trace of cover.

On W. and NE. exposures, the forest composition shifts to a higher Douglas-fir dominance with fewer Brewer spruce and noble fir (this phase is called xeric enriched conifer). White fir, sugar pine, and incense-cedar increase in dominance. The shrub layer shifts to *Quercus vaccinifolia* dominance with some *Arctostaphylos nevadensis*, *Garrya fremontii*, and *Symphoricarpos acutus*. This more xeric forest has a scattering of such understory herbs as *Xerophyllum tenax*, *Iris* sp., *Whipplea modesta*, *Bromus marginatus*, and *Hieracium albiflorum*.

The most mesic form of the enriched conifer forest occurs adjacent to moist seeps on NW. slopes, as near Dillon Camp. Douglas-fir, noble fir, and Brewer spruce co-occur with Port Orford-cedar (*Chamaecyparis lawsoniana*) in the canopy (fig. 142). The understory is dominated by *Quercus sadleriana* and *Vaccinium membranaceum*, but it also includes *Vaccinium parvifolium* and *Alnus sinuata*. Herbs are dense and diverse including *Linnaea borealis*, *Achlys triphylla*, *Polystichum munitum*, *Clintonia uniflora*, *Trientalis latifolia*, and *Vancouveria hexandra*.

The highest-elevation form of this forest occurs just below the ridgeline on the NW.-facing slope. Douglas-fir is much less important than at lower elevations, with Brewer spruce and noble fir nearly equally dominant. The forest is relatively dense (1090 trees/ha) but has substantially lower basal area than the typical phase (112 m²/ha). The relatively small stature of the trees is a result of the harsh ridgetop environment and a large number of young trees. This upper ridge forest is structurally variable with several lobes of dense young trees dropping down from the ridge to interfinger with the more mature, open forest. These dense lobes originated from one or more fires over the past 100 years. Several virtually pure groves of Brewer spruce occur in steep or rocky areas, or both, along the ridges. These groves have been spared from fire for several hundred years. Reproduction is strongly dominated by noble fir, with Brewer spruce the second most important reproducer. The understory of this forest is poorly developed. *Quercus sadleriana* and *Vaccinium membranaceum* are dominant, but they account for less cover than at lower elevations.

Douglas-Fir-Sugar Pine Forest (84110): 111 acres (50 ha). This association covers moderate to steep slopes on SE. exposures. It is an open forest with numerous mature trees, survivors of the last fire (around 1932). The canopy is dominated by Douglas-fir and sugar pine with discrete patches of *Quercus vaccinifolia* forming the principal understory. Ponderosa pine (*Pinus ponderosa*) and incense-cedar are more common at lower elevations.



Figure 142—Rock Creek Butte, mature enriched conifer forest near Dillon Camp with Brewer spruce (4 ft [1.2 m] dbh, right foreground), Port Orford-cedar, noble fir, white fir, and Douglas-fir in Rock Creek Butte cRNA. (1986)

Rock Outcrop (no Holland equivalent): Although there are no large areas of continuous outcrops, many small rocky areas exist. These may be divided into mesic and xeric subtypes. Species of the mesic subtype (either on NW. exposures or shaded by trees) include *Acer glabrum* var. *torreyi*, *Amelanchier pallida*, *Cheilanthes gracillima*, *Cryptogramma acrostichoides*, *Heuchera macrantha*, *Holodiscus discolor*, *Polystichum imbricans*, *Sedum laxum*, and *Saxifraga fragarioides*. The xeric subtype includes *Luina hypoleuca*, *Penstemon newberryi* ssp. *berryi*, *Streptanthus tortuosus*, and *Eriogonum umbellatum*.

Spring and Seep (45400, 63500): Minimal acreage. Hydrophilic vegetation is restricted to small springy areas on the NW. side of the ridge. These may be either sunny or shaded. The shady type lies within the mesic phase of the enriched conifer forest and includes such species as *Alnus sinuata*, *Cornus occidentalis*, *Rosa gymnocarpa*, *Paxistima myrsinites*, *Sorbus cascadiensis*, and *Vaccinium parvifolium* along with such herbs as *Aquilegia formosa*, *Boykinia major*, *Habenaria saccata*, *Senecio triangularis*, *Tiarella unifoliata*, and *Tolmiea menziesii*. On sunnier exposures species include *Salix coulteri*, *S. jepsonii*, *S. leavigata*, *Agrostis exarata*, *Aruncus vulgaris*, *Carex cusickii*, *C. diandra*, *C. nervina*, *Epilobium adenocaulon*, *E. angustifolium*, *E. hornemannii*, *Galium aparine*, *Juncus effusus* var. *exiguus*, and *Petasites palmatus*.

Plant Diversity

One hundred fifteen taxa of vascular plants are listed.

Conflicting Impacts

Although the area is bound on three sides by roads, these have little effect. A small dilapidated, radio-transmitting shack on the summit ridge is the only structure within the proposed boundaries. The long-established campsite at Dillon Camp is not heavily used, and associated woodcutting and litter are not strongly evident. Several years ago a lightning strike was actively suppressed by cutting a few stems of Douglas-fir near Dillon Camp. Management of the montane chaparral and Brewer spruce target elements will have divergent requirements: the former needs regular fire, and the latter requires protection from fire.

71. Rough Gulch (Yolla Bolla) (Taylor 1975a, Taylor 1975b)

Location

The Yolla Bolla ecological survey area is divided into two RNA proposals, Rough Gulch (including Rough Gulch and Chinquapin Ridge) and South Fork Mountain, by the Shasta-Trinity National Forest. The forest plan recommended the establishment of Rough Gulch cRNA. The Yolla Bolla ecological survey area lies about 16 miles (26 km) SE. of Forest Glen in Trinity County, within portions of sects. 14, 15, and 16 T28N, R12W MDBM (40°17'N., 123°11'W.), USGS Pony Buck Peak quad (SW1/4 Dubakella 15' quad) (fig. 143). Ecological subsection – Eastern Franciscan (M261Ba).

Target Elements

Giant Chinquapin (*Chrysolepis chrysophylla*) and Pacific Douglas-Fir (*Pseudotsuga menziesii*)

Distinctive Features

Old-Growth Douglas-Fir Forest: The Yolla Bolla ecological survey area is within a relatively large region of productive Douglas-fir-dominated forest that includes parts of both Rough Gulch and South Fork Mountain candidate RNAs (neither of which has had a complete ecological survey). In comparison to Rough Gulch recommended RNA (rRNA), the South Fork Mountain cRNA bears some distinctions. First, it is located on a more E. aspect than the Rough Gulch rRNA. Thus, in South Fork Mountain cRNA, the importance of giant chinquapin is relatively reduced, while such species as incense-cedar (*Libocedrus decurrens*) and ponderosa pine (*Pinus ponderosa*) are relatively more important than in the Rough Gulch rRNA. The girths of individual Douglas-fir and sugar pine in South Fork Mountain cRNA are far greater than any reported from the adjacent Rough Gulch rRNA (Keeler-Wolf 1984c). The E. exposure also brings in a more xeric component with species such

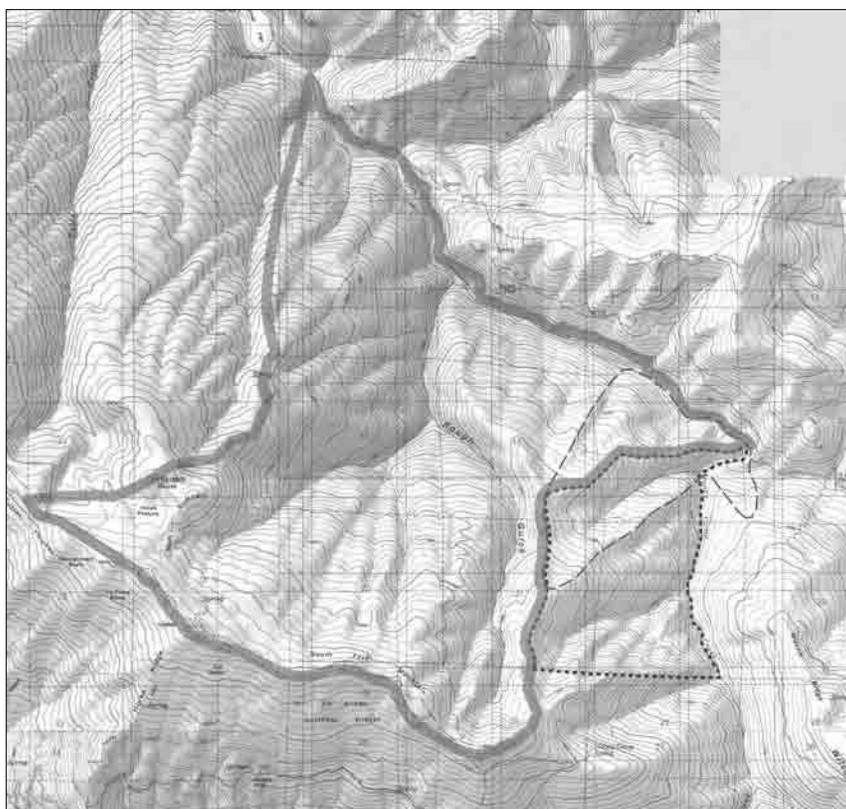


Figure 143—Rough Gulch rRNA and South Fork Mountain cRNA (Yolla Bolla)

Dashed line=South Fork Mountain Study Area;
Dotted line= proposed South Fork Mountain RNA;
Solid gray line = proposed and recommended Rough Gulch RNA.

as canyon live oak (*Quercus chrysolepis*), California black oak (*Q. kelloggii*), and Pacific madrone (*Arbutus menziesii*) attaining greater importance than in the adjacent predominantly NE.- and N.-facing areas.

This entire area of old-growth forest on South Fork Mountain is reported to contain one of the most productive Douglas-fir forests remaining in the State (from the standpoint of board-feet per unit area) (Shasta-Trinity National Forests 1988). It is a prime example of a relatively interior type climax Douglas-fir forest and shows characteristic gap regeneration dominated by Douglas-fir with white fir (*Abies concolor*) as a subordinate reproducer except at the upper elevations (see Hennessy Ridge, #39).

Well-Studied Vegetation: Research by Taylor (1975a, b) and Keeler-Wolf (1984c, 1988b) on the forest vegetation of the South Fork Mountain forests is relatively thorough. Taylor arranged his plots and releves in relation to moisture availability, basal area, relative dominance, density, relative density, and importance value. A number of conclusions can be drawn from these data. For example, the lowest basal area and densities of trees generally occur at the driest, most exposed (ridge crest) sites, whereas cover diversity of the releves increases with moisture availability. Keeler-Wolf (1988b) documents the requirements for giant chinquapin subdominance in these and other forests of the Klamath Mountains ecological section. Some of his study plots are within the proposed boundaries of South Fork Mountain candidate RNA.

Riparian Vegetation and Riverine Values: The South Fork of the Trinity River forms the N. boundary of the area. It is one of the streams least disturbed by human activities in NW. California and is being considered for “wild and scenic” status by the State (Shasta-Trinity National Forests 1988). The South Fork of the Trinity River is a major salmon (*Oncorhynchus* spp.) and steelhead (*Salmo gairdneri gairdneri*) spawning stream, and it is also used by Pacific lamprey (*Lampetra tridentata*). The riparian zone has numerous well-developed white alder (*Alnus rhombifolia*) and an interior stand of red alder (*A. oregona*), both of which may attain large size along the narrow riparian fringe. The rather rare Oregon subspecies of the ruffed grouse (*Bonasa umbellus sabinii*) is generally restricted to the riparian zone in the area.



Figure 144—Rough Gulch and South Fork Mountain, (Yolla Bolla), a spotted owl (*Strix occidentalis*) seen in a dense stand of white fir and a few Douglas-fir saplings. This density of reproduction is typical in the study area. (1975)

Uncommon and Sensitive Fauna: Several uncommon, rare, or sensitive vertebrates are known from the area, including spotted owl (*Strix occidentalis*, State-listed species of special concern) (fig. 144), fisher (*Martes pennanti*, Forest Service-listed sensitive species), and mountain lion (*Felis concolor*).

Physical Characteristics

The area treated by Taylor covers 3212 acres (1380 ha). Elevations range from 2953 ft (900 m) at the banks of the South Fork of the Trinity River to 4495 ft (1370 m) atop the divide separating the drainages of Happy Camp Creek and Rough Gulch. Slopes average about 30° (20-50°) and face generally ENE. with smaller areas of NE., SE., E., and N. exposures.

Rocks are largely South Fork Mountain schist, a pre-Cretaceous metasediment. A few small lenses of serpentinite outcrop are found in sect. 15.

Soils are generally well-drained, moderately acid, clay-loam or gravelly loam of moderate depth (1-1.5 m). They fall into the Hugo and Josephine series. Precipitation is estimated at 60 inches (1525 mm), and records at Forest Glen indicate a mean annual temperature of 52 °F (11 °C). Snow is common in winter months, but typically it does not linger for more than a few days.

Association Types

A total of 28 releves and 18 plots ranging from 314 to 2827 m² were sampled in the one forest association. Additional vegetation sampling in this area was performed by Keeler-Wolf (1988a). Sizes of associations are not given.

Douglas-Fir/*Berberis nervosa* (82420, 81100, 45400): The entire forested portion of the area is classified as this association. Plot data for trees indicate a mean basal area of 36.2 m²/ha (range 14.5-104.7 m²/ha), with Douglas-fir comprising 71.1 percent of this value. The highest basal area for Douglas-fir on any plot is 74.5 m²/ha. Sugar pine (*Pinus lambertiana*), ponderosa pine, and white fir are the major canopy subdominants (fig. 144). Together they contribute an average relative basal area of about 8 percent. The canopy trees are 164-197 ft (50-60 m) tall with average crown cover of about 50 percent. The largest Douglas-fir individuals may be 9.8 ft (3.0 m) dbh, and the largest sugar pine may attain 11.5 ft (3.5 m) dbh. A second tree stratum is composed of the hardwoods: bigleaf maple (*Acer macrophyllum*), Pacific madrone, giant chinquapin, Pacific dogwood (*Cornus nuttallii*), canyon live oak, and California black oak reach heights of 65-82 ft (20-25 m). Giant chinquapin is the dominant member of the subcanopy and attains dbh of up to 30 inches (75 cm).

A shrub layer occurs in scattered, open patches and is dominated by *Berberis nervosa*, *Amelanchier pallida*, *Corylus cornuta* var. *californica*, *Rosa pisocarpa*, *Rubus parviflorus*, and *Toxicodendron diversilobum*. Herbs and low shrubs including *Adenocaulon bicolor*, *Chimaphila umbellata* var. *occidentalis*, *Disporum hookeri*, *Iris tenuissima*, *Lathyrus polyphyllus*, *Rubus leucodermis*, *Trientalis latifolia*, and *Xerophyllum tenax* form the fourth layer.

Six unions within the main association are identified by construction of an association table. The unions are: *Silene californica*-*Erigeron inornatus*, *Iris tenuissima*-*Xerophyllum tenax*, Giant chinquapin-*Chimaphila umbellata*, canyon live oak-*Toxicodendron diversilobum*, *Trientalis latifolia*-*Lathyrus polyphyllus*, and *Vaccinium parvifolium*-*Thelypteris oregana* (Holland 45400). The dominant young trees and saplings are Douglas-fir and white fir. Abundant evidence of past fire (ground fire with small areas of canopy destruction) indicates that fire is an important natural element in the forest.

***Carex senta*/*Peltiphyllum peltatum* (61510, 61130):** This association is confined to the riverbed below the annual flood level. Other species associated with this type include *Aralia californica*, Pacific yew (*Taxus brevifolia*), *Rhamnus purshiana*, white alder (*Alnus rhombifolia*), and red alder (*Alnus oregona*).

Plant Diversity

Ninety-five species are listed.

Conflicting Impacts

The area is being considered part of a major timber sale (as of 1988). Soils are subject to mass-wasting and are classified as high to severely sensitive (Scott and others 1980). Access at present is relatively difficult because there are no roads within 5 trail-miles (8 km) of the area. Access from the N. is limited to times of low river water level (late spring through early fall).

72. Ruth (Thornburgh 1981, Cheng 1998)

Location

This established RNA is on the Six Rivers National Forest, Trinity County. It is about 3 miles (5 km) SW. of the town of Forest Glen. It includes all or part of sects. 27, 34, 35, and 36 T1S, R7E HBM (40°20'N., 123°22'W.), USGS Forest Glen quad (fig. 145). Ecological subsection – Eastern Franciscan (M261Ba).

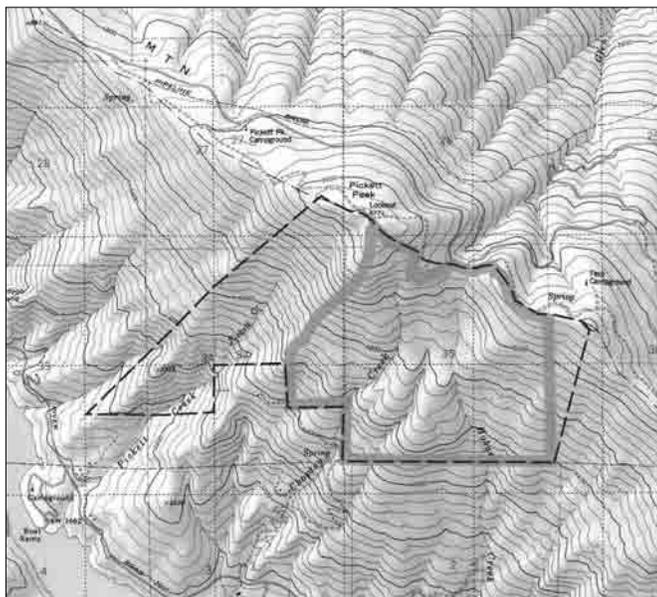


Figure 145—Ruth RNA

Dashed line = Ecological study area
Solid gray line = RNA Boundary

Target Element

Pacific Ponderosa Pine-Douglas-Fir (*Pinus ponderosa*-*Pseudotsuga menziesii*)

Distinctive Features

Pacific Ponderosa Pine-Douglas-Fir Forest: This forest type described as SAF type 244 (Eyre 1980) is not well represented in the California RNA system (see Doll Basin RNA and Hale Ridge RNA). The definition of this type, in which ponderosa pine and Douglas-fir together comprise a majority of the stocking and in which white fir (*Abies concolor*) is only a minor associate, is well met in the 166 acres (67 ha) of the Douglas-fir-ponderosa pine phase of the mixed conifer forest.

Other Related Vegetation Types: Adjacent to the ponderosa pine-Douglas-fir forest are related coniferous forests. In the fir-pine-Douglas-fir phase of mixed conifer forest, most young trees are white fir and, thus, could be considered mixed conifer forest

(Holland type 84230). The lower-elevation, mixed evergreen type contains a small amount of ponderosa pine and is similar to the ponderosa pine phase of the mixed evergreen forest described in Sawyer and others (1977). The oak-conifer woodland and the montane chaparral associations are successional series and represent various seral conditions within the general realm of the target element, thus indicating typical successional directions after fire or prolonged slope disturbance.

Together, the relatively large size and elevational span of the area include a wide variety of association types typical of xeric exposures in the inner North Coast Ranges and adjacent S. Klamath Mountains ecological section.

Physical Characteristics

This established RNA covers 630 acres (255 ha) on the SW.-facing slopes of South Fork Mountain (original surveyed area is 1339 acres, 542 ha). Elevations in the survey range from 2800 ft near the Mad River to 5760 ft (853-1756 m) atop Pickett Peak (final boundary elevations are 3920-5760 ft, 1195-1756 m). Small streams have dissected the relatively uniform slope into several draws with steep W.- and S.-facing slopes. The area has some unstable slopes with evidence of recent movement.

The South Fork Mountain Fault crosses the area at about 4000 ft (1219 m). Most of the area is above this fault, where moderate slopes (5-50 percent) and benches prevail. Below the faultline slopes are steeper (70-100 percent). Rocks NE. of the fault are South Fork Mountain schist. Rocks SW. of the fault are Franciscan assemblage graywacke. However, only a few areas have outcrops. Soils include Bins-Nanny-Woodseye families, Skalan-Kistirn-Holland families, and Albus-Race families. Climate is typical for the inner North Coast Ranges,

with average annual precipitation estimated at 70 inches (1778 mm), most falling from November to March. For the mid-elevations the January mean minimum temperature is 32 °F (0 °C), and the July mean maximum is 90 °F (32 °C).

Association Types

Thirty-six releves were sampled, and the information is arranged in an association table. Several additional 100- by 50-ft (5000 ft², 465 m²) plots were sampled for density and basal area of trees.

Mixed Conifer Forest (84110, 84230, 84240): 502 acres (203 ha). This association has been divided into three phases: Douglas-fir-ponderosa pine (target, 84110), white fir (84240), and fir-pine-Douglas-fir (84230).

The Douglas-fir-ponderosa pine phase (about 166 acres, 67 ha) is similar to Pacific ponderosa pine-Douglas-fir (SAF type 244), the target element for the area. It occurs between 4000 and 4800 ft (1219-1463 m) on SW.- to SE.-facing slopes. It is the most xeric of the three phases. The forest is dominated by scattered large Douglas-fir and ponderosa pine over dense young understory Douglas-fir and ponderosa pine. Diameter of the typical dominants ranges from 50 to 60 inches (1.27-1.52 m) with occasional large specimens up to 85 inches (2.2 m) dbh. Understory trees are typically about 14 inches (36 cm) dbh (range 6-34 inches or 15-86 cm). These trees resulted from a fire 80-90 years before the survey. Variation in proportions of Douglas-fir and pine in stands is high. Incense-cedar, sugar pine, canyon live oak, and California black oak also occur as young understory individuals. Average basal area is 88 m²/ha (range 71-106). Site index for Douglas-fir is 140 ft (43 m) for 100 years; for ponderosa pine it is 128 ft (39 m) for 100 years.

The understory is very sparse with a few scattered saplings of canyon live oak and *Toxicodendron diversilobum* and a very sparse representation of such herbs as *Pteridium aquilinum* and *Hieracium albiflorum*.

The fir-pine-Douglas-fir phase represents the true mixed phase of the mixed conifer forest with white fir, ponderosa pine, and Douglas-fir in an all-aged stand (273 acres, 111 ha). This phase occurs between 4400 and 5200 ft (1341-1585 m). Topography is moderate with large areas of level benches and slight SW.-facing slopes. Stand structure is quite varied, and white fir, sugar pine, ponderosa pine, incense-cedar, or Douglas-fir may dominate. White fir has the highest densities in the younger age classes; ponderosa pine dominates the larger size classes with Douglas-fir as the second dominant species (fig. 146). Incense-cedar is scattered as individuals and small groves. Sugar pine is the least common tree, occurring typically as widely scattered giants. Average basal area for this type is 138 m²/ha (range 61-235), with 100-year site index for Douglas-fir averaging 130 ft (40 m). Shrub and herb layers average less than 5 percent cover and include *Bromus tectorum*, *Hieracium albiflorum*, *Pyrola picta*, *Pteridium aquilinum*, and *Adenocaulon bicolor*.

The white fir phase (63 acres, 26 ha) occupies the upper elevations of the mixed conifer forest, usually above 5000 ft (1524 m). Typical sites are moderately SW.-facing slopes with gravelly loam soils. White fir is the only species with an all-age distribution in this phase; the other species (e.g., ponderosa pine and incense-cedar) usually occur only as large individuals. The average basal area is



Figure 146—Ruth, ponderosa pine dominated stand of mixed coniferous forest on southwest-facing exposure in Ruth RNA. (1988)

150 m²/ha (range 126-172). The 100-year site index for white fir is 100 ft (31 m). Understory is very sparse (<1 percent) with scattered *Amelanchier alnifolia*, *Rosa gymnocarpa*, *Elymus glaucus*, *Pyrola picta*, and *Pteridium aquilinum*. This type is similar to the white fir types described in Sawyer and Thornburgh (1977).

Oak-Conifer Woodland (71120, 81340): 243 acres (98 ha), not included in the RNA. This type is actually a mosaic of California black oak stands, small grassy meadows, and clumps of Douglas-fir or ponderosa pine, or both, which lie between the upper limit of the mixed evergreen forest and the lower end of the montane chaparral. Typical stands consist of an even canopy of large California black oak, ponderosa pine, and Douglas-fir over saplings of Douglas-fir or ponderosa pine. Some stands are a true woodland of California black oak with a thick fern-grass understory dominated by *Pteridium aquilinum* and *Elymus macounii*.

Soils are clay-rich, and occasional slumps and bare erosional slopes indicate instability. The combinations of mobile soils and SW.-facing xeric slopes probably explain the presence of oak-conifer woodland and not forest at this site. Succession appears to be proceeding toward the white fir phase of the mixed conifer forest type. Very little of this forest is actually included within the final RNA boundaries.

Montane Chaparral (37510, 37541, 71110): 128 acres (52 ha). Above 5000 ft (1524 m) the area is covered by a large expanse of chaparral dominated by *Quercus garryana* var. *breweri*, *Q. vaccinifolia*, *Symphoricarpos mollis*, and *Arctostaphylos patula*. Slopes are moderate to steep SW.-facing, and soils are very rocky gravelly loam. Within the chaparral are patches of medium-sized Oregon white oak (*Quercus garryana*), with a grass-fern understory containing some white fir seedlings (Holland 71110). Also some young, pure clumps of white fir are located within the chaparral. The successional trend is toward the white fir phase of mixed conifer forest.

Mixed Evergreen Forest (81100): 92 acres (37 ha), not included in the RNA. This forest is dominated by Douglas-fir and characterized by the presence of the hardwoods Pacific madrone (*Arbutus menziesii*), California black oak (*Quercus kelloggii*), and canyon live oak (*Q. chrysolepis*). Ponderosa pine occurs as an occasional codominant. This association occurs below the South Fork Mountain Fault. Throughout, the forest stands are dominated by large Douglas-fir and ponderosa pine overlying a younger pole-size mixture of Douglas-fir and the hardwoods. This younger size class became established 80-90 years before, following a fire. Most stands contain a few saplings and seedlings.

Four different stands are described from 0.2-acre (0.08-ha) samples. These stands are a few large Douglas-fir over smaller California black oak and Douglas-fir; large Douglas-fir and ponderosa pine over smaller madrone, canyon live oak, and black oak; even-aged canyon live oak and madrone with a few Douglas-fir; and large black oak with pole-size Douglas-fir and ponderosa pine.

The understory is usually sparse, with less than 2 percent cover. A small amount of sapling canyon live oak and Douglas-fir are scattered throughout. *Hieracium albiflorum* and *Bromus tectorum* are the most common herbs. Basal area for trees averages 121 m²/ha (range is 78-152 m²/ha). One-hundred-year-old Douglas-fir average 120 ft (37 m) tall.

White Alder (*Alnus rhombifolia*) Riparian (61510, 45400): This association is limited to very small areas adjacent to streams and seeps. Other woody species besides white alder include bigleaf maple (*Acer macrophyllum*), giant chinquapin (*Chrysolepis chrysophylla*), *Rubus ursinus*, *Corylus cornuta* ssp. *californica*, and large incense-cedars. Herbs include *Asarum hartwegii*, *Mimulus guttatus*, *M. moschatus*, *Viola glabella*, *Tolmiea menziesii*, *Lilium pardalinum*, *Athyrium felix-femina*, *Juncus effusus*, *Hypericum anagalloides*, and *Cystopteris fragilis*.

Plant Diversity

One hundred fifty-eight taxa are in the updated list in the establishment record.

Conflicting Impacts

Past and present cattle grazing may have encouraged the relatively high densities of non-native grasses such as *Bromus tectorum* now present. However, cattle grazing does not appear to have affected conifer establishment and is not a significant factor in most of the RNA. An old tractor trail crosses part of the area, and scattered trees have been felled near it.

73. San Emigdio Mesa (Parikh 1993a, Phillips 1998e)

Location

This established RNA is located on Los Padres National Forest in Ventura County. It is approximately 83 miles (133 km) from Santa Barbara. The RNA lies within the Chumash Wilderness of the Mount Pinos Ranger District. Its boundaries include portions of sections 7, 8, 12, 13, and 18 of T8N, R22W (34°48'N., 119°15'W.), USGS Apache Canyon and Sawmill Mountain quads (fig. 147). Ecological subsection – Northern Transverse Ranges (M262Bb).

Target Element

Pinyon-Juniper Woodland

Distinctive Features

The pinyon-juniper woodland type is rare within the Region 5 RNA network. Dwarf oak (*Quercus turbinella* ssp. *californica*) occurs with the pinyon-juniper woodland throughout the RNA and can be considered a co-dominant species in many areas. Most of the vegetation of the RNA is located on a large alluvial fan in a transition zone between cismontane and desert communities in S. California. Some of the species occur outside their typical ranges.

In addition to the pinyon-juniper woodland, the RNA supports a variety of other habitats including cushion-plant lower montane flats, a mesa, rocky canyons, washes, creeks, alluvial terraces, and a wetland spring and meadow area.

Rare Plants: Lemmon's xerasid (*Syntrichopappus lemmonii*) (CNPS List 4) occurs in the RNA, 75 miles (121 km) outside its previously documented range. The California jewel flower (*Caulanthus californicus*) (CNPS List 1B) has been reported in nearby canyons but was not sighted in the RNA.

Rare Fauna: The RNA falls within the breeding region of the California condor (*Gymnogyps californianus*), a Federally- and State-listed endangered species.

Archeological: Open-air campsites and historic rock-art sites occur on the slopes below San Emigdio Mesa and at lower elevations in Apache Canyon and nearby washes.

Fire History: No major fires have been recorded since 1912. Risk of major damage due to fire is currently low because understory is sparse and fuel load is low in the stands.

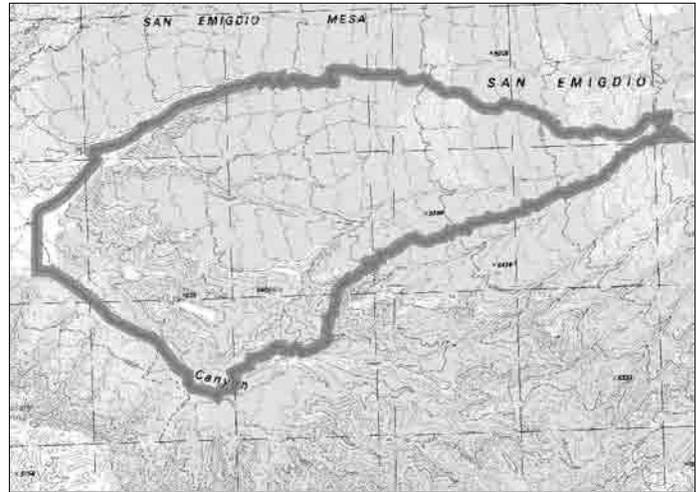


Figure 147—San Emigdio Mesa RNA

Physical Characteristics

The area covers 1200 acres (486 ha) with an elevation of 4500-5800 ft (1372-1767 m). Most of the RNA in the E. part is composed of an alluvial fan dissected by many intermittent streams and gullies. The RNA is part of the Transverse Ranges in the South Coast Drainage Basin. It is bordered on the E. by the Mount Pinos region and on the W. by Cuyama Valley.

The RNA is bounded by faults on its N., S., and W. sides. It is composed of Mesozoic Era (Jurassic Period or older) granitic intrusive igneous and metamorphic rocks and Cenozoic Era nonmarine sedimentary rocks and alluvial deposits. The top of the mesa is made up of Quarternary Period surficial sediments (coarse fan gravel of granite and metamorphic rocks embedded in a sandstone matrix). The area along the W. boundary is composed of folded rock (alluvial gravel, sand, and some clay) from the lower part of the Morales formation. Portions of the S. boundary area are composed of clays, sandstone, and conglomerates of the Quatal formation.

Soils belong mainly to the Morical-Supan-Green Bluff families association (10-60 percent [6-31° slope, 0-7 inches [0-17.8 cm] deep, dark brown to dark grayish brown gravelly or sandy loam). The remaining soils fall into the Los Robles-Trigo families-Orthents association (30-60 percent [17-31° slope, 0-10 inches [0-25.4 cm] deep, light yellowish brown sandy to gravelly loam) and the Orthents-Fluvents complex (0-15 percent [0-9° slope, 0-14 inches [0-35.5 cm] deep, pale brown to light yellowish brown coarse sandy loam).

Two nearby weather stations, Apache Camp and Chuchupate Ranger Station, have mean annual precipitation (1951-1960) of 8.7 inches (22.0 cm) and 11.1 inches (28.1 cm), respectively. Temperature data are not available. Nevertheless, for the pinyon-juniper woodland region, the mean summer maximum temperatures range from 88 to 95 °F (31-35 °C), and the mean winter minimum temperatures range from 20 to 30 °F (-7 to -1 °C), with 150-250 frost-free days per year.

Association Types

Pinyon-Oak-Juniper Woodland (72210/72220): The RNA is almost exclusively dominated by this association type (*fig. 148*), containing a homogeneous distribution of even-aged, open stands of low trees with shrubs in between. One-needle pinyon pine (*Pinus monophylla*) is the dominant tree species. Pinyon pines range from 6 to 65 ft (1.8-20 m), but most are 10 to 30 ft (3-9 m) tall. Dbh values vary from about 1 to 30 inches (3-76 cm), the average being about 7 inches (18 cm). Mean basal area is 0.43 ft²/acre (0.10 m²/ha). Density of adult pinyon pines is about 91 trees/acre (225 trees/ha), with the basal cover being 40 ft²/acre (9.3 m²/ha).

The major shrub species are dwarf (scrub) oak and California juniper (*Juniperus californica*). Dwarf oak is the dominant shrub at high elevations and on N. exposures. Juniper occurs more at lower elevations and on W. and S. exposures. Juniper heights range from 6 to 16 ft (1.8-5 m), and density is 17 trees/acre (42 trees/ha). Very few juniper saplings were counted, and no seedlings were found. In contrast, oaks had the highest number of saplings and seedlings.

Other major understory shrub species found on flat alluvial washes and terraces include *Artemisia tridentata*, *Chrysothamnus nauseosus* ssp. *hololeucus*, and *Haplopappus linearifolius*. The understory in most places also is dominated by perennials such as *Lupinus excubitus* var. *austromontanus*, *L. formosus*, *Eriogonum*



Figure 148—San Emigdio Mesa, pinyon-oak-juniper woodland with an understory of basin sagebrush (*Artemisia tridentata*) and annual species, dry wash leading to the top of San Emigdio Mesa. (1992)

fasciculatum ssp. *polifolium*, *E. wrightii* ssp. *subscaposum*, and *Penstemon centranthifolius*. At higher elevations at the top of the mesa, low cushion plants such as *Eriogonum kennedyi* and *Astragalus purshii* var. *tinctus* are found in gravelly or rocky soil.

Wetland Meadow (45100): This association type occurs in a small area at Cienega Spring in the NW. part of the RNA. It is composed of species from both wetter and drier wetland habitats. The dry-meadow wetland community is dominated by *Juncus* spp. and *Carex* spp. The wetter areas contain *Scirpus* spp., *Eleocharis* spp., *Mimulus guttatus*, *Veronica americana*, and *Ranunculus cymbalaria*.

Plant Diversity

One hundred six species of vascular plants are listed.

Conflicting Impacts

The entire RNA lies within the Apache Canyon grazing allotment, which is currently grazed between June 1 and October 31. Grazing is the only major disturbance in the W. section of the RNA; it is most intense in the Cienega Spring meadow area and at the base of the nearby washes. Wetlands are rare in the RNA, but they contain a unique assemblage of desert transitional and lower montane plant species. Grazing should be discontinued or severely restricted to protect and preserve this habitat.

Nettle Spring Campground (approximately 1 mile [1.5 km] W. of the RNA) is the only campground in the vicinity that is open to the public. Only light recreational activities associated with camping and some hunting and target practice go on immediately outside the RNA. Recreation within the RNA is limited largely to off-trail hiking and bird watching.

74. San Joaquin Experimental Range (no ecological survey, Pacific Southwest Forest and Range Experiment Station 1971)

Location

This established RNA is on the San Joaquin Experimental Range, near the town of O'Neals, Madera County, approximately 28 miles (45 km) N. of Fresno. It is within the E1/2 of section 6 T10S, R21E MDM (37°06'N., 119°43'W.), USGS Millerton Lake West quad (fig. 149). Ecological subsection – Lower Granitic Foothills (M261Fc).

Target Element

Blue Oak-Foothill Pine (*Quercus douglasii*-*Pinus sabiniana*)

Distinctive Features

The blue oak-foothill pine woodland (71410) is representative of the vegetation type typical of most of the granitic foothills on the E. side of the San Joaquin Valley from Madera County southward. This RNA has been maintained as a research area since 1934 and has been associated with research studies on the Experimental Range since that date. From 1935 to 1965, 192 publications relating to research done on the Experimental Range were released. The Range scientists maintain a zoological collection as well as an herbarium. Basic weather data have been collected since 1934. The RNA provides opportunities for studying the impact of livestock grazing and fire on annual plants. Permanent photo stations and vegetation sampling transects (installed in 1992) exist at the Range.

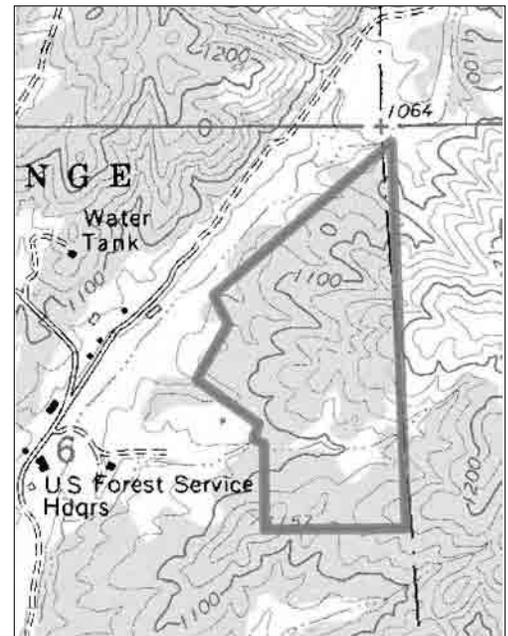


Figure 149—San Joaquin Experimental Range RNA



Figure 150—San Joaquin Experimental Range, blue oak – foothill pine woodland in San Joaquin Experimental Range RNA. (A. Dennis 1992)

Physical Characteristics

The area covers 70 acres (28 ha). Its topography consists of rolling hills with gentle slopes. Elevations range from 1065 to 1200 ft (325-366 m). The soil is mostly Ahwahnee coarse sandy loam with small inclusions of Hanford coarse sandy loam and Visalia coarse sandy loam. Mean annual precipitation is 19 inches (4835 mm), and mean monthly temperatures vary between 41.9 and 80.4 °F (5.5-26.9 °C).

Association Types

Foothill Pine-Oak Woodland (71410) and Non-Native Grassland (42200): Vegetation cover of the RNA is open woodland (foothill pine, blue oak, and *Quercus*

wislizenii) with shrub and annual plant understory (fig. 150). *Ceanothus cuneatus*, *Arctostaphylos mariposa*, *Bromus mollis*, *B. rigidus*, *Festuca megalura*, and *Erodium botrys* are among the more important nontree species. There is no map of vegetation cover.

Fire History

The last fire occurred in the area around 1929.

Grazing History

In the late 1800s, domestic livestock grazed the area heavily. The RNA has not been grazed since 1934.

Plant Diversity

Three hundred and nineteen species are identified for the whole San Joaquin Experimental Range. There is no specific plant list for the RNA.

75. Sawmill Mountain (Parikh 1993b)

Location

The Sawmill Mountain recommended Research Natural Area is on Los Padres National Forest in N. Ventura and S. Kern counties. It lies immediately W. of Mount Pinos, SE. of Cerro Noroeste (Mount Abel), just W. of San Emigdio Mesa, and occupies parts of sects. 25 and 36 T9N, R22W; sects. 30 and 31 T9N, R21W; sects. 1, 2, 11, 12, 13, and 14 T8N, R22W; and sects. 7 and 17 T8N, R21W MDBM (38°48'N., 119°10'W.), USGS Sawmill Mountain quad (fig. 151). Ecological subsection – Northern Transverse Ranges (M262Bb).

Target Element

Jeffrey Pine (*Pinus jeffreyi*) Forest

Distinctive Features

The flora here is mainly derived from the Sierran forest of the West American element of the Arcto-Tertiary geoflora. The pine belt in S. California is similar to the S. Sierra Nevada: many of the high-elevation, montane species with disjunct distributions have affinities with the Sierran flora. Many other species present here are transitional between drier, interior desert flora and montane flora from wetter, cooler regions.

Rare Plants: *Monardella linoides* ssp. *oblonga* is on CNPS List 1B; *Delphinium parishii* ssp. *purpureum* (*D. parryii* ssp. *purpureum* in Hickman [1993]), *Frasera neglecta* (*Swertia* n. in Hickman [1993]), and *Lupinus elatus* are all on CNPS List 4.

Rare Fauna: The region is a part of the breeding habitat of the Federally- and State-listed endangered species California condor (*Gymnogyps californianus*).

Physical Characteristics

The area encompasses about 3800 acres (1539 ha). Elevations range from 6250 feet to 8750 feet (1905-2667 m) at the summit of Sawmill Mountain. Although many small peaks, high ridges, and rocky outcrops are included, the rRNA consists mainly of steep slopes, narrow drainages, seeps, springs, meadows, and some drier, wider washes. Grouse Mountain, W. of the summit, is also included. The rugged slopes of Sawmill Mountain drain N. to San Emigdio and Cuddy creeks and W. by way of Dry and Apache canyons to the Cuyama River. To the S., they drain by Lockwood and Piru creeks into the Santa Clara River.

The Mount Pinos mountains are granitic intrusive igneous and metamorphic rocks of the Mesozoic and, perhaps, the Precambrian eras. The northernmost edge of the rRNA is composed of Precambrian to Mesozoic Pelona schists, and the N. slopes of Sawmill Mountain and its summit are made up of gneissic rocks of similar age, primarily banded biotite-quartz-feldspar gneiss with some granitic rocks. A vein and small outcrop of mylonitic rocks of the same age have been mapped in the N. part of the rRNA. These metamorphic rocks are covered in places by Quaternary landslide rubble of Pleistocene or recent Holocene epochs. Mesozoic or older granitic rocks are present in most of the area S. of the summit and in a small section N. of the summit.

The granitic bedrock has decomposed in most areas to form slightly acidic soils. Bedrock outcrops are evident on ridges, rises, and actively eroding sites. Soils belong to the Hades-Ginser-Ola families association, the Kilburn-Wrentham-Supan families association, and the Los Gatos-Kilburn-Panamint families association.

No climate data are available from the rRNA. Average precipitation in the S. California montane coniferous forest region ranges from 35 to 60 inches (89-152 cm), and the growing season is 3-7 months. Snowfall occurs at higher elevations and is often heavy; summer thundershowers also occur. Summit snow-depth records maintained by the Forest Service report averages of 32.4 inches (82.3 cm) of snow on March 1 and 18.2 inches (46.2 cm) on April 1. Average annual temperature in the area ranges from 50 to 60 °F (10-15 °C), with a large range in annual temperature.

Association Types

The point-centered quarter method was used to sample forest vegetation types.

Jeffrey Pine Forest (85100): No acreage is given. The target vegetation type, Jeffrey pine (*Pinus jeffreyi*) forest, occurs as a fairly homogenous, dense distribution of large trees (particularly large on slopes adjacent to drainages) with a varied understory at different locations (fig. 152). This species dominates drier slopes and S., E., and W. exposures, which receive more sunlight. Heights of trees range to 131 ft (40 m). Soils are generally finer than the denuded gravelly soils near the summit. White firs may occur rarely. Understory varies in density, and typical components are *Chrysothamnus vicidiflorus*, *Lupinus elatus*, *Ribes cereum*, and *Symphoricarpos parishii*. Annual species are present in spring and summer.



Figure 151—Sawmill Mountain rRNA

White Fir Forest (85320): No acreage is given. Fine and moist soils with a thick litter cover on steep and shady N. slopes are covered by white fir (*Abies concolor*) forest, with a lower, denser, and more closed crown cover than the Jeffrey pine forest. Tree height ranges up to 98 ft (30 m). The understory is generally not dense; it is composed of species such as *Delphinium parishii* ssp. *purpureum*, *Erysimum capitatum*, *Ribes cereum*, *Viola purpurea*, and a host of summer annuals.

Jeffrey Pine-White Fir Forest (85210): No acreage is given. Less steep N. slopes with E. and W. exposures are dominated by a mixed forest of Jeffrey pine and white fir. One or the other species dominates locally depending on soil moisture and exposure. The understory appears to be dominated by species from the Jeffrey pine forest type. Although limber pine (*Pinus flexilis*) occurs relatively frequently and with some abundance at Mount Pinos on N. slopes, it is found only occasionally at higher elevations in the Sawmill Mountain rRNA, on gently sloping, relatively open summit flats, outcrops, and ridges. Limber pine appears to be absent where overstory is dense and can be considered a rare component of both white fir forest and mixed Jeffrey pine-white fir forest at Sawmill Mountain.



Figure 152—Sawmill Mountain, Jeffrey pine (*Pinus jeffreyi*) forest with an understory dominated by squaw current (*Ribes cereum*) (1992)

Montane Meadow (45100): Montane meadow vegetation is found in washes, drainages, springs, seeps, depressions, and concave slopes in the Sawmill Mountain rRNA. The meadows vary in size depending on microtopography, generally contain fine soils, and are covered with *Juncus* spp., *Carex* spp., and *Eleocharis* spp. Creeks at lower elevations are edged with a plant association made up of *Cercocarpus ledifolius*, *Lupinus latifolius*, and *Salix lasiolepis*. Montane meadows of both wet (45110) and dry (45120) subtypes occur within the rRNA. Species occurring in the dry meadow habitats include *Equisetum laevigatum*, *Helenium bigelovii*, *Iris missouriensis*, and *Sisyrinchium halophilum*. Plants found in wet meadow, spring, and seep habitats include *Mimulus guttatus*, *M. moschatius*, *M. primuloides*, and *Potentilla glandulosa* ssp. *reflexa*. The overstory in most of these areas is dominated by Jeffrey pine.

Southern California Fell-Field (91130): No acreage is given. At the highest elevations near the summit of Sawmill Mountain where overstory tree species are very sparse, low subalpine fell-field cushion vegetation is found in gravelly or rocky soil on gently sloping, open flats. Species include *Astragalus purshii* var. *tinctus*, *Calochortus invenustus*, *Eriogonum kennedyi*, and *Sitanion hystrix*, with scattered shrubby plants such as *Chrysothamnus vicidiflorus*.

Most locations in the Sawmill Mountain rRNA have an understory of scattered elements of rabbitbrush scrub and montane chaparral. Some species found here include *Chrysothamnus nauseosus* ssp. *mohavensis*, *C. vicidiflorus*, *Ribes cereum*, *Eriogonum* spp., *Lupinus elatus*, *Penstemon speciosus*, *Castilleja applegatei*, *Achillea millefolium* var. *lanulosa*, *Eriophyllum confertifolium*, and *Ceanothus cordulatus*. At elevations below 8000 ft (2438 m), scattered canyon live oaks (*Quercus chrysolepis*) begin to appear in the overstory of the Jeffrey pine forest. The oaks increase in abundance with decreasing elevations, where occasional one-needle pinyon (*Pinus monophylla*) also are found. This forest vegetation type of Jeffrey pines mixed with oaks and pinyon pines is particularly prevalent below 7500 feet (2286 m).

Plant Diversity

Ninety-three taxa are listed.

Conflicting Impacts:

The region has been mined for borates and gypsum in the past, but in general the potential for the presence of undiscovered mineral and petroleum resources is very low. The steep, rugged slopes of the rRNA probably preclude grazing altogether, and most recreational activities are restricted to the two main trails. Adverse impacts have not been observed at the area's two primitive campgrounds. An increase in mountain biking has been observed and should be discouraged in the area.

76. Sentinel Meadow (DeDecker 1975b, Talley 1978, Inyo National Forest 1982b)

Location

This established RNA is on the Inyo National Forest, Mono County. It is about 14 miles (27 km) NE. of the town of Mammoth Lakes. It lies within portions of sects. 7, 8, 9, 10, 15, 16, 17, and 18 of T2S, R29E MDBM (37°47'N., 118°47'W.), USGS Crestview and Dexter Canyon quads (fig. 153). Ecological subsection – Glass Mountain (341DI).

Target Elements

Lodgepole Pine (*Pinus contorta* ssp. *murrayana*) and Limber Pine (*Pinus flexilis*)

Distinctive Features

Tree Growth: A large number of lodgepole pine, Jeffrey pine (*Pinus jeffreyi*), whitebark pine (*P. albicaulis*), and limber pine were sampled throughout the area, and quantitative estimates of diameter and height growth-rates were made. These are too detailed to summarize here, but the information is valuable and may be compared to the estimates for the same species at other sites or for different species under similar climatic regimes (e.g., the extensive dendrochronological data for White Mountains bristlecone pine [*Pinus longaeva*] stands [Fritts 1969]).

Structure and Forest History: by using the data accumulated for growth-rate estimates, establishment times and age-classes for the major tree species were constructed. Thus, a large body of knowledge exists for the structure of the major tree-dominated associations at Sentinel Meadow. For example, the clusters of the few Jeffrey pine age-classes were found to be closely associated with periods in history when climate was relatively moist. Fire history of the Jeffrey pine forest suggests that fires were frequent between 1800 and 1900. In contrast, only one widespread fire (about 1800) is evident in the lodgepole pine forest.

Solar Beam Irradiation: The major plant associations were evaluated for solar intensity on the basis of estimates calculated for their characteristic slope exposures. Sites with the highest insolation include *Cercocarpus ledifolius* and Jeffrey pine types, whereas sites with the lowest insolation contain whitebark and western white pine mixed with lodgepole pine.

Mesicness of an E-Side Range: The presence of such species as *Chrysolepis sempervirens*, whitebark pine, western white pine (*Pinus monticola*), and, according to C. Millar (personal communication 1989), mountain hemlock (*Tsuga mertensiana*) was unknown in this area before this survey and suggests that,

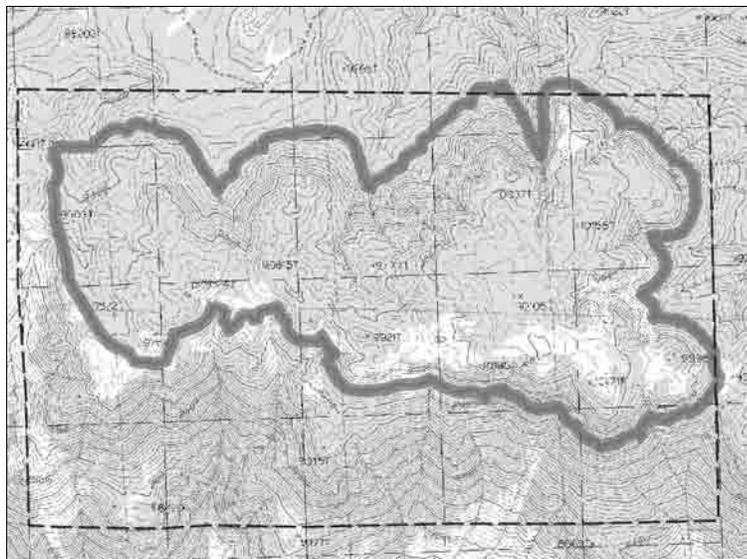


Figure 153—Sentinel Meadow RNA

Dashed line = Ecological study area;
Solid gray line = RNA Boundary

perhaps because of the gap in the Sierra Crest to the W. near Mammoth Mountain, a relatively large amount of precipitation falls at this site given its E.-side location.

Physical Characteristics

The ecological survey of this RNA covers 3840 acres (1554 ha) (actual size of the established RNA is 2041 acres, or 827 ha). Elevations range from 9200 to 10,171 ft (2805-3101 m). The RNA straddles a high E.-W. ridge (plateau) in the Glass Mountains on the N. rim of the Long Valley caldera. N. slopes drain into the Mono Basin, and the S. escarpment drops into the Owens River drainage. All aspects are represented. Slopes range from less than 7° to more than 45°.

S.-facing slopes are underlain by granite and are steeper than N.-facing slopes which are underlain by rhyolite with local obsidian outcrops. Climate is somewhat moister than at other similar ridges lying E. of the main Sierra Crest, with estimated precipitation at 18-22 inches (450-550 mm) annually. Seasonal temperature variation is relatively high, with estimated average January lows of 7 °F (-14 °C) and July highs of 78 °F (25.4 °C).

Association Types

Description and acreage are based on ecological survey. The area was sampled using 0.07-ha plots. The Jeffrey pine forest has 16 plots, lodgepole pine forest 18 plots, lodgepole-whitebark pine forest 7 plots, and limber pine forest 9 plots.

Lodgepole Pine Forest (86100, 81B00): 1289 acres (522 ha). Pure or nearly pure stands of lodgepole pine occur on level or gently sloping ground on the E., N., and W. flanks of Sentinel Ridge and on the W. and NE. slopes of the Sentinel Ridge

plateau (fig. 154). The sample plots average 245 stems/ha and a basal area of 29 m²/ha. Frequency, cover, and basal area of lodgepole pine decline with increasing elevation and exposure. Upper plateau stands exposed to strong S. winds are composed of scattered trees with wind-trained branches but significant girth. Combined understory and tree stratum cover is estimated at 43 percent on gentle W.-facing slopes, but cover is much reduced at upper elevations. Total cover of the herb stratum seldom exceeds 25 percent. Typical understory species include

Carex spp., *Gayophytum nuttallii*, *Sitanion hystrix*, *Stipa elmeri*, *Poa nervosa*, *Ribes cereum*, *R. roezlii*, *Symphoricarpos vacciniifolia*, *Lupinus breweri*, and *L. alpestris*. Species apparently locally confined to this type include *Chaenactis douglasii*, *Frasera puberulenta*, and *Pterospora andromedea*. Scrubby aspen (*Populus tremuloides*) occur in this type on gentle slopes on the N. edge of the RNA.

Jeffrey Pine Forest (85100): 862 acres (349 ha). This association occurs on S. exposures. Soil is a coarse friable granite. Stocking is relatively uniform (124 stems/ha), accounting for 41 m²/ha basal area and 43 percent cover. Jeffrey pine

Figure 154—Sentinel Meadow, exposed hillsides result in open lodgepole pine stands in Sentinel Meadow RNA. (between 1977-1982)



is the sole dominant at most sites, with some admixture of western juniper (*Juniperus occidentalis* ssp. *australis*) on convex slopes at elevations of about 8038 ft (2450 m) and *Cercocarpus ledifolius* on rocky or exposed convex slopes. All mature Jeffrey pines are wind-sheared at their tops, with crooked stems. At 9842 ft (3000 m) Jeffrey pine and limber pine forests form an ecotone. The Jeffrey pine are strongly stunted and may not produce viable seed at this level.

Ecotones with sagebrush scrub indicate invasion by Jeffrey pine with good cone production. Common associates with Jeffrey pine are shared with sagebrush scrub and mountain mahogany woodland. A few species locally restricted to this type include *Chrysolepis sempervirens*, *Streptanthus tortuosus*, *Cryptantha muricata* var. *dentata*, and *Eriogonum spergulinum* var. *reddingianum*.

Lodgepole Pine-Whitebark Pine Forest (86220): 709 acres (287 ha). Mixed stands of lodgepole and whitebark pines are largely restricted to N. slopes. Some of these forests contain occasional western white pine (*Pinus monticola*). Whitebark and lodgepole pines have nearly equal density and cover (292 vs. 218 stems/ha and 12 vs. 8 percent cover, respectively). Locally (one plot), basal area cover of whitebark pine may be as high as 200 m²/ha, but the average for the other six 0.07-ha plots is 7.8 m²/ha, one-third that of typical lodgepole-pine-forest basal area. Lodgepole pines in this mixed forest are smaller than those in pure lodgepole pine forest. However, cover is similar. Understory species include *Arabis holboellii*, *A. inyoensis*, *A. platysperma*, *Calyptridium umbellatum* var. *caudiciferum*, *Carex* sp., *Erysimum argillosum*, *Lupinus alpestris*, *Poa nervosa*, *Stipa elmeri*, and *Eriogonum lobbii*.

Limber Pine Forest (86700): 507 acres (205 ha). Limber pine forest extends over S. and E. exposures between 9462 and 10,000 ft (2884-3048 m) in the E. half of the study area. Open stands (10-15 percent tree cover) are typical of exposed sites. Jeffrey pine may occur in these forests on S. slopes below 9514 ft (2900 m). More gradual slopes at the plateau rim or other exposed sites with N. to NW. exposures may have mixed stands of limber, whitebark, and lodgepole pines. Tree cover and density varies widely throughout the sampled plots (1-30 percent, 14-290 stems/ha, respectively), as does basal area (0.1-17.0 m²/ha). Establishment of limber pines is limited to xeric exposures.

Herb- and shrub-stratum taxa are typically widespread species from other types. *Lesquerella kingii* and *Chamaebatiaria millefolium* are locally confined to this type.

Subalpine Forest (86600): 177 acres (54 ha). This type occurs above 9810 ft (2990 m) on the S. half of the plateau. Soil is loose and rhyolitic, with local obsidian outcrops. Clusters of whitebark, limber, and lodgepole pines dominate. Total tree cover is less than 1 percent. Three subtypes occur on the basis of varying degrees of slope exposure and wind action.

Subtype one occurs at the S. and E. rims of the high, 9842-ft (3000-m), plateau. It is characterized by stony soil pavement because of removal of fine particles by wind. This type has isolated clusters of primarily limber and whitebark pines and a sparse (5-15 percent) understory including *Chrysothamnus viscidiflorus* ssp. *viscidiflorus*, *Haplopappus macronema*, *Leptodactylon pungens* ssp. *hallii*, *Phlox covillei*, *Eriogonum ovalifolium* var. *nivale*, *Eriophyllum lanatum* var. *monoense*, *Holodiscus microphyllus*, *Lupinus breweri*, and occasional *Cercocarpus ledifolius*.

Areas characterized by alternating removal and deposition of sandy soil (subtype two) comprise well over half of the subalpine forest. Vegetation is dominated by patches of *Ribes cereum*, with largely open ground dotted with sparse cover of most species mentioned in subtype one scattered in between. In addition to those species, several others including *Hulsea vestita*, *Raillardella argentea*, *Senecio spartioides*, *Cryptantha confertiflora*, *Lupinus montigenus*, and *Mimulus coccineus* appear to occur only in this type.

Subtype three is characterized by sand deposition areas in depressions left by two volcanic craters. Vegetation is virtually absent except for widely spaced *Lupinus breweri*.

Sagebrush Scrub (35100, 35210): 158 acres (64 ha). This association occurs on gradual S. to SE. aspects at about 9600 ft (2926 m). It is characterized by deep sandy soil, and most of it is relatively undisturbed by grazing. Cover is about 50 percent, 20-50 percent of which is *Artemisia tridentata*. Other significant species include *Symphoricarpos vaccinioides*, *Monardella odoratissima* ssp. *parviflora*, *Haplopappus suffruticosus*, *Leptodactylon pungens*, *Holodiscus microphyllus*, *Purshia tridentata*, *Ribes cereum*, *Eriogonum umbellatum* var. *umbellatum*, *Sitanion hystrix*, *Stipa elmeri*, *Orobanche corymbosa*, *Tetradymia canescens*, *Silene montana* ssp. *bernardina*, *Oryzopsis hymenoides*, and *Stephanomeria tenuifolia*.

Mountain Mahogany Woodland (no Holland equivalent): 89 acres (36 ha). This type is concentrated along the upper margin of the Jeffrey Pine forest and restricted to windy sites below 9842 ft (3000 m) with steep convex S. exposures and rocky soil. *Cercocarpus* accounts for at least 700 stems/ha, but only 20 percent cover and 10 m²/ha basal area. Most species are shared with the sagebrush scrub with the possible exception of *Abronia turbinata* and *Lygodesmia spinosa*.

In the establishment record, vegetation cover is divided into lodgepole pine (788 acres [319 ha]), mixed stands of lodgepole and whiteback pines (637 acres [258 ha]), limber pine (228 acres [92 ha]), and 388 acres (157 ha) of shrubs, Jeffrey pine, and pinyon pine.

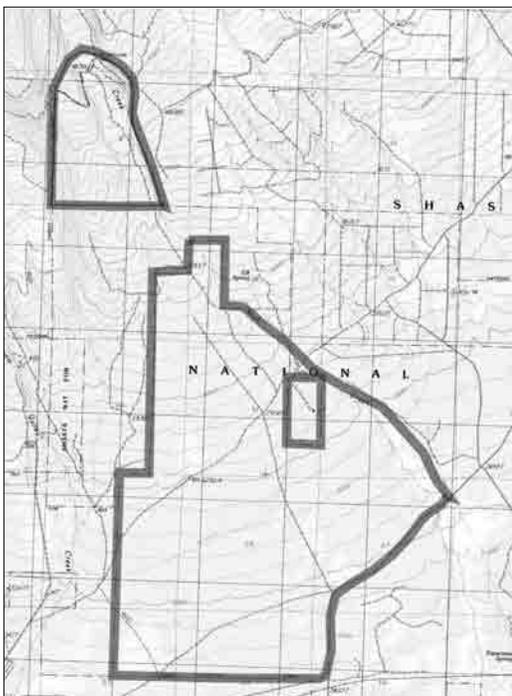
Plant Diversity

Seventy-one species are listed.

Conflicting Impacts

Domestic grazing in the sagebrush scrub has significantly disturbed portions of that community. No other impacts are mentioned.

Figure 155—Shasta Mudflow RNA



77. Shasta Mudflow (Mt. Shasta Mudflow) (Keeler-Wolf 1984b)

Location

This established RNA is on the Shasta-Trinity National Forest. Its center is about 3 miles (5 km) NE. of the town of McCloud. It occupies portions of 13 sections in T40N, R2W MDBM (41°18'N., 122°6'W.), USGS Elk Spring quad (fig. 155). Ecological subsection – McCloud Flat (M261Dg).

Target Elements

Pacific Ponderosa Pine (*Pinus ponderosa*) and Successional Mudflows (unique element)

Distinctive Features

Successional Status: The glacial outwash floods of 1924-1931 deposited millions of cubic yards of new substrate on the RNA. Many similar events occurred before these floods. The result of these periodic deposits has been a chronosequence of soils with associated variations in vegetation and physical and chemical properties. The floods and the soils they produced have been studied by several soil scientists, geologists, and ecologists since the 1930s (see Hill and Egenhoff 1976, and Sollins and others 1985).

Primary succession on these mudflows progresses from bare mineral soil with no successful colonization of woody species for several years to *Purshia tridentata* dominance followed by ponderosa pine colonization and growth and, finally, to development of a mature forest with variable mixtures of other mixed conifer species. The early dominance of *Purshia* is made possible by nitrogen-fixing bacteria on its root nodules. The success of ponderosa pine has much to do with rapid root growth and tolerance of deep droughty soils.

The idealized succession on a series of progressively older soils is confounded by fire history, logging, mudflow depth, flow rockiness, distance from seed sources, and climatic variations across the area. Much more information must be accumulated to have an accurate view of the successional trends on the area. Comparative research on the two most recent flows in the RNA is also lacking.

A larger portion of the RNA (about 1640 acres, 664 ha) has been affected by secondary succession, resulting from extensive fires between the late 1800s and early 1900s, rather than by mudflow succession. Secondary succession is markedly different from primary succession with longer-persisting shrub stages dominated by different species and different tree colonizers than on mudflows.

Physical Characteristics

The study area covers 3467 acres (1403 ha) of gently S.-sloping terrain on the lower S. slopes of Mount Shasta. The Shasta Mudflow RNA covers 3115 acres (1261 ha) and excludes the disjunct N. portion of the study area. Elevations range from about 5040 ft (1536 m) in the NW. corner to about 3440 ft (1049 m) approximately 4.5 miles (7.2 km) away at the SE. corner. Volcanic mudflows resulting from glacial outburst floods have created large areas of volcanic mud deposits in the region. Five flows (A-E) of different ages are identified in the RNA, including three broad flows (A, D, E) that run N.-S. and two intermediate-aged flows (B, C) that occur as islands in the three broad flows. Mud Creek traverses the length of the area. The entire area is underlain by deep andesitic ash, boulders, and gravel. Soils are regosolic and considered vitrandepts.

Precipitation averages 45-50 inches (1143-1270 mm) annually. Twenty to 50 percent of this falls as snow, with average April 1 snow depths from 10 to 25 inches (25-64 cm). Mean January temperatures are about 36 °F (2.2 °C); mean July temperatures, 65 °F (18.3 °C).

Association Types

Forty-two 100-m² plots were sampled on a series of transects in the ponderosa pine, mixed conifer, and white fir associations.

Ponderosa Pine Forest (84220): 2462 acres (996 ha). As a result of different successional histories in this association, there is great variation in tree size, tree density, and understory composition. The ponderosa pine forest also varies clinally as a result of differing climatic conditions across the RNA. Thirty-two 100-m² plots were sampled in this vegetation type. Basal area cover ranges from 21 to 300 m²/ha. The association is divided into five subtypes. Four of these are arranged along a successional series.

Subtype 1 occurs on very deep, recent mudflow deposits (>15 ft, 5 m). Growth of ponderosa pine is slow, taking 40 yr to attain 5.5 inches (14 cm) dbh and 16 ft (5 m) in height. *Purshia tridentata* dominates the understory (25-45 percent cover) with *Haplopappus bloomeri*, *Penstemon deustus* ssp. *heterander*, *Elymus glaucus*, *Sitanion hystrix*, and *Eriogonum nudum*. Bare soil covers 30-50 percent of the surface.

Subtype 2 occurs on a recent mudflow (Flow A) where depths are 10-17 ft (3.0-5.2 m). Here, ponderosa pine is denser and larger than subtype 1. The dbh of the dominant species ranges from 6 to 12 inches (15-31 cm); heights are 25-45

ft (7.6-13.7 m). *Purshia tridentata* covers 20-70 percent. Few other shrub and herb species occur. *Arctostaphylos patula*, *Haplopappus bloomeri*, *Ribes roezlii*, *Ceanothus prostratus*, *Arabis holboellii* var. *retrofracta*, *Linanthus ciliatus*, *Vulpia* sp., *Sitanion hystrix*, *Stipa occidentalis*, and *S. columbiana* are occasional.

Subtype 3 is widespread on the recent Flow A, with depths of 2-6 ft (0.6-1.8 m). Dominant trees average 15-22 inches dbh (38-56 cm) with heights from 65 to 100 ft (20-31 m). Ponderosa pine dominates, with small numbers of incense-cedar (*Libocedrus decurrens*) and white fir (*Abies concolor*). The understory is relatively shady and very sparse (fig. 156); large areas have no herbs or shrubs.

Subtype 4 occurs on Flow B at the S. end of the area. Ponderosa pines average 90 years old, 25-36 inches (64-91 cm) dbh, and 93-116 ft (28-35 m) tall. This subtype is relatively open with fewer trees/area than subtype 3. California black

oak (*Quercus kelloggii*) is frequently an important subdominant, and grasses such as *Bromus marginatus* and *B. orcuttianus* are often common. Herbs such as *Agoseris heterophylla*, *Lagophylla* sp., *Osmorhiza chilensis*, *Lupinus adsurgens*, *Rumex angiocarpus*, *Pteridium aquilinum*, and *Horkelia fusca* are common.

Beyond these four types there are more advanced successional stages. These may be viewed as members of an E.-W. continuum ranging from a drier, more interior type on the E. side of the RNA, with *Purshia tridentata* the understory dominant, to a more mesic W. side type which is transitional with mixed conifer forest, having an understory of mountain chaparral sclerophylls and other typical mixed-conifer-forest species. Many of these older forests are dominated by ponderosa pine largely because of its resistance to fire. Younger trees of Douglas-fir (*Pseudotsuga*



Figure 156—Shasta Mudflow, ponderosa pine on shallow 1924-26 mudflow in the Shasta Mudflow RNA. Note senescent *Purshia* in understory. (1983)

menziesii), white fir, and incense-cedar are certain to increase in importance, barring future fire or other disturbance.

Mixed Conifer Forest (84230): 924 acres (374 ha). This association is dominated by variable mixtures of Douglas-fir, incense-cedar, white fir, sugar pine (*Pinus lambertiana*), ponderosa pine, and California black oak. The best examples occur on the W. side of the area, on older surfaces that were lightly logged 80-90 years ago. Nine 100-m² plots were sampled in this type. Total basal area varies from 85 to 234 m²/ha. White fir is the most ubiquitous species, occurring on all plots, but the dominants are ponderosa pine and Douglas-fir, both averaging about 43 m²/ha basal area. Densities average between 600 and 4900 stems (>2 m tall) per hectare. All species are reproducing, and barring further disturbance, forest composition should remain consistent. Typical understory is sparse, with scattered individuals of *Symphoricarpos acutus*, *Chimaphila menziesii*, *C. umbellata*, *Pyrola picta*, *Goodyera oblongifolia*, *Corallorhiza maculata*, *Galium bolanderi*, and *Viola lobata*.

White Fir Forest (84240): 91 acres (37 ha). This association occurs at the upper elevations. It may be a closed climax forest or a young successional forest. Both types are strongly dominated by white fir. The successional phase results from fires in the late 1800s and early 1900s that killed all but a few trees. Survivor trees are largely ponderosa pine 4-6 ft (1.2-1.8 m) dbh and 130-160 ft (40-49 m) tall. These trees tower over the dense canopy of 10- to 14-inch (25- to 36-cm) dbh white fir with heights of 50-60 ft (15-18 m). There is a senescent, shrubby

understory dominated by *Chrysolepis sempervirens*, *Arctostaphylos patula*, and *Ceanothus velutinus*. Before the fires, this forest was probably a mixed conifer type, as young incense-cedar, Douglas-fir, and sugar pine also occur in the area.

The old-growth type was spared from fire by its valley-bottom location. Basal area cover for old-growth white fir forest averages 120 m²/ha, with white fir comprising 78 percent of the cover. Basal area on the successional plots averages 198 m²/ha, with white fir comprising 37 percent of the total cover. Tree density is 1200/ha on mature plots and 2500/ha on the successional plots. White fir relative density is 92 percent on mature plots and 52 percent on the successional plots.

Mountain Chaparral (37510, 37530): No acreage is given. Several small patches of chaparral dating from the fires 80-120 years ago occupy the NW. portion of the RNA adjacent to white fir forest. These are dominated by a varying mixture of *Ceanothus velutinus*, *Chrysolepis sempervirens*, *Arctostaphylos patula*, and *Prunus emarginata*. Most have numerous *Abies concolor* saplings and young trees associated with them. Herbs and grasses are few and include *Hackelia californica*, *Apocynum pumilum*, *Carex languinosa*, and *Melica aristida*.

Another form of mountain chaparral occurs at lower elevations in the S. portion of the RNA. This subtype is dominated typically by *Arctostaphylos patula* with *Ceanothus cordulatus*, *C. prostrates*, and occasionally *Arctostaphylos nevadensis*, *Purshia tridentata*, *Amelanchier pallida*, *Ribes roezlii*, and *Prunus emarginata*. Unlike the previous subtype, *Chrysolepis sempervirens* is rare. This subtype is more open than the previous subtype.

Riparian (61510, 61530, 63500): No acreage is given. While unstable banks and variable water levels in Mud Creek are not conducive to good riparian growth, small areas of riparian vegetation exist at the diversion dam at the upper end of the RNA and along Squaw Creek on the NW. boundary. The following woody species are characteristic: *Alnus tenuifolia*, *Salix lemmonii*, and black cottonwood (*Populus trichocarpa*). Herbs include *Juncus mertensianus*, *Luzula comosa*, *Agrostis scabra*, *A. exarata*, *A. variabilis*, *Glyceria elata*, *Carex jonesii*, *Epilobium glaberrimum*, *Gnaphalium chilense*, *Stellaria crispa*, *Mimulus guttatus*, *Castilleja miniata*, *Achillea millefolium*, and *Potentilla glandulosa* ssp. *nevadensis*.

Plant Diversity

Ninety-five species are listed.

Conflicting Impacts

Portions of the area were logged in 1885 and 1900. Three dirt roads and a water pipeline cross parts of the RNA. The remnants of a small diversion dam exist at the N. boundary along Mud Creek. However, the majority of the area shows little human alteration.

Note: for Shasta Red Fir, see Red Butte-Red Fir Ridge, #69

78. Smoky Creek (Taylor and Teare 1979a)



Figure 157—Smoky Creek rRNA

Location

This recommended RNA is located on Shasta-Trinity National Forest, in Trinity County, about 5 miles (8 km) SE. of Forest Glen. It includes portions of sects. 20, 21, 28, and 29 of T27N, R12W MDBM (40°22'N., 123°15'W.), USGS Pony Buck Peak quad (SW 1/4 Dubakella 15' quad) (fig. 157). Ecological subsection – Rattlesnake Creek (M261Au).

Target Elements

Pacific Ponderosa Pine-Douglas-Fir (*Pinus ponderosa*-*Pseudotsuga menziesii*) Forest and Jeffrey Pine (*Pinus jeffreyi*)

Distinctive Features

Rare Plants: Five species of rare plants occur in the vicinity of the rRNA. These are all serpentine endemics. Two species (*Haplopappus ophitidis* [CNPS List 1B] and *Helianthus exilis* [CNPS List 3]) occur on the study site.

Serpentine Jeffrey Pine Forest: Although this vegetation type is widespread on drier serpentine areas of the Klamath Mountains ecological section, this area is the only recommended RNA currently considered as representative of this vegetation in California. Numerous endemic plants occur in the serpentine Jeffrey pine forest and have been well-studied in other parts of the Klamath Mountains ecological section (Waring 1969, Whittaker 1960).

Physical Characteristics

The study area lies at the head of the easternmost fork of Silver Creek and on the North Fork of Smoky Creek, both of which drain into the South Fork of the Trinity River. Elevations range from 3200 to 4200 ft (975-1280 m). The recommended RNA encompasses 960 acres (389 ha).

Slopes average 10-20° with extensive interfluves of lesser slope between Smoky and Silver creeks. Both streams are intermittent within the area, although several seeps and springs (e.g., Swim Meadow, Silver Springs) flow year-round.

The area is underlain by pre-Cretaceous metamorphic rocks, with extensive outcrops of altered ultrabasic rock (serpentine).

Soils are probably Sheetiron-Josephine families over the metamorphics and Dubakella-Neuns over the serpentine. Mean annual temperature is estimated at somewhat lower than 51 °F (10.8 °C). Mean annual precipitation is estimated at about 62 inches (1572 mm).

Association Types

Fifteen circular plots (10-m radius) and 24 releves were employed to sample the various types of vegetation in the area. The releve data are arranged into an association table. Acreages are not given.

Douglas-Fir (*Pseudotsuga menziesii*)-Ponderosa Pine (*Pinus ponderosa*) (84110): This is the most extensive vegetation in the area (fig. 158). This forest develops only over nonserpentine areas. A typical stand is open to semidense. The overstory is composed of older age-class individuals in low density. Dense conifer reproduction is patchy. Douglas-fir dominates the canopy, averaging 49.4 m²/ha basal area and 498 stems/ha. Sugar pine (*Pinus lambertiana*) and ponderosa pine share codominance at 14.6 and 18.2 m²/ha basal area, respectively, and both occur in approximately equal densities of about 100 stems/ha. California black oak (*Quercus kelloggii*) and canyon live oak (*Q.*

chrysolepis) form a subcanopy. The shrub understory is open, with *Toxicodendron diversilobum* and occasional *Arctostaphylos viscida*, *Corylus cornuta* var. *californica*, and *Ceanothus integerrimus*. The herb layer is sparse, with few constant species. These include *Pyrola picta*, *Chimaphila umbellata* var. *occidentalis*, *Hieracium albiflorum*, *Bromus marginatus*, *Lathyrus polyphyllus*, and *Apocynum pumilum*.

White Alder (*Alnus rhombifolia*)-*Galium triflorum* (61510): This association lines the ephemeral streams. This type has a sparse overstory of white alder with bigleaf maple (*Acer macrophyllum*) and Douglas-fir as codominants, averaging 11.0, 1.1, and 3.1 m²/ha basal area, respectively. Mesic shrubs such as *Rosa pisocarpa*, *Philadelphus lewisii* ssp. *gordonianus*, *Rubus parviflorus*, and *Euonymus occidentalis* are common. *Galium triflorum* dominates the sparse herb layer.

***Prunella vulgaris* ssp. *lanceolata*-*Carex bolanderi* (45400):** This association is typical of seeps and small springs. Occasional riparian species of the previous type are present, but this type has primarily a meadow physiognomy. *Carex bolanderi* is common, with *C. amplifolia*, *Torreyochloa* (*Puccinellia*) *pauciflora*, and the constant *Prunella vulgaris*.

***Deschampsia caespitosa*-*Carex buxbaumii* (45100, 45400):** This is the seep and meadow vegetation characteristic of serpentine areas such as Silver Spring and Swim Meadow. Swim Meadow is dominated by *Deschampsia caespitosa*, *Juncus covillei*, and *J. effusus*, with *Carex buxbaumii* and *Helenium bigelovii* as codominants. Silver Spring is more heavily mineralized than Swim Meadow and has *Sisyrinchium idahoense*, *Cirsium breweri*, and *Hastingsia* (*Schoenolirion*) *alba* along with *Rhynchospora glomerata* var. *minor*.

***Carex exsiccata* (52430):** One small pond is dominated by this sedge, related to the montane species *C. vesicaria* and *C. rostrata*.

Jeffrey Pine-*Haplopappus ophitidis* (84171): This association is typical of the most sparsely vegetated serpentine areas. The two namesake species characterize the tree and shrub layer, respectively. Jeffrey pine is widely spaced (300/ha), but represented by relatively large individuals (36 m²/ha basal area). Scattered small shrubs of *Ceanothus cuneatus* dominate the shrub layer; *Calamagrostis koelerioides* is the dominant grass of the herb layer. Other species characteristic of this open forest include *Phacelia corymbosa*, *Cirsium calipes*, *Senecio greenei*, *Arenaria rosei*, *Eriogonum strictum*, *Onychium densum*, *Rhamnus californica* ssp. *tomentella*, and *Allium* sp.

***Ceanothus cuneatus*-*Sitanion hystrix* (37810, 37600):** This association occurs on very rocky soils or serpentine outcrops. *Ceanothus cuneatus* forms a dense (50 percent cover) shrub layer about 3 ft (1 m) high. Herbs and occasional shrubs typical of the previous type also occur here, along with such serpentine chaparral species as *Quercus durata*. Soils are too poorly developed to allow widespread establishment of Jeffrey pine, although occasional stunted individuals occur.

Jeffrey Pine-*Calamagrostis koelerioides* (85100): This association resembles the Jeffrey pine-*Haplopappus ophitidis* association, with an open overstory of Jeffrey pine (32.8 m²/ha cover and 381 stems/ha). It occurs on less heavily mineralized, more highly weathered soil than that association, and consequently it has a



Figure 158—Smoky Creek, view of the canopy of Pacific ponderosa pine – Douglas-fir forest, showing the characteristic structure of a mosaic of old-growth and younger successional stage stands in Smoky Creek rRNA (1979)

different set of associated species. These include incense-cedar, *Rhamnus californica* ssp. *tomentella*, *Toxicodendron diversilobum*, *Balsamorhiza sagittata*, *Monardella odoratissima* ssp. *pallida*, and *Iris tenuissima*.

Plant Diversity

One hundred sixty-six taxa are listed.

Conflicting Impacts

Current (1990) impacts include a lightly used jeep road that enters the rRNA and a number of timber sales in forests bordering the rRNA.

79. Snow Canyon (Nachlinger 1992)

Location

This candidate RNA is on the Eldorado National Forest in Alpine County, W. of the main crest of the central Sierra Nevada and roughly 80 miles (129 km) E. of Sacramento. It lies in the N. half of sect. 27 T9N, R18E MDBM and unsurveyed sects. to the N. (38°37'N., 119°59'W.), USGS Pacific Valley and Carson Pass quads (*fig. 159*). Ecological subsection – Glaciated Batholith and Volcanic Flows (M261Ek).

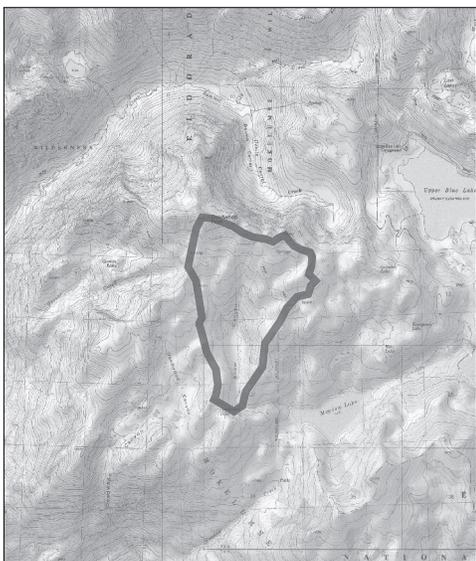


Figure 159—Snow Canyon cRNA

Target Elements

Western White Pine (*Pinus monticola*)

Distinctive Features

Subalpine Western White Pine Forest: Stands of subalpine conifers dominated by western white pine are uncommon in the Sierra Nevada, although the species is commonly present throughout the upper montane and subalpine zones in the Rocky Mountain and Intermountain regions. The nearly pure stands at Snow Canyon are in exemplary condition and a good example of this forest type for the central Sierra Nevada region (*fig. 160*).

Distinctive Species Mix: The location of the cRNA places it within the Sierra Nevada ecological section but near the Mono ecological section. A large number of Mono ecological section disjunct plant species add to the area's biological diversity. The flora of Snow Canyon is distinctive because of this mix of mountain and desert species.

Rare Plants: *Silene invisa* (CNPS List 4) is known to occur at middle elevations in the western white pine forest and was observed in the cRNA by a Forest Service reconnaissance team.

Physical Characteristics

Snow Canyon (703 acres [285 ha]) is within the upper watershed of the North Fork of the Mokelumne River, situated immediately adjacent to the main Sierra Nevada crest. Elevations range from 8200 ft (2499 m) in the lower drainage of Snow Canyon to 9846 ft (3001 m) along the N. ridgeline.

At the uppermost elevations are gentle to steep talus slopes, outcrop knolls, and a well-defined ridgeline. The mostly S.-facing slopes below the ridgeline are open, moderately steep, and composed of talus and cobble-size stones. Several notable seeps and springs issue from a readily apparent contact between volcanic rock and the granitic batholith at about 9200 ft (2804 m). Lower and middle elevations feature open, broad slopes, glacially-scoured rock lands, gullies of decomposed granite, knolls, a flat canyon bottom, and several perennial streams. Pliocene volcanic rock of unknown composition

predominates on the ridgeline at highest elevations and covers about 18 percent of the cRNA. Mesozoic granodiorite, which forms the core of the Sierra Nevada, commands the remainder of the Snow Canyon area.

A thin mantle of soil, classified as medial Lithic Cryadeps or Typic Cryopsamments, occurs in crevices and depressions and on gentle-to-steep slopes at the higher elevations of Snow Canyon. At lower elevations on gently sloping to flat sites are somewhat deeper Typic Cryopsamments and deep Aquic Entic Cryumbrepts.

Climate data collected at two nearby stations at 8000 ft (2438 m) may represent conditions at lower elevations of the cRNA. Snowfall is greatest in January, with an average of 84 inches (210 cm), and snowpack is deepest in late March. Summer rainfall is scant. Winter minimum daily temperatures average 15.6 °F (-9.1 °C), maximum average is 36.3 °F (2.4 °C). Summer maximums average 66.7 °F (19.3 °C) whereas average minimums are 41.9 °F (5.5 °C). Freezing temperatures can occur in any month.

Association Types

Qualitative assessments of plant communities were made using the releve method of vegetation sampling. Within the western white pine forest two 0.1-ha sites in five rectangular plots were sampled.

Alpine Barrens and Scree (91200): 120 acres (49 ha). The alpine barrens and scree association is found at the highest elevations in Snow Canyon on substrates derived from volcanic rocks. It occurs on S- and SW-facing gentle-to-steep slopes which are probably windswept and snow-free in winter. The alpine community is dominated by herbaceous perennials and low-growing shrubs. Plants may cover as little as 2 percent of the area on more exposed sites, but as much as 25 percent on moist, more protected sites. The most common dominants are *Polygonum davisiae* and *Haplopappus suffruticosus*. Common shrubs are *Eriogonum umbellatum*, *Leptodactylon pungens* ssp. *pulchriflorum*, and *Ribes montigenum*. Grasses and low growing perennials are commonly scattered throughout the community, but they provide little cover.

Alpine Shrub Steppe (94000): <1 acre (0.4 ha). Alpine shrub steppe is found at high elevations, about 9500 ft (2896 m), on a SW-facing, moderately inclined slope. It occurs on volcanic substrates at a windswept site kept moist from seepage from a higher snowbank. Low shrubs dominate the alpine shrub steppe. *Artemesia tripartita* is the most common woody species, with 25-50 percent cover. Other shrubs present include *Eriogonum umbellatum*, *Haplopappus macronema*, *H. suffruticosus*, and *Leptodactylon pungens* ssp. *pulchriflorum* with cover values <5 percent. Scattered among the shrubs are herbaceous grasses and broad-leaved perennials common in the adjacent alpine barrens.

Subalpine Barrens and Bedrock (no Holland equivalent): 320 acres (130 ha). This community is a broad ecotone between subalpine coniferous forest (Holland type 86000) and alpine boulder and rock field (Holland type 91000). The subalpine barrens and bedrock community is found at high elevations, about 8600 to 9200 ft (2621-2804 m), on granitic substrates sandwiched above the



Figure 160—Snow Canyon, a view south of the southern portion of Snow Canyon. The target element, subalpine western white pine forest, forms a band of vegetation from about 8250 to 8800 ft (2514 – 2682 m) in elevation, and surrounds a large subalpine meadow, which lies in a flat at about 8250 ft (2514 m). (1990 or 1991)

more continuous forest and below the alpine community of volcanic substrates. It occurs on SW-, S-, and SE-facing slopes of moderate inclinations. The community is governed by extensive outcrops of bedrock scoured and exposed by Pleistocene glacier activity. Little soil has developed except in crevices and depressions. Accordingly, few trees are present, although scattered individuals of western juniper (*Juniperus occidentalis* ssp. *australis*), whitebark pine (*Pinus albicaulis*), Jeffrey pine (*P. jeffreyi*), and western white pine occur. *Holodiscus microphyllus* is a commonly occurring shrub, and *Polygonum davisiae* and *Sitanion hystrix* var. *brevifolium* are the most common perennials. Other scattered perennials contribute little to the total plant cover. They include *Antennaria rosea*, *Calochortus leichtlinii*, *Eriogonum incanum*, *E. lobbii*, *E. umbellatum*, *E. wrightii* var. *subscaposum*, *Haplopappus suffruticosus*, *Ivesia gordonii*, *Lomatium nevadense*, *Penstemon davidsonii*, *P. newberryi*, *Potentilla breweri*, *Silene sargentii*, *Streptanthus tortuosus* var. *orbiculatus*, and *Valeriana capitata*.

Subalpine Western White Pine Forest (86200): 195 acres (79 ha). The western white pine forest is found at middle elevations, 8250-8800 ft (2515-2682 m), on granitic substrates with gentle-to-steep inclinations, on all but N.-facing slopes. It is dominated by western white pine, although pure stands are not present. Mountain hemlock (*Tsuga mertensiana*) is common, generally on moister sites with W.-facing exposures. Other tree species occurring in low numbers are red fir (*Abies magnifica*), western juniper, whitebark pine, lodgepole pine (*P. contorta* var. *murrayana*), and Jeffrey pine. The forest has a fairly open canopy throughout its elevational range, even on the best sites with good soil development. Up to 70 percent of the forest floor may be covered by herbaceous plants, the most common of which are *Polygonum davisiae*, *Festuca viridula*, and *Poa nervosa*. Each may attain up to 50 percent cover.

Subalpine Riparian Scrub (63500): <2 acres (0.8 ha). The subalpine riparian scrub community lines major drainages from low to high elevations at about 8250-9100 ft (2515-2774 m). It typically occurs within the larger surroundings of the subalpine western white pine forest and subalpine barrens and bedrock and sometimes in close association with subalpine meadows. It forms narrow corridors of streamside vegetation along little more than 3 miles (4.8 km) of perennial streams. The canopy is dominated by shrubs, which may form open or closed thickets. *Salix jepsonii* or *S. orestera* may dominate with *Alnus incana* ssp. *tenuifolia*, *Cornus sericea*, *Prunus emarginata*, and *Sambucus racemosa* var. *microbotrys* as codominants. Undergrowth is sparse where canopies are closed or where topography limits the width of the riparian area. Where adequate light penetrates, many herbaceous plants occur, and mosses, liverworts, and foliaceous lichens are found at ground level.

Subalpine Meadow (45200): 65 acres (26 ha). Subalpine meadows occur from lowest to highest elevations, on flat to gently-sloping terrain in Snow Canyon. At highest elevations, they tend to cover small areas at seeps, especially at the interface between volcanic and granitic substrates. Throughout the entire elevational range they are found along gentle drainages within the subalpine barrens or forest complex, and are often associated with the riparian community. An extensive meadow occurs in the bottom of the drainage with the main creek meandering along its E. half. These subalpine meadows are often diverse communities dominated by herbaceous plant species about 1-2 ft (0.3-0.6 m) tall. Wet, moist, and dry phases occur along a moisture gradient defined by depth of the water table and distance to flowing water. Drier phases tend to occur at the outer margins of meadows where soils are well-drained and soil texture is coarse. Dominants here are *Polygonum davisiae*, *Penstemon heterodoxus*, and *Calyptidium umbellatum*. Moist phases are most common and dominated by species such as *Festuca viridula*, *Lupinus sellulus*, and *Phyllodoce breweri*. Wet phases occur in close association with flowing water. Soils are saturated

throughout the growing season and may have high organic matter content. *Graminoids*, such as *Carex aquatilis*, *C. nebrascensis*, and *C. scopulorum* dominate wet meadow. Both moist and wet phases may have up to 100 percent cover, but in the wet meadows only one or few species contribute to that cover.

Plant Diversity

Two hundred twenty-three taxa are listed.

Conflicting impacts

A moderately used hiking trail crosses the upper watershed, but most hikers are bound for a destination beyond the rRNA and do not wander off the trail. The relatively isolated location of Snow Canyon restricts most impacts and conflicts by humans. Livestock grazing has occurred historically. The most recent livestock permit has expired, and there is no current allotment management or annual operating plan. There is little evidence of past grazing, and older damage to stream banks in the largest meadow is recovering, although occasionally cattle wander through the meadow.

80. Soda Ridge (Conard and Robichaux 1980)

Location

This recommended RNA is on the Lassen National Forest. It lies just 1.5 miles (2.4 km) NE. of the Green Island Lake RNA and is about 14 miles (23 km) SW. of Canyon Dam. It occupies portions of sects. 21, 22, 27, 28 T26N, R6E MDBM (40°05'N., 121°18'W.), USGS Jonesville 15' quad (fig. 161). Ecological subsection – Lassen-Almanor (M261Dm).

Target Element

White Fir (*Abies concolor*)

Distinctive Features

Mature White Fir Forest: This area contains large areas of mature white fir forest on the N.-facing slope of Soda Ridge. The dominants average at least 200-300 years on the steeper slopes with younger forests (100-120 years) on gentle slopes near Soda Creek. Understory vegetation varies from sparse and species-poor under old forest to relatively diverse and dense on the creek benches. White fir forest is frequently affected by fire, with the largest and oldest forests occurring on steep mesic slopes where fire is less prevalent. There is a mosaic of stands locally representing different successional stages and fire histories. The broad elevational band represented includes transitional types to Douglas-fir (*Pseudotsuga menziesii*)-dominated forest at low elevations and red fir (*Abies magnifica*)-dominated forest at highest elevations.

Mixed Conifer Forest: The SE. exposures above Soda Creek have a well-developed ponderosa pine (*Pinus ponderosa*)-dominated mixed conifer forest with an open understory and many large trees.

Meadow Vegetation: A series of wet meadows arises from a line of seeps on the N. side of Soda Creek. These meadows are diverse and relatively unspoiled. They include *Drosera rotundifolia* and a number of other montane hydrophilic species.



Figure 161—Soda Ridge rRNA

Physical Characteristics

This area covers about 1300 acres (525 ha). Elevations range from 4560 ft to slightly more than 6000 ft (1390-1829 m). The SW.- to NE.- trending canyon of Soda Creek dominates the area. The canyon slopes are steep (25-30°) on both NE.- and SW.-facing slopes from the summits of the ridges (5600-6000 ft, or 1707-1829 m) down to about 5200 ft (1585 m) where a series of creekside benches occur with 5-15° slopes. The summit of Soda Ridge is broad and relatively flat (<5° slope).

The flat ridges and steep valley slopes are influenced by the Pliocene basalt flows that underlie the area. These flows are considered part of the Southern Cascade ecological section.

Climate data are given for Canyon Dam, indicating a typical Mediterranean climate with 95 percent of the precipitation falling October-May. Average annual precipitation is estimated (Rantz 1972) at 60-70 inches (1524-1778 mm).

Association Types

The white fir forest was sampled using the point-centered quarter method along several transects adding up to 44 points. The remainder of the association types are described qualitatively.

White Fir-Mixed Conifer Forests (84240, 84230): 601 acres (243 ha). Sampling indicates that relative density of white fir is high (mean 82 percent, range 73-88 percent) with overall tree density ranging from 290-350 stems/ha on steep slopes to 550-650 stems/ha in younger stands along the creek (fig. 162). The relative cover of white fir varies depending on the number of surviving large, old trees of sugar pine (*Pinus lambertiana*), Douglas-fir, and Jeffrey pine (*Pinus jeffreyi*) after fires. In most areas the basal area of white fir is relatively low compared to its high density. Red fir is represented by smaller trees in the upper elevations, indicating a trend toward red fir dominance in the absence of fire. White fir is reproducing well throughout the area, indicative of the stability of this type. Average cover of saplings is 10 percent, with white fir dominant.

Understory cover averages less than 5 percent throughout this association. *Pyrola picta*, *Chimaphila menziesii*, and *Corallorhiza maculata* predominate on the steep slopes, while additional species such as *Achillea millefolium*, *Amelanchier pallida*, *Galium triflorum*, *Goodyera oblongifolia*, *Hieracium albiflorum*, *Osmorhiza chilensis*, *Potentilla glandulosa*, *Smilacina racemosa* ssp. *amplexicaulis*, *Symphoricarpos acutus*, and *Viola* spp. occupy the understory of the bench areas.

Ponderosa Pine-Mixed Conifer Forest (84210, 84230): 512 acres (207 ha). This is the major vegetation association on the S.-facing slopes. The forest is dominated by ponderosa pine, but Jeffrey pine, sugar pine, Douglas-fir, and incense-cedar (*Libocedrus decurrens*) are common associates. The forest is almost uniformly mature, with many dominants more than 3.3 ft (1 m) dbh. The understory is extremely open.

Montane Chaparral (37510): 121 acres (49 ha). This vegetation occurs as patches within the white fir forest. It is entirely seral in this area, with 75-100 years required for white fir to fully emerge from the shrub canopy. A large ridge crest patch is dominated by *Quercus vaccinifolia* (30 percent cover), *Arctostaphylos patula* (5-10 percent), and *A. nevadensis* (5-10 percent). There is 5-10 percent cover of white and red fir saplings. Several large residual Jeffrey pine also occur. Other areas of young fir forest have skeletons of montane chaparral shrubs in the



Figure 162—Soda Ridge, typical white fir forest in Soda Ridge rRNA. (around 1980)

understory. Other smaller patches of this vegetation are dominated by *Arctostaphylos patula*, *Quercus chrysolepis* var. *nana*, *Ceanothus velutinus*, *Prunus emarginata*, *Salix scouleriana*, and *Ribes* spp.

Rock Outcrop and Talus Slopes (no Holland equivalent): 47 acres (19 ha). This type is not specifically discussed although species such as *Onychium densum*, *Penstemon deustus*, and *Streptanthus tortuosus* var. *orbicularis* (among others in the plant list) are likely members.

Wet Meadows (45100, 45400): 12 acres (5 ha). Species noted for this association include *Veratrum californicum*, *Senecio triangularis*, *Drosera rotundifolia*, *Dodecatheon jeffreyi*, *Lilium pardalinum*, *Mimulus guttatus*, *Veronica americana*, two species of *Habenaria*, and *Vaccinium* sp.

Riparian Zone (61530, 63500): 12 acres (5 ha). Soda Creek supports a narrow band of riparian vegetation with scattered tall black cottonwood (*Populus trichocarpa*) and intermittent dense thickets of mountain alder (*Alnus tenuifolia*) with scattered aspen (*Populus tremuloides*). Mountain alder also occurs in thickets along swales away from the creek. One such area has a cover of 75 percent mountain alder, 20 percent *Salix caudata*, and <5 percent *S. scouleriana*. Other species characteristics of such thickets include *Heracleum lanatum*, *Adiantum pedatum*, *Acer glabrum*, *Cornus stolonifera*, and *Stachys rigida*. Rocky alluvial flats along the creek have some herbaceous species such as *Calystegia malacophyllus*, *Eriogonum nudum*, *E. umbellatum*, *Monardella villosa*, *Scutellaria californica*, *Silene californica*, and *Verbascum thapsus*.

Plant Diversity

One hundred sixty-eight taxa of vascular plants are listed.

Conflicting impacts

The Peacock Point timber sale may have affected the N. boundary of the area. The sale had been proposed but not logged at the time of the survey. Other human impacts are minimal in the area.

81. Soldier (Leitner and Leitner 1988)

Location

This recommended RNA is on the Six Rivers National Forest about 12 miles (19 km) ENE. of Alderpoint. It lies within portions of sects. 4 and 5 T3S, R7E and sects. 32 and 33 T2S, R7E HBM (40°14'N., 123°23'W.), USGS Zenia quad (fig. 163). Ecological subsection – Central Franciscan (M261Bb).

Target Element

Oregon White Oak (*Quercus garryana*)

Distinctive Features

Oregon White Oak Forest: Oregon white oak is considered a successional species throughout much of its range. In this part of California the dominance of the species was favored by natural and native American-caused fires. As a result of fire suppression in recent decades, Douglas-fir (*Pseudotsuga menziesii*) is rapidly replacing Oregon white oak as the dominant in many areas, including parts of the Soldier recommended RNA (fig. 164).

In addition to increases in Douglas-fir, recent poor reproduction by Oregon white oak has been noted in this area. The lack of historical information on fire

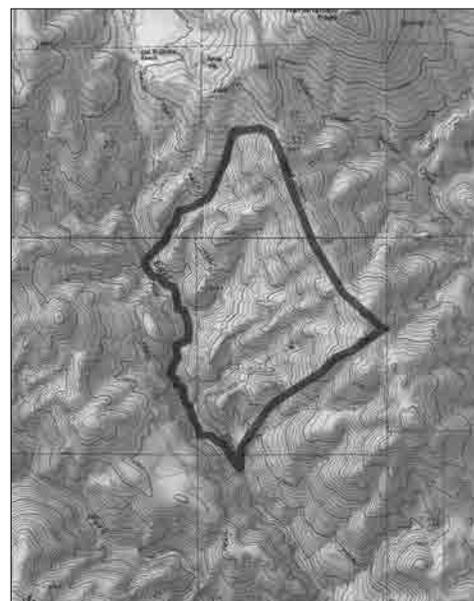


Figure 163—Soldier rRNA

frequencies, grazing and browsing pressure, acorn predation, and other possible factors contributing to poor reproduction limits the understanding of this association.

The area is at the S. end of the range of the Oregon white oak woodlands and is relatively xeric compared to other such woodlands to the N. in Redwood National Park and elsewhere. The mixed foothill pine (*Pinus sabiniana*) and Oregon white oak association described at Soldier may be relatively stable and less susceptible to conifer invasion and dominance. Local site conditions may represent the dry, rocky, edaphic limit of Oregon white oak and other Douglas-fir associates and the high elevation and high rainfall limit for foothill pine.

Rare Plant: This area contains populations of *Sanicula tracyi* (CNPS List 1B).

Physical Characteristics

The area covers 709 acres (287 ha) between 2300 and 3650 ft (701-1113 m) elevation within the drainage of the North Fork of the Eel River. It occupies SW.-facing slopes above the East Fork of the North Fork of the Eel River. These slopes are dissected by six small ravines affording small areas of NW.- and SE.-facing exposures.

The geology is Franciscan assemblage dominated by late Jurassic graywacke and shale. Soils are considered part of the Doty-Hecker family association mapping unit, ranging from fine to heavy loam in the Doty family to gravelly or gravelly clay loam in the Hecker family. Annual precipitation is estimated at 65 inches (1651 mm); about 60 days are at or below freezing per year.

Association Types

Four associations are described in the survey. Nine 0.1-ha vegetation samples were taken in the three forest types. The grassland is qualitatively described. Acreages of the associations are not given.

Oregon White Oak-Foothill Pine (71110, 71410): This is the most extensive association in the area. It is dominated by medium-sized, moderately spaced Oregon white oaks with younger, faster-growing foothill pines overtopping the oaks. A small number of young Douglas-fir also occur. Oregon white oak 3.5-6.3 inches (9-

16 cm) dbh dominate with 300-590 individuals/ha. Foothill pine is substantially less dense, with most individuals in the smaller size classes, 0-3.5 inches (0-9 cm) dbh, but with occasional individuals (<50/ha) 22-25 inches (56-64 cm) dbh. California black oak (*Quercus kelloggii*), canyon live oak (*Q. chrysolepis*), and Douglas-fir are scattered and of low cover and density. Canopy cover on three plots is estimated at 70 percent. Shrub and herb layers are well-developed and include *Toxicodendron diversilobum*, *Elymus glaucus*, *Clarkia* sp., *Agoseris apargioides*, *Brodiaea laxa*, and *Arctostaphylos canescens*.

Figure 164—Soldier, view of Oregon white oak – foothill pine in the Soldier rRNA with a small “island” of Douglas-fir in the upper left. (1987)



Upland Douglas-Fir (82420): Douglas-fir dominates with California black oak, Pacific madrone (*Arbutus menziesii*), ponderosa pine (*Pinus ponderosa*), sugar pine (*Pinus lambertiana*), and Oregon white oak. Much of the understory is covered with litter and duff. The shrub and herb layers are sparse. This association is most extensive on the main ridgeline along the E. boundary and on smaller ridgelines with well-developed, deep soils. Two types of this forest are described.

The climax type is exclusively dominated by Douglas-fir. The sparse understory is made up of *Toxicodendron diversilobum*, *Hieracium albiflorum*, *Cacaliopsis nardosmia*, and *Viola* sp. The largest Douglas-fir are between 31 and 35 inches (80-88 cm) dbh, but the majority are seedlings (330/ha) or in the 0- to 3.5-inch (0- to 9-cm) dbh size class (380/ha).

The late-successional type is successional from oak woodland to Douglas-fir forest. Here, Oregon white oak has been overtopped by Douglas-fir. Seedlings and saplings of Douglas-fir are abundant (670/ha in 0- to 9-cm size class). Shrub and herb layers are diverse, a carryover from the oak woodland which preceded it. Understory species include *Cynosurus echinatus*, *Arctostaphylos manzanita*, *Clarkia* spp., *Cynoglossum occidentale*, and *Eriophyllum lanatum*.

Oregon White Oak, Dense Stands (71110): This association consists of dense, small-diameter, nearly pure Oregon white oak stands about 20-26 ft (6-8 m) tall. The canopy is nearly closed. Minor tree associates include Douglas-fir, California black oak, and foothill pine. Foothill pine and Douglas-fir are of approximately equal frequency. Some shrubs and herbs here also occur in Douglas-fir forest, while some occur in Oregon white oak-foothill pine forest. The most abundant shrub is *Toxicodendron diversilobum*. Others include *Cercocarpus betuloides*, *Arctostaphylos manzanita*, and shrubby canyon live oak. Herbs include *Cynosurus echinatus*, *Brodiaea* sp., *Elymus glaucus*, *Silene californica*, *Agoseris* sp., and *Ranunculus* sp.

Grassland (42200 and 41200): Grassland occurs mainly on the lower, steep S.- or W.-facing slopes on soils high in clay and prone to slumping. The local grassland is a mixture of non-native annual grassland and bald-hills prairie. Dominants include *Bromus mollis*, *B. diandrus*, *Avena barbata*, *Cynosurus echinatus*, *Festuca* spp., *Melica californica*, *Poa scabrella*, *Elymus glaucus*, and *Stipa lemmonii*.

Plant Diversity

One hundred fifty-seven taxa of vascular plants are listed.

Conflicting impacts

Fire likely will be necessary to maintain or enlarge the cover of the target element. Little is known about the requirements of the Oregon white oak association. Thus, management of the target element will require some research.

82. South Fork Mountain, see Rough Gulch, #71

Note: for South Fork of Devil's Canyon, see Cone Peak Gradient, #19

83. South Mountaineer Creek (Mountaineer Creek) (Keeler-Wolf 1991c)

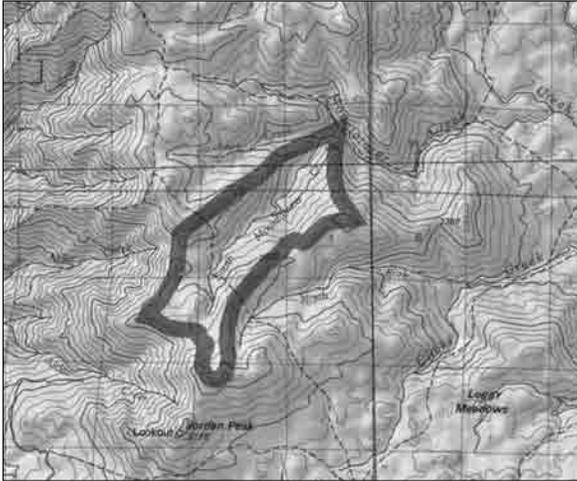


Figure 165—South Mountaineer Creek cRNA

Location

This candidate RNA (cRNA) lies within the Tule River Ranger District, Sequoia National Forest. It is approximately 37.4 miles (60 km) from the Tule River Ranger Station and within the Golden Trout Wilderness. Its boundaries include all or portions of sections 1, 2, 3, 10, 11, and 14 of T20S, R31E, and sections 35 and 36 of T19S, R31E (36°12'30"N., 118°35'W.), USGS Camp Nelson quad (*fig. 165*). Ecological subsection – Upper Batholith (M261Eq).

Target Element

Red Fir (*Abies magnifica*)

Distinctive Features

The area includes several age groups of red fir represented throughout most of the cRNA's environmental range.

Widespread associates of the red fir forest, such as western white pine (*Pinus monticola*) and lodgepole pine (*Pinus contorta* ssp. *murrayana*), also occur in typical conditions and densities on the cRNA. In addition to the identified target element, well-developed montane meadow and aquatic plant and fauna communities add value to this cRNA.

Rare Plants: Two CNPS List 4 species occur in the cRNA. Sierra corydalis (*Corydalis caseana* ssp. *caseana*) is locally common and widespread in streamside and rivulet situations at 6900-8600 ft (2103-2621 m). Sierra corydalis is known in the S. Sierra Nevada only from Tulare County. Mineral King draba (*Draba cruciata*) is restricted to rocky, N.-facing slopes at the highest elevations beneath open canopies of western white pine and red fir. Its location in the cRNA is within a mile (1.6 km) of the southernmost known occurrence for this taxon.

Rare Fauna: The Federally-listed threatened species little Kern golden trout (*Onchorynchus aguabonita whitei*) is native to the Mountaineer Creek drainage. Introduced, non-native rainbow trout (*Onchorynchus gairdneri*) have hybridized with the little Kern golden trout in parts of the drainage. The California State Department of Fish and Game has established a program to remove the hybrids and non-native fish and re-establish the pure-bred little Kern golden trout population.

In addition to the trout, a golden eagle (*Aquila chrysaetos*, California State species of special concern) was observed in the cRNA. The cRNA may also be the southernmost location of pikas (*Ochotona princeps*) in the Sierra Nevada.

Fire History: The most recent major fire in the cRNA occurred about 150 years ago (approximately 1850), affecting at least 60 percent of the canopy in the drainage. Stands spared from the fire occur at the S. head of the drainage and the upper slopes of the SE. part of the drainage. Individuals occurring at the edges of rocky areas and meadows also were spared.

Physical Characteristics

The area covers 1603 acres (649 ha) with an elevation of 6840-9236 ft (2085-2815 m) as moderate to steep slopes. It encompasses the entire South Mountaineer Creek drainage.

The majority of the area is underlain by Mesozoic granitic rock of the Sierra Nevada Batholith with just a few small outcrops of Paleozoic metamorphics

(primarily schistose with mica visible in outcrops) in the E. portions of the drainage. The granitic rock is broken into talus in several areas at the head of the drainage and on upper slopes.

The soils of the cRNA are divided into five mapping units. The Cannell-Kriest family-Rock outcrop complex (30-50 percent [17-27°] slope; grayish, brown sandy loam; 5-7 inches [13-18 cm] thick) and the Cannell-Sirretta-Nanny family complex (30-50 percent [17-27°] slope; dark grayish brown gravelly coarse sandy loam; 6-7 inches [15-18 cm] thick) are the principal mapping units for the cRNA. The remainder of the soils are mapped as Dome Chaix-Rock outcrop, Rock outcrop-Toem complex, and Rock outcrop.

No permanent weather stations exist within the cRNA. The closest weather recording site is at the Lodgepole Ranger Station, approximately 24.5 miles (39.4 km) NW. of the cRNA at 36°36'N., 118°44'W., 6735 ft (2053 m) elevation. Average annual temperature at Lodgepole Ranger Station is 41.4 °F (5.2 °C), and average annual precipitation is 48.6 inches (1234 mm). The climate at the cRNA is probably similar to that at the Lodgepole Ranger Station, with January and February receiving the highest precipitation. Temperature is likely to decrease substantially with elevation in the cRNA. Average annual temperature at the higher elevations is estimated at 34 °F (1.1 °C). Snow depths at the cRNA can average 36-45 inches (914-1143 mm) at low elevations and 11 ft (3.4 m) at higher elevations.

Association Types

Red Fir Forest (85310): 1110 acres (449 ha). The red fir forest in the cRNA is only 28 miles (45 km) N. of the southernmost extent of this forest type. It occurs on all major slope directions and comprises approximately 70 percent of the cRNA.

The majority of the red fir forest on the cRNA is monospecific and uniform in age, resulting from the extensive crown fire of the mid-1800s. Most of the trees are members of the 140-year-old cohort. A few older individuals (200-350 years old) occur in more protected areas and above 8600 ft (2622 m) on NW.-facing slopes (*fig. 166*). Red fir averages 270 trees/acre (669 trees/ha), 508 ft²/acre (117 m²/ha) basal area, and 18.5 inches (47 cm) dbh. The largest trees encountered were 68-73 inches (173-185 cm) dbh and up to 170 ft (51.8 m) tall. Only sampling plots with less than 30 percent crown cover supported dense stands of saplings. The sampling period was in the midst of a severe drought, and recent tree death was widespread.

Western white pine is the most common tree associate, but it occurs only in relatively low densities [7 trees/acre (17 trees/ha)] on N.-facing slopes. Lodgepole pine is an associate along lower reaches of the creek bottom and adjacent to meadows.

The understory cover is low (6 percent) due to the uniform canopy conditions. Vegetation is largely restricted to scattered sunny openings and includes *Hackelia* sp., *Monardella odoratissima*, *Collinsia torreyi*, *Draperia systyla*, *Lupinus andersonii*, and *Senecio integerrimus*. Shade-tolerant species in the



Figure 166—South Mountaineer Creek, an even-aged stand of ca. 210 year old red fir on a northwest-facing slope in South Mountaineer Creek cRNA. Note long clean boles and relatively small apical tufts of branches. (1990)

understory include *Dentaria pachystigma*, *Pedicularis semibarbata*, *Pyrola picta*, and *Corallorhiza maculata*. *Chrysolepis sempervirens* and *Angelica lineariloba* occur on stabilized talus on N. slopes.

Upper Montane Mixed Coniferous Forest (85200): 221 acres (89 ha). This association type is dominated by white fir (*Abies concolor*) and sugar pine (*Pinus lambertiana*) and is found on dry, SE.-facing slopes. Jeffrey pine (*Pinus jeffreyi*) is a codominant on more xeric, rocky sites. Red fir occurs scattered throughout the cRNA, but is most common on the upper, N.-facing slopes and areas along the creek bottom. California black oaks (*Quercus kelloggii*) occur as scattered shrubby individuals on the lowest-elevation, rocky, metamorphic sites. Herbs and grasses such as *Pteryxia terebinthina*, *Melica stricta*, *Erigeron foliosus*, and *Bromus richardsonii* occur with the California black oak.

The largest sugar pine are up to 90 inches (2.3 m) dbh, 170 ft (52 m) tall, and more than 600 years old. The largest white fir are up to 70 inches (1.8 m) dbh and at least 400 years old.

The forest has an open canopy averaging about 40 percent crown cover. Ground cover is higher than in the red fir forest, averaging 18.5 percent. The understory is dominated by *Chrysolepis sempervirens*, *Prunus emarginata*, *Ceanothus cordulatus*, *Ribes roezlii*, *Hieracium horridum*, and *Arctostaphylos patula*. Plants that are largely restricted to this forest are *Zigadenus exaltatus*, *Delphinium pratense*, and *Nemophila pedunculata*.

Crown fire does not appear to be as widespread in this forest type as in the red fir forest.

Sierran White Fir Forest (84240): 124 acres (50 ha). This association type is limited to the lower-elevation NW. exposures at the NE. portion of the cRNA. The physiognomy is, in general, similar to that of the red fir forest, with sugar pine, Jeffrey pine, and red fir as common associates. A zone of pure white fir forest occupies a vertical distribution between 7200 and 7400 ft (2200-2255 m).

Most of the white fir trees are members of even-aged stands dating back to the fire 140 years ago. A few larger trees that survived this fire reach 76 inches (193 cm) dbh.

Understory is sparse except adjacent to rocky areas where a mixture of mountain chaparral shrubs and herbaceous vegetation occurs. Associated species include *Sanicula crassicaulis*, *Melica stricta*, *Stipa columbiana*, *Crepis occidentalis*, *Galium bolanderi*, *Gayophytum diffusum* ssp. *parviflorum*, *Cryptantha simulans*, *Allophyllum violaceum*, *Cirsium* sp., *Eriogonum spergulinum* var. *pratense*, *Orochaenactis thysanocarpha*, *Hieracium albiflorum*, *Habenaria unalascensis*, and *Osmorhiza chilensis*.

Wet Meadow (45100): 45 acres (18 ha). The wet meadows are the most productive and species-rich communities in the cRNA. The most extensive meadow, a classic hanging meadow, covers about 10 acres (4 ha) at the head of the South Fork Mountaineer Creek between about 8300 and 8600 ft (2530-2621 m). Several boggy pools of open water exist within this meadow. Red fir and lodgepole pine, along with *Ledum glandulosum* var. *californicum*, *Pyrola secunda*, *Mitella breweri*, and *Caltha howellii*, occur along the border of the meadow. *Carex nebrascensis*, *Heleocharis* sp., *Aster alpigenus* ssp. *andersonii*, *Pedicularis groenlandica*, *Hypericum anagalloides*, *Calamagrostis canadensis*, *Mimulus primuloides*, *Salix drummondiana* var. *subcaerulea*, *Corydalis caseana*, *Oxypolis occidentalis*, *Veratrum californicum*, *Lingusticum grayi*, and *Ranunculus alismaefolius* var. *alismellus* are among the species dominating wetter areas.

An additional type of meadow forms narrow stringers a few yards wide along the creek. Many of the above-mentioned species also occur here. Species common only to this habitat include *Arnica longifolia* ssp. *myriadenia*, *Athyrium*

felix-femina, *Cardamine breweri*, *Carex fracta*, *Castilleja miniata*, *Epilobium angustifolium*, *Habenaria sparsiflora*, *Mertensia ciliata*, *Orobancha uniflora*, *Saxifraga nidifica*, and *Veronica serpyllifolia* var. *humifusa*.

Lodgepole Pine Forest (86100): 35 acres (14 ha). Lodgepole pine is restricted to mesic-to-hydric situations with cold air drainage in the cRNA. The most extensive stand occurs on the N.-facing basin at the head of the drainage, where it forms a variable cover. It is often associated with western white pine and red fir. Understory species include *Juncus parryi*, *Antennaria rosea*, *Draba cruciata*, *Chrysopsis breweri*, *Dentaria pachystigma*, *Allium campanulatum*, *Senecio integerrimus*, and *Poa fendleriana*.

Further into the drainage, the forest becomes denser, and the understory becomes more lush. Canopy closure is more than 50 percent, and lodgepole pine can be up to 48 inches (122 cm) dbh. Understory species here include *Ligusticum grayi*, *Erigeron peregrinus*, *Veratrum californicum*, *Pyrola secunda*, and *Mitella breweri*.

Mixed Montane Chaparral (37510): 34 acres (14 ha). This association type occurs on xeric, rocky substrates in the cRNA. Currently, there are only a few small areas of montane chaparral, the largest of which occurs on the upper S.-facing slope of the N. boundary ridge. These areas are typically codominated by *Arctostaphylos patula*, *A. nevadensis*, *Ceanothus cordulatus*, *Holodiscus microphyllus*, *Prunus emarginata*, *Chrysolepis sempervirens*, *Rhamnus californicus*, and *Ribes roezlii*. The stands of these shrubs are typically open and separated by rocky soil or granitic outcrops, among which grow herbaceous species such as *Senecio integerrimus*, *Comandra pallida*, *Phacelia eisenii*, *Arenaria congesta*, *Mimulus whitneyi*, *Phlox diffusa*, *Eriogonum nudum*, *Pteryxia terebinthina*, and *Erigeron foliosus*.

Montane Riparian Scrub (63500): This association type is not well developed in the cRNA. It occurs in small, scattered stands dominated by several shrubby willows including *Salix caudata* var. *bryantina*, *S. pseudocordata*, and *S. scouleriana*. Other shrubs include *Cornus stolonifera*, *Lonicera involucreta*, *Sorbus californicus*, and *Sambucus microbotrys*.

Western White Pine Forest (no Holland equivalent): This open forest dominates the highest elevations of the cRNA on NW.- to NE.-facing exposures. Red fir is the major associate, and lodgepole pine is a minor associate.

The western white pines are presumed to be the oldest trees in the cRNA. The largest individual recorded (possibly two fused individuals) is 8 ft (2.43 m) dbh. The canopy is open, averaging 25-45 percent cover. The understory is rocky with occasional patches of *Chrysolepis sempervirens*. Dominant herbs include *Draba cruciata*, *Juncus parryi*, *Cryptogramma acrostichoides*, *Linanthus oblanceolatus*, *Dicentra uniflora*, *Pellaea breweri*, *Allium obtusatum*, *Carex rossii*, *Hackelia mundula*, *Penstemon caesius*, *Monardella odoratissima* ssp. *pallida*, *Fritillaria pinetorum*, and *Chrysopsis breweri*.

Plant Diversity

Two hundred twenty species of vascular plants are listed.

Conflicting impacts

A few campsites are located near the South Mountaineer Creek. Aside from these sites, little recreational impact was noted in the cRNA. The wet meadows are largely undisturbed and show no noticeable signs of grazing.

Clear-cut blocks (cut over the past 15-20 years) border the SE. side of the cRNA but do not affect the South Mountaineer Creek drainage.

84. Specimen Creek (Sawyer and Stillman 1977a)

Location

This study area (dropped from RNA consideration in 1984) is on the Klamath National Forest. It lies about 4 miles (6 km) NW. of Sawyer's Bar. It includes portions of sects. 12 and 13 T40N, R12W and sect. 7 T40N, R13W MDBM (41°19'N., 123°10'W.), USGS Sawyers Bar quad (*fig. 167*). Ecological subsection – Forks of Salmon (M261Ap).



Figure 167—Specimen Creek ecological survey area

Target Element

Pacific Douglas-Fir (*Pseudotsuga menziesii*)

Distinctive Features

Typical Interior Klamath Douglas-Fir/Hardwood Forest: The Douglas-fir-dominated forest at Specimen Creek is representative of the most interior phase of the Douglas-fir/hardwood forest in the Klamath Mountains ecological section. It is a climax vegetation with Douglas-fir regeneration in gaps and partial shade, unlike the most coastal Douglas-fir forests, which are largely seral to western hemlock and other coastal species. There is no tanoak (*Lithocarpus densiflorus*); Pacific madrone (*Arbutus menziesii*) is not as important as in more westerly forests; giant chinquapin (*Chrysolepis chrysophylla*) is restricted to localized mesic sites; and several other species indicative of more mesic coastal conditions are lacking.

Physical Characteristics

The area includes about 600 acres (243 ha). Elevations range from 2100 to 4400 ft (640-1341 m). The area is composed of W.- and SW.-facing slopes on a ridge bounded by the Little North Fork of the Salmon River, the North Fork of the Salmon River, Kelly Gulch, and a small tributary of Specimen Creek. Slopes range from nearly level alluvial terraces to steep (60-100 percent) upper slopes. The majority of the area is steeply sloping.

Mesozoic granitics occur at low elevations with pre-Cretaceous meta-volcanics on the upper slopes and ridgetop areas. Soils are generally thin and rocky with some exposed rock on the upper slopes. Some of the SW.- exposures have lithosolic scree with little vegetation. Climate is similar to that of much of the central Klamath Mountains ecological section, with an estimated annual precipitation of 50-55 inches (1270-1397 mm). Mean daily temperatures at Sawyer's Bar range from 38-40 °F (3-4 °C) in the coldest months to 72-75 °F (22-24 °C) during the warmest summer months.

Association Types

Relevés were sampled to construct an association table, and point-center quarter method was employed to estimate density and basal cover. Sizes of associations are not given.

Douglas-Fir/*Adenocaulon bicolor* (82420): This association (*fig. 168*) is divided into three topographic categories: terraces, lower slopes, and steep slopes. It also is divided into two phases based on releve analysis: The Douglas-fir/*Linnaea* and Douglas-fir/*Chimaphila menziesii* phases.

1. The Douglas-fir/*Linnaea* phase is characterized as relatively herb-rich and mesic, occupying the terraces and lower slopes. This phase also has characteristic patches of the subcanopy trees, Pacific yew (*Taxus brevifolia*) and giant chinquapin on the most mesic exposures. The point-centered quarter

samples in portions of this phase (low slope stands) are the densest and highest cover of any in the area (669 trees/ha, 162.5 m²/ha). However, the terrace stands, which also largely fall into this phase, show the least density and basal area (464 trees/ha, and 104 m²/ha).

Sixteen species of shrubs and 38 species of herbs are included in the seven relevés taken in the Douglas-fir/*Linnaea* phase. Among the most important are *Berberis nervosa*, *Symphoricarpos* sp., *Corylus cornuta*, *Rosa gymnocarpa*, *Toxicodendron diversilobum*, *Trillium ovatum*, *Viola sempervirens*, *Whipplea modesta*, *Viola glabella*, *Lupinus latifolius*, *Lathyrus polyphyllus*, *Adenocaulon bicolor*, *Fragaria californica*, *Osmorhiza chilensis*, *Disporum hookeri*, *Trientalis latifolia*, *Galium triflorum*, *Chimaphila umbellata*, *Vancouveria hexandra*, *Melica* sp., *Vicia californica*, *Pteridium aquilinum*, *Hieracium albiflorum*, and *Campanula prenanthoides*.

2. The Douglas-fir/*Chimaphila menziesii* phase is drier than the *Linnaea* phase. Here, ponderosa pine (*Pinus ponderosa*) and sugar pine (*P. lambertiana*) become more important than in the previous phase in a canopy dominated by Douglas-fir. On the upper slope plots, both pine species together account for 17 trees/ha and 10.3 m²/ha, whereas Douglas-fir accounts for 267 trees/ha and 121 m²/ha. Pacific madrone is relatively more common in the understory than in the previous phase (57/ha, 3 m²/ha), and many of the more mesophilic herbs do not occur. In the Douglas-fir/*Chimaphila* phase, 15 species of shrubs and 34 species of herbs were tallied on 11 relevés. These include *Symphoricarpos* sp., *Corylus cornuta*, *Rosa gymnocarpa*, *Toxicodendron diversilobum*, *Disporum hookeri*, *Trientalis latifolia*, *Pyrola picta*, *Pteridium aquilinum*, *Campanula prenanthoides*, *Hieracium albiflorum*, and *Arnica discoidea*.

Productivity (measured by mean radial growth increment, cored at breast height) for the steep-slope portions of the Douglas-fir/*Adenocaulon* forest appears higher (17.5 years/inch, n=9) than the average for terrace areas (24.9 years/inch, n=10).



Figure 168—Specimen Creek, slopes of the Specimen Creek study area. The major tree in these *Pseudotsuga menziesii* / *Adenocaulon bicolor* forests is Douglas-fir. (1976)

Ponderosa Pine/Canyon Live Oak (*Quercus chrysolepis*) (84110, 81320): This forest occurs on the most xeric slopes. It typically has a more open canopy and herb-poor understory than the previous association. This association also has two phases.

1. The ponderosa pine/*Arctostaphylos manzanita* phase occurs on mid- and upper SW.-facing slopes with relatively well-developed soils. The canopy is codominated by ponderosa pine (16.2 m²/ha), sugar pine (7.8 m²/ha), and Douglas-fir (10.3 m²/ha). Herb and shrub cover is often less than 10 percent with the following species most common: *Ceanothus integerrimus*, *Toxicodendron diversilobum*, *Iris purdyi*, *Hieracium albiflorum*, *Galium californicum*, *Carex* sp., and *Polystichum imbricans*.

2. The canyon live oak/*Polystichum imbricans* phase occurs on the driest ridges and rock outcrops. Although canyon live oak is not a member of the canopy, it is dominant. Here ponderosa pine, sugar pine, and Douglas-fir comprise a total basal area of only 18.8 m²/ha, while canyon live oak makes up 61 m²/ha. The density of canyon live oak averages 973 trees/ha, or 82 percent relative density. Productivity of Douglas-fir is lower than that of the terrace stands (29.7 years/inch). The most common shrub is *Toxicodendron diversilobum*

(of only three species listed for the relevés), and the most common of the eight species of herbs listed for the relevés are *Galium californicum*, *Polystichum imbricans*, and *Festuca idahoensis*.

Plant Diversity

One hundred eighty-nine taxa of vascular plants are listed.

Conflicting impacts

The area has been dropped from candidate RNA status (with Bridge Creek chosen to replace it) and is presently under multiple-use management. Before it was dropped, the authors noted several conflicts, including the need for enlargement of the original boundaries to include other slope aspects, the potential impact of trail use adjacent to the terrace stands along the Little North Fork of the Salmon River, and the high degree of insect damage to the Douglas-fir forest.

85. Station Creek (Bald Mountain) (Taylor and Randall 1977a, Berg 1990)

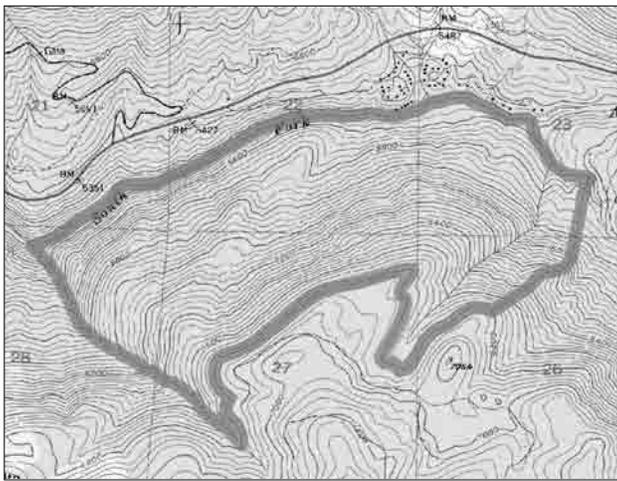


Figure 169—Station Creek RNA

Location

The established RNA is on the Eldorado National Forest, in El Dorado County. It is about 6 miles (10 km) E. of Kyburz and 3 miles (5 km) W. of Strawberry. It lies within portions of sects. 21, 22, 23, 26, 27, and 28 of T11N, R16E MDBM (38°47'N., 120°12'W.), USGS Pyramid Peak quad (fig. 169). Ecological subsections – Upper Batholith and Volcanic Flows (M261Eh).

Target Element

Transitional Forest Type: Sugar Pine (*Pinus lambertiana*)-White Fir (*Abies concolor*)-*Goodyera oblongifolia*

Distinctive Features

This area is located on the important transition between the relatively species-rich, cool, moist mixed conifer forest of the mid-elevations of the Sierra Nevada, and the species-poor, cold, moist montane forests. It supports old-growth stands of sugar pine and white fir as well as Douglas-fir (*Pseudotsuga menziesii*) at its upper elevation limit. Site indices for sugar pine are probably highest in this part of the mixed conifer zone, a fact which has not been commonly recognized because widespread logging activity has removed large, healthy sugar pine from this type throughout most of the Sierra Nevada (fig. 170).

Physical Characteristics

This site covers 749 acres (303 ha). Elevations range from 5200 to 6800 ft (1585-2073 m). Slope aspect is primarily N. and NE. The area occupies the slopes immediately above the South Fork of the American River. Glaciation may have occurred in the Tahoe stage but not the most recent Tioga stage. Slopes are generally uniformly steep (30-40°) with a few large outcrops.

Parent material is entirely Mesozoic granitics. Soils are probably related to the Cagwen-Totem series, which includes excessively drained loamy coarse sands and gravelly coarse sands derived from granodiorite. Precipitation is estimated at 51 inches (1300 mm) per year with a mean annual temperature of 42 °F (5.3 °C). Snow is on the ground for up to two months at the upper elevations.

Association Types

Nine plots (from 315 to 700 m²) were sampled in the main forest association. Three plots were sampled in the white fir-*Goodyera oblongifolia* association. No acreages are given for the associations.

Sugar Pine-White Fir (84230): This is generally an open forest dominated by sugar pine and white fir with the canopy cover ranging typically from 50 to 75 percent. Important associates are incense-cedar (*Libocedrus decurrens*) and Douglas-fir, the latter species attaining dbh of up to 7.9 ft (2.4 m). Average basal area of sugar pine is 61.8 m²/ha and 39.9 m²/ha for white fir. Douglas-fir is important in only three of the plots. Total mean basal area is 121.6 m²/ha, and total mean density is 1111.5 stems/ha. White fir is the principal species in the sapling and seedling layer. Average stem density is 950/ha for trees of white fir more than 2 cm dbh.

Chrysolepis sempervirens is a constant understory shrub. A total of 25 understory species are recorded on the sample plots, and they include *Symphoricarpos acutus*, *Pyrola picta*, *Smilacina racemosa* ssp. *amplexicaulis*, *Hieracium albiflorum*, *Pedicularis semibarbata*, *Apocynum pumilum*, *Galium bolanderi*, *Carex rossii*, *C. multicaulis*, *Adenocaulon bicolor*, *Pteridium aquilinum* var. *pubescens*, and *Chrysopsis breweri*.

White Fir-*Goodyera oblongifolia* (84240): This association forms a matrix with the previous association and predominates where snow cover is deeper (higher elevations or more directly N.-facing exposure) than the previous type. There is a dense and closed canopy of *A. concolor* with only occasional larger individuals of sugar pine (although seedlings are more common). Sampling indicates a mean tree density of 1018 stems/ha and mean basal area cover of 97.4 m²/ha. White fir comprises 95 percent of the total cover and 94 percent of the total number of stems.

The understory is very sparse (<5 percent cover). *Corallorhiza maculata* and *Pleuricospora fimbriolata* are locally restricted to this type. Other herbs and shrubs in this type include *Salix scouleriana*, *Rubus parviflorus*, *Galium triflorum*, *Chrysopsis breweri*, and *Arceuthobium campylopodum*.

Hydric Associations (45400, 63500): Although not specifically treated in the survey, a number of species in the plant list are hydrophilic and suggest that seep and montane riparian situations exist in the area.

In the RNA establishment record, all 749 acres (303 ha) are grouped into one vegetation type: Sierran Mixed Conifer Forest (84230).

Plant Diversity

One hundred eleven species are listed.

Conflicting impacts

The N. boundary of the area is formed by the South Fork of the American River. Summer homes and campsites adjacent to Highway 50 border the river along the boundary of the study area. Thus, the area is accessible to a potentially large number of people. However, no negative impacts are discussed. Recent observation following the survey shows the sugar pines to be infected with white pine blister rust.

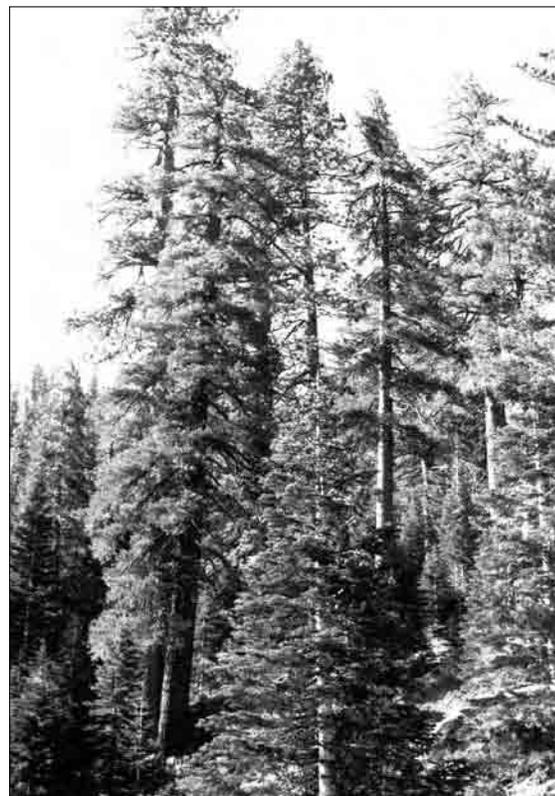


Figure 170—Station Creek, steep slope with multi-aged forest dominated by sugar pine and white fir in Station Creek RNA. (L. Johnson 1975)

Note: for Stone Corral-Josephine Peridotite, see L. E. Horton, #50

86. Sugar Creek (Keeler-Wolf 1984d, 1989f, Sawyer and Thornburgh 1971)

Location

This candidate RNA is on the Klamath National Forest. The area is located largely within the Russian Wilderness and is about 6 miles (9.7 km) W. of Callihan. It occupies portions of sects. 18, 19, 20, 29, 30, and 31 T40N, R9W and sects. 25 and 36 T40N, R10W MDBM (41°17'N., 122°56'W.), USGS Eaton Peak quad (*fig. 171*). Ecological subsection – Upper Salmon Mountains (M261Ag).



Figure 171—Sugar Creek cRNA

Target Elements

Enriched Conifer Forest and Mixed Conifer Forest

Distinctive Features

Enriched Conifer Forest: This RNA (hereafter referred to as SCRNA) was selected primarily to preserve the richest known assemblage of conifers in the world. It contains 17 species of conifers within one square mile (2.59 km²). This diversity and composition cannot be duplicated elsewhere (*fig. 172*).

The diversity of the coniferous forests at SCRNA is a result of several factors. The presence of relict species such as Brewer spruce (*Picea breweriana*), Engelmann spruce (*Picea engelmannii*), subalpine fir (*Abies lasiocarpa*), foxtail pine (*Pinus balfouriana*), and whitebark pine (*Pinus albicaulis*), in conjunction with the typical overall regional dominant trees of the white fir (*Abies concolor*), Shasta red fir (*Abies magnifica* var. *shastensis*), and mountain hemlock (*Tsuga mertensiana*) forests have much to do with the enrichment. Although not unique to the area, the abrupt alternates between mesic, hydric, and xeric habitats and the great range in elevation (and thus, climate) over short distances also contribute to the diversity. These last two factors allow the juxtaposition of numerous species that are normally separated from one another in California. Although Holland (1986) and others have defined an enriched mixed conifer forest type to characterize these locally diverse forests, Sawyer (1987) has argued that the diversity of conifers in the area does not constitute a single forest type. The fact that these forests are not replicated throughout the E. Klamath Mountains or even in adjacent drainages with very similar environments suggests that Sawyer's contention is correct. It appears that they are agglomerations of species brought together by the vagaries of present-day climate and historical forces.

The highest conifer diversity in a single stand of uniform habitat at SCRNA is 10 species. This occurs in several sites between 5400 and 6000 ft (1645-1829 m) along the major branches of Sugar Creek where Engelmann spruce tends to dominate and a mixture of upper and lower elevation conifers are subdominants. In general, average stands in this forest contain seven or eight conifer species.

Surprisingly, xeric exposures at high elevations may also contain high diversities of conifers. An open subalpine forest on a S. exposure at 7200 ft (2195 m) contains up to nine species of conifers in a stand. Such forests understandably

have little species overlap with the mesic creekside forests and contain such xerophytic subalpine species as foxtail pine, whitebark pine, and *Juniperus communis*.

Type Locality for Klamath Montane Vegetation: As a result of research by Sawyer and Thornburgh (1969, 1970, 1971), a great deal of data was collected on the vegetation of the area. More than 200 stands were sampled in the vicinity of the cRNA, and a vegetation classification system based on the data collected locally has become widely accepted as the standard way of viewing the vegetation of the entire montane and subalpine zone of the Klamath Mountains (Sawyer and Thornburgh 1977). Thus, this area provides not only a unique diversity of conifers but also exemplifies the typical vegetation zonation for the entire ecological section.

Rich Flora: In addition to the diversity of conifers in the area, the vascular flora in general is rich. Nearly 400 taxa of vascular plants are known from the cRNA. This wealth of species is due in large part to the diversity of habitats ranging from xeric to hydric and from lower montane to subalpine. Sawyer and Thornburgh (1971) describe 15 forest associations from the area, and Keeler-Wolf (1984d) indicates 26 mapping units.

Sierran Mixed Conifer Forest: This mixed conifer forest is characteristic of the lower elevation slopes in the area. It has a variety of subtypes, including ponderosa pine (*Pinus ponderosa*)-, white fir-, and Douglas-fir (*Pseudotsuga menziesii*)- dominated types. California black oak (*Quercus kelloggii*) is occasional on lower xeric sites, and sugar pine (*Pinus lambertiana*) and incense-cedar (*Libocedrus decurrens*) are widespread. The mixed conifer forest is represented by large old-growth stands and by younger successional stands associated with past crown fire.

Rare Plants: Several rare plants are known from the area. Subalpine fir and Engelmann spruce are both members of CNPS List 2. *Angelica arguta*, *Cypripedium fasciculatum*, *Draba howellii*, *Poa rhizomata*, and *Lomatium engelmannii* are all members of CNPS List 4.

Entire Basin Included: The SCRNA encompasses the entire upper drainage of Sugar Creek. It includes three major subwatersheds, each of which has essentially remained unchanged by humans since before the European colonization of California. This not only gives the area excellent ecological integrity but also enables watershed studies of various sorts to be carried out.

Physical Characteristics

The area covers 3963 acres (1604 ha). Elevations range from 4800 to 8196 ft (1463-2498 m). The cRNA is dominated by Russian Peak on the W. with two roughly equal-sized glacial valleys (S. Sugar and the main Sugar Creek drainages) incising the Salmon-Scott Divide immediately to the N. and S. of the peak. These valleys converge about 2 miles (3.2 km) NE. of Russian Peak and form the main Sugar Creek Valley, which continues northeastward another mile (1.6 km) to the E. edge of the cRNA. The ridges bounding these valleys have several points rising above 7600 ft (2317 m), creating valley depths more than 2000 ft (610 m) in many places. Upper and middle slopes are typically steep with gradually sloping valley floors. Slope aspects are primarily NW.- and

Figure 172—Sugar Creek, enriched conifer forest in Sugar Creek cRNA adjacent to small lateral moraine-dammed pond. Trees in photo include Engelmann and Brewer spruces, Shasta red and white firs, western white pine, mountain hemlock, and lodgepole pine. (1988)



SE.-facing. The effects of Pleistocene glaciation are widespread. Two ponds above the S. side of the main valley were formed by a lateral moraine dam. South Sugar Lake and High Lake lie in glacially scoured cirque bowls. The small tarn, about 0.65 miles (1 km) NNE. of Russian Peak, and Sugar Lake, about 1 mile (1.6 km) downstream, together constitute a short series of pater-noster lakes.

The entire area is underlain by granitic rock (Russian Peak Pluton). Soils have been divided into six mapping units with the most extensive being Teewinot-Endlich families association and the Gerle family-Entic Xerumbrepts association. The Nanny family occupies the valley bottom morainal deposits. Precipitation is estimated at 30-50 inches annually (762-1270 mm) with snow as the major form.

Association Types

Sawyer and Thornburgh (1971) and Keeler-Wolf (1984d) treat the vegetation differently. Sawyer and Thornburgh base their summary on extensive sampling (221 releves analyzed) of the four major forested vegetation zones in the area. Keeler-Wolf bases his mapping units on canopy dominance of various forest types and, in addition, treats the nonforest vegetation. This present summary of the vegetation is the same as that used in Keeler-Wolf (1989f) and relies largely upon the Holland classification system (1986). One type, the mountain mahogany scrub, is not described by Holland and more closely resembles Kuchler's (1966) type 31. Another type, the Brewer spruce woodland, is described as a result of the fieldwork for the establishment report. It has no Holland, Kuchler, or SAF (Eyre 1980) analog. Comparisons to the Sawyer and Thornburgh (1971) and Keeler-Wolf (1984d) types are made. References to "S and T" signify Sawyer and Thornburgh (1971), whereas mention of "K-W" refers to Keeler-Wolf (1984d).

Red Fir Forest (85310, 86100): 1053 acres (426 ha). This forest dominates on mid-elevation mesic slopes and upper-elevation xeric slopes with well-developed soil. The most extensive essentially pure Shasta red fir forests occur on E.- and W.-facing exposures between 6800 and 7200 ft (2073-2195 m). These forests are typically dense, with relatively even-aged canopies and abundant reproduction only in sunny openings. These are mapped as RF (red fir) in K-W. K-W maps several additional types with red fir as an important canopy member. Many of these are transitional forests between true red fir and types from lower or upper elevations. These include WF-RF (white fir-red fir), RF-WF-MH (red fir-white fir-mountain hemlock), RF-LP-WF (red fir-lodgepole pine [*Pinus contorta* ssp. *murrayana*]-white fir), RF-MH (red fir-mountain hemlock), RF-MH-WP (red fir-mountain hemlock-western white pine [*Pinus monticola*]), MH-RF, and RF-WP-LP. These forests vary from open to closed and from relatively mesic to xeric.

S and T describe red fir-dominated forests from both their Shasta red fir and mountain hemlock zones. Their *Abies magnifica* var. *shastensis* / *Quercus vaccinifolia* type includes the relatively open forests with montane chaparral-dominated understory. S and T also include the species-rich forests of the mesic valley bottoms (treated herein as enriched conifer forest) and the shrub-dominated montane chaparral as part of the red fir zone. Their closed forests dominated by red fir are included as part of the mountain hemlock zone. Their type most descriptive of the closed, well-developed fir-dominated forests is termed *Abies magnifica* var. *shastensis* / *Pyrola picta*. This type occurs on fairly deep, high elevation soils. The related *Tsuga mertensiana* / *Pyrola picta* type occurs under similar conditions at higher elevations or more mesic sites. Both types have trees averaging 80 ft (24.4 m) tall and canopy cover approaching 90 percent. Shrub and herb cover is light.

Whitebark Pine-Mountain Hemlock Forest (86210): 921 acres (373 ha). The forests of the highest mesic slopes are dominated by mountain hemlock. These may be dense, shady groves or range to open and rocky. Typically, these forests occur on relatively sheltered slopes except at the highest elevations, as on the summit area of Russian Peak, where they may occupy S.-facing slopes. The typical closed forest is described as *Tsuga mertensiana* / *Pyrola picta* by S and T and called mountain hemlock (MH) by K-W. Canopy dominance may be shared with Shasta red fir on less mesic slopes. Shrubs are scattered and associated with openings. Herbs are typically sparse. Characteristic understory species include *Luetkea pectinata*, *Cassiope mertensiana*, *Phyllodoce empetriformis*, *Vaccinium scoparium*, *V. arbuscula*, *Pyrola secunda*, and *P. picta*.

Whitebark pine is typically not an important constituent except on the steep N. slopes of Russian Peak where it occurs scattered with hemlock among the granite slabs and boulders. Western white pine is occasional throughout in more open stands.

Sierran Mixed Coniferous Forest (84230, 84210): 857 acres (347 ha). One of the two target elements, this is an extensive forest at the lower elevations (<6000 ft, 1829 m). This association includes K-W map units MCF-pp (mixed conifer forest-ponderosa pine dominant) and MCF-wf (mixed conifer forest-white fir dominant). S and T consider all forests of this type in the cRNA to be in the white fir zone. They define two types, the *Abies concolor* / *Berberis nervosa* type and the *Abies concolor* / *Ceanothus prostratus* type. The latter is analogous to MCF-pp of K-W, and the former is equivalent to MCF-wf.

On warm sunny exposures, ponderosa pine dominates the canopy, with white fir and Douglas-fir as secondary species. Also present are sugar pine (*Pinus lambertiana*) and incense-cedar (*Libocedrus decurrens*). A subcanopy of scattered California black oak and canyon live oak (*Quercus chrysolepis*) is common, especially along ridges. Shrubs such as *Chrysolepis sempervirens*, *Quercus vaccinifolia*, and *Ceanothus prostratus* form a scattered to dense understory. Herbs are uncommon and include *Pyrola picta*, *Apocynum pumilum*, and *Goodyera oblongifolia*. Certain areas on the SE.-facing slopes above Sugar Creek have been affected by crown fire in the past 100 years and have dense even-aged young ponderosa pine.

On mesic slopes with deep soils, white fir dominates the canopy and reproduction. The other four typical mixed conifer species are subordinate. Ponderosa pine is represented by the largest individuals, but has poor reproduction except in openings. This is a moderately dense forest with characteristic shared dominance of the canopy species. Productivity is high, and trees commonly attain heights of 165 ft (50.3 m) and dbh of 5 ft (1.5 m). The ground layer is moderately developed and includes *Campanula prenanthoides*, *Disporum hookeri* var. *trachyanthrum*, *Chimaphila umbellata* var. *occidentalis*, *Hieracium albiflorum*, *Pteridium aquilinum*, and *Linnaea borealis*.

A third type dominated by Douglas-fir occurs in the lowest elevation valley bottoms (below 5000 ft, 1524 m). This type is alluded to in S and T but not discussed in K-W (similar to Holland 84110). In addition to other typical conifers of the zone, it contains scattered Engelmann spruce in semi-riparian areas.

Alpine Talus and Scree Slope (91200, 91300): 310 acres (126 ha). This association occurs on all open rocky substrates at the upper elevations. It is not discussed by S and T but is called RO (rock outcrop) in K-W. Although sparsely vegetated, this association is an important constituent of the area. It may be divided into xeric (S.-facing) and mesic (N.-facing) types. Although many species are shared between the two subtypes, there is a well-defined split. Typical taxa of N.-facing outcrops include *Saxifraga tolmiei*, *S. ferruginea*, *S. nidifica*, *Juncus drummondii*, *Luetkea pectinata*, *Polemonium pulcherrimum*, *Sibbaldia procumbens*, *Penstemon davidsonii*, and *Phyllodoce empetriformis*. Species of S.-facing outcrops include

Arenaria congesta, *Sedum obtusatum* ssp. *boreale*, *Arabis platysperma*, *Juncus parryi*, *Koeleria macrantha*, *Eriogonum umbellatum*, *Melica stricta*, *Stipa californica*, and *Penstemon newberryi* ssp. *berryi*.

Salmon-Scott Enriched Conifer Forest (85420): 195 acres (79 ha). This type occurs along the valley bottoms and moist, sheltered slopes from low to mid-elevations in the cRNA. It is a poorly defined vegetation association with variable mixture of species. In general, it is characterized by the presence of Engelmann spruce or subalpine fir, or both, along with numerous other conifers overlapping from adjacent habitats, including red fir, white fir, mountain hemlock, western white pine, lodgepole pine, Brewer spruce, incense-cedar, sugar pine, ponderosa pine, and Jeffrey pine (*Pinus jeffreyi*). The mesophilic Pacific yew (*Taxus brevifolia*) is a characteristic subcanopy species of lower elevations. K-W map-units analogous to this association include ES (Engelmann spruce), ES-SF (Engelmann spruce-subalpine fir), and SF (subalpine fir). Analogs in S and T are *Abies magnifica* / *Leucothoe davisiae*, *Abies magnifica* / *Linnaea borealis*, and *Tsuga mertensiana* / *Phyllodoce empetriformis*.

Stand density in one 2000-m² sample dominated by Engelmann spruce (Sawyer and Thornburgh 1969) is 1515 trees/ha and basal area is 71.8 m²/ha. Stand density in a subalpine fir-dominated area sampled by Sawyer and Thornburgh (1969) is 1710 trees/ha with a basal area of 53.8 m²/ha. Upper (rocky) elevations typically are dominated by subalpine fir; lower (poorly drained) elevations are dominated by Engelmann spruce. This pattern reflects the dominance patterns of these two species as they occur in their extensive range in the central and N. Cascades and mountains of Idaho and Montana (Alexander 1980).

The understory is typically well developed with a diversity of mesophyllic species. Thirty-eight shrub species are listed by S and T for the *Abies magnifica* / *Leucothoe* type alone. Among the most important species are *Leucothoe davisiae*, *Ribes lacustre*, *Alnus tenuifolia*, *Vaccinium scoparium*, *V. membranaceum*, and *Berberis nervosa*. The herb layer is also rich with such species as *Linnaea borealis*, *Anemone deltoidea*, *Adenocaulon bicolor*, *Clintonia uniflora*, *Disporum hookeri*, *Mitella pentandra*, *Streptopus amplexifolius*, *Viola glabella*, and *Senecio triangularis*.

Mixed Montane Chaparral (37510): 156 acres (63 ha). This vegetation occurs on xeric exposures within the red fir zone of S and T. It is dominated by a number of shrubs that generally cover 70-80 percent of the surface. These include *Quercus vaccinifolia*, *Arctostaphylos patula*, *A. nevadensis*, *Ceanothus velutinus*, and *Holodiscus microphyllus*, among others. Herbs are scattered and include *Senecio integerrimus*, *Monardella odoratissima*, *Phlox diffusa*, *Castilleja applegatei*, and *Penstemon newberryi*. This association is called *Quercus vaccinifolia* / *Arctostaphylos patula* by S and T and is included in map units MC (mountain chaparral), MC-JP-RF-WF (mountain chaparral-Jeffrey pine-red fir-white fir), and MC-JP-WP-RF-LP (mountain chaparral-Jeffrey pine-western white pine-red fir-lodgepole pine) of K-W.

Jeffrey Pine-Fir Forest (85100, 85210): 125 acres (51 ha). This is an open forest typical of shallow soils and xeric exposures. It is discussed by K-W as Jeffrey pine-red fir-white fir-lodgepole pine forest. It occurs in similar situations as mixed montane chaparral (open, rocky understory on S.- and SE.-facing slopes) but usually in areas with somewhat deeper soil. Typically, Jeffrey pine dominates the scattered canopy, but fir species (red fir at higher, and white fir at lower elevations) dominate the reproduction layers. Lodgepole pine is occasional. All species of shrubs typical of montane chaparral occur.

Sierran White Fir Forest (84240): 88 acres (35 ha). This forest is not well developed in the cRNA. Mature stands strongly dominated by white fir typically occur on mid- and lower E.-facing exposures between mixed coniferous and red

fir-dominated vegetation. Some dense young stands are the result of recent crown fire. This type is included in K-W MCF-WF and WF-RF (white fir-red fir) and is included within the *Abies concolor*/*Berberis nervosa* type in the white fir zone of S and T.

Montane Riparian Scrub (63500): 46 acres (19 ha). This shrub-dominated association lines the sunnier seeps and creeks. The typical dominants are *Alnus tenuifolia* and *Salix commutata*, both species forming extensive thickets. Characteristic species above about 6000 ft (1829 m) include *Sambucus microbotrys*, *Spiraea douglasii*, *Lonicera conjugialis*, and the willow *Salix lemmonii*. In general, willows dominate on warmer SE. exposures while mountain alder dominates on E. and N. exposures. At lower elevations, between 5000 and 6000 ft (1524-1829 m), the riparian zone along Sugar Creek is shaded by surrounding coniferous forest, and the numerous large boulders and frequent scouring floods restrict riparian growth. In this area *Alnus sinuata* may dominate with other relatively shade-tolerant species such as *Salix scouleriana*, *Cornus stolonifera*, and *Sorbus scopulina*.

Brewer Spruce Woodland (no Holland equivalent): 46 acres (19 ha). This type is distinctive for its strong dominance by Brewer spruce. The trees form an open woodland on extremely steep, rocky, NW.-facing slopes between 6400 and 7200 ft (1951-2195 m) above the main Sugar Creek valley. Scattered western white pine, mountain hemlock, and red fir are of low importance, and in many stands Brewer spruce (BS) is the only tree. Shrubs and herbs are typical of mesic rock outcrops. This type is included within MH-BS-WP-RF of K-W and may be considered part of *Abies magnifica*/*Quercus vaccinifolia* or *Tsuga mertensiana*/*Abies magnifica*/*Pyrola picta* of S and T.

Whitebark Pine Forest (86600): 42 acres (17 ha). This is the forest with the most severe climate in the cRNA. It occupies ridgetops and adjacent upper slopes of the highest parts of the Sugar Creek drainage from 7500 to 8200 ft (2286-2499 m). Mountain hemlock is the principal tree associate. Trees are typically low, gnarled, and twisted, with multiple crowns. Shrubs include *Haplopappus greenei*, *Holodiscus microphyllus*, *Cercocarpus ledifolius*, and *Chrysolepis sempervirens*. Herbs are similar to the next described association. This association is called WBP-MH (whitebark pine-mountain hemlock) in K-W and *Pinus albicaulis*/*Holodiscus microphyllus* in S and T.

Foxtail Pine Forest (86300): 30 acres (12 ha). This forest is restricted to two groves: One is on rocky shallow soil on a S.-facing slope, and the other is on deep, decomposed granite on an E.-facing exposure. Both stands are small and marginally dominated by foxtail pine. The S.-facing stand has a higher diversity of subdominant species including red fir, mountain hemlock, lodgepole pine, western white pine, Jeffrey pine, whitebark pine, and white fir. The E.-facing stand has red fir and *Cercocarpus ledifolius* as the principal associates. Stand density for two samples in the S.-facing stand is 260 and 658/ha, and basal area is 19.0 and 29.3 m²/ha (Sawyer and Thornburgh 1969).

Understory species are sparse in the E.-facing stand and include *Arctostaphylos patula*, *Stipa occidentalis*, *Lupinus breweri*, and *Eriogonum ovalifolium*. In the S.-facing grove, mountain chaparral species such as *Arctostaphylos patula*, *A. nevadensis*, and *Holodiscus microphyllus* dominate the understory. Other species include *Juniperus communis*, *Arenaria congesta*, *Achillea lanulosa*, *Senecio integerrimus*, *Phlox diffusa*, *Lewisia leana*, and *Penstemon newberryi*.

Mountain Mahogany (*Cercocarpus ledifolius*) Scrub (no Holland equivalent): 16 acres (7 ha). This association is not discussed by either K-W or S and T. It occupies a small area of steep, windy, rocky W.-facing slopes at 7000-7300 ft (2134-2225 m) to the W. of the E.-facing foxtail pine grove. The soil is virtually

nonexistent, and the substrate is dominated by fractured granitic boulders. Reproduction of the dominant *C. ledifolius* is moderate. Other species in this association include red fir, *Arctostaphylos patula*, and *Ceanothus velutinus*.

Wet Montane Meadow (45100, 45210, 51110, 51200): 9 acres (4 ha). Wet meadow associations occur along narrow riparian borders, seeps, and lakesides. K-W discusses three types: Seep— dominated by *Aster* spp., *Dodecatheon* spp., *Ligusticum grayi*, *Carex spectabilis*, and so forth; open meadow— dominated by such species as *Carex gymnoclada*, *C. interior*, *Juncus mertensianus*, *J. dubius*, *Perideridia gairdneri*, and so forth; and bog (fen)— dominated by *Kalmia polifolia* var. *microphylla*, *Ledum glandulosum* var. *californicum*, *Drosera rotundifolia*, *Narthecium californicum*, *Tolfieldia glutinosa* ssp. *occidentalis*, and so forth. The best developed bog and meadow complex occurs around the shallow tarn NNW. of Russian Peak.

Montane Freshwater Marsh (52430): 7 acres (3 ha). This association occurs in several shallow ponds with muddy bottoms and fluctuating water levels. It is also well developed at Sugar Lake. This type was mapped as L (shallow lake) in K-W. Characteristic species include *Carex rostrata*, *Sparganium angustifolium*, *Nuphar polysepalum*, *Callitriche verna*, *Isoetes occidentalis*, and *Ranunculus aquatilis*.

Plant Diversity

Three hundred eighty-six species are listed in the establishment record.

Conflicting impacts

The area receives light recreational use. The wilderness status of most of the area precludes other multiple-use impacts.

87. Sugar Pine Point (Berg 1991b, Palmer 1981)

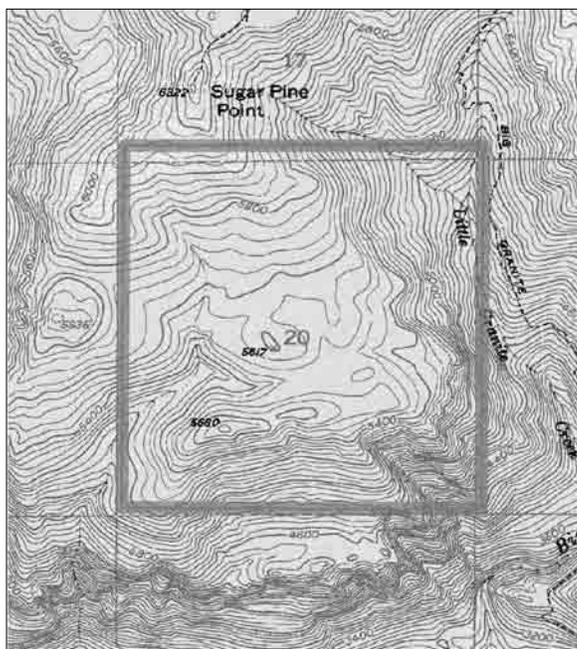


Figure 173—Sugar Pine Point RNA

Location

This established RNA is located on the Tahoe National Forest about 4 miles (6 km) S. of Cisco Grove. The area encompasses sect. 20 T16N, R13E MDBM (39°15'N., 120°32'W.), USGS Duncan Peak quad (fig. 173). Ecological subsection – Upper Batholith and Volcanic Flows (M261Eh).

Target Element

Mixed Conifer Forest

Distinctive Features

Succession: This study site provides numerous examples of the dynamics of mixed conifer forest succession from montane chaparral through mature stands codominated by several species.

Rare Plants: Although not specifically listed from the study site, several rare plants were mapped in the vicinity of the site and may occur here. These include *Cypripedium fasciculatum* (CNPS List 4) and three members of CNPS List 1B: *Lewisia pygmaea* ssp. *longipetala*, *Lewisia serrata*, and *Phacelia stebbinsii*.

Physical Characteristics

The area covers 640 acres (259 ha) of a S.-facing canyon slope above the North Fork of the American River. Elevations range from 4000 ft to about 6100 ft (1219–1859 m). The area consists of a bowl-like slope with promontories extending southward on the E. and W. edges of the area. Small drainages and rolling

topography exist in the middle of this bowl. Slopes are generally moderate within the bowl, but they drop steeply at the lower (S.) edge of the area toward the riverbed.

The area is underlain by Paleozoic and Jurassic marine sediments and metasediments. There are minor exposures of granitic rock (Sierra Nevada Batholith) in the area. Soil development is poor except on the more level portions of the bowl, which also support the largest trees. Precipitation at Lake Spaulding (7.5 miles, 12.1 km N.) averages 65.8 inches (1673 mm) per year. Temperature averages are 34 °F (1.1 °C) for January and 63 °F (17.3 °C) for July, with annual average of 48 °F (8.7 °C).

Association Types

Based on 14 releves and subsequent construction of an association table, four associations were recognized. Five releves also double as sample plots where density and basal area cover for trees were recorded.

Ponderosa Pine (*Pinus ponderosa*)-Sugar Pine (*P. lambertiana*)-White Fir (*Abies concolor*) (84230, 84240): 250 acres (101 ha). Eight releves are located on this association, which is dominated by the three namesake species or incense-cedar (*Libocedrus decurrens*), or by all four. There is a wide variation in size-class distribution and dominance, ranging from dense stands of young white fir to mature forest codominated by large sugar and ponderosa pines and white fir (fig. 174). Total basal area cover ranges from 9.7 to 110 m²/ha and tree density from 308 to 764/ha. Douglas-fir (*Pseudotsuga menziesii*) is occasional. Red fir (*Abies magnifica*) and Jeffrey pine (*Pinus jeffreyi*) also occur at the upper elevations.

As a result of fire, young forest has senescent shrubs of *Quercus vaccinifolia* and *Arctostaphylos patula*, indicating past dominance by these mountain chaparral species. Shrubs vary in density and composition depending on the history of the individual plot. *Arctostaphylos patula*, *Quercus vaccinifolia*, *Ceanothus fresnensis*, and *C. integerrimus* are among the most common shrubs. Herbs also vary with plot history. Among the most prevalent are *Gayophytum humile*, *Apocynum androsaemifolium*, *Pteridium aquilinum* var. *pubescens*, *Chimaphila menziesii*, and *Penstemon deustus*.

Montane Chaparral (37510): 219 acres (89 ha). The largest portion of this association is on the steepest part of the central bowl area. This montane chaparral is maintained by fire, which carries well up the steep slopes. Typical species are the same as those shrubs listed for the ponderosa pine-sugar pine-white fir association.

California Black Oak (*Quercus kelloggii*) Forest (71120, 81340): 94 acres (38 ha). California black oak is an important species of the lower elevation forests. Many California black oaks are resprouts from

previous fires. Some root crowns are 3-5 ft (1-1.5 m) in diameter. One sample stand is representative of this type and has a number of young ponderosa pine, sugar pine, incense-cedar, and white fir in it. California black oak comprises 67 percent of the basal area and 50 percent of the stems. Average stem diameter of California black oak in this stand is 6.7 inches (17 cm).



Figure 174—Sugar Pine Point, mature *Pinus ponderosa* stand with a dense understory of *Abies concolor* and *Libocedrus decurrens* in Sugar Pine Point RNA. (1989)

Rocky Herbaceous Association (no Holland equivalent): In open, rocky sites the montane chaparral gives way to this type, dominated by scattered herbs and grasses. These include *Poa palustris*, *Arabis holboellii*, *Penstemon deustus*, *Zauschneria californica*, *Onychium densum*, *Zigadenus venosus*, *Pterixia* sp., and *Sitanion hystrix*.

Riparian (63500): Along the streambed of Little Granite Creek, a weakly developed riparian association occurs with such species as *Acer glabrum* var. *torreyi*, *Spiraea densiflora*, *Lonicera conjugialis*, *Lilium parvum*, *Senecio triangularis*, and *Navarretia propinqua*.

Plant Diversity

One hundred nine taxa are listed.

Conflicting impacts

None are mentioned. However, the area is surrounded by private land, necessitating unnatural boundaries to the RNA.

88. Teakettle Creek (Griffin 1975b)

Location

This study area (dropped from RNA consideration) is on the Teakettle Experimental Forest, Sierra National Forest. It occupies portions of sects. 16, 17, 20, 21, and 22 T11S, R27E MDBM (36°58'N., 119°02'W.), USGS Patterson Mountain (fig. 175). Ecological subsection – Upper Batholith (M261Eq).

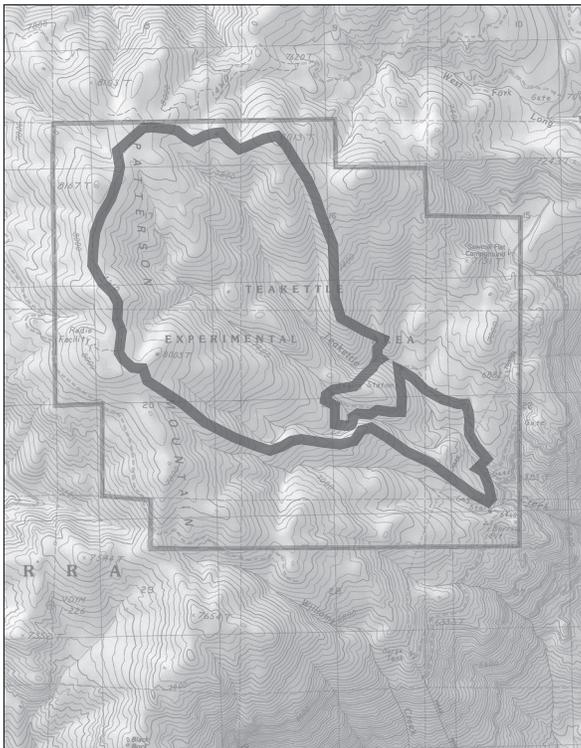


Figure 175—Teakettle Creek ecological survey area

Target Element

Red Fir (*Abies magnifica*)

Distinctive Features

Well-Developed Southern Sierra Red Fir Forest: Red fir-dominated forest covers several hundred acres that are divided into many small stands with a wide range of density and basal areas (fig. 176). These are augmented with brushy stands and extensive transitions to white fir (*Abies concolor*)-dominated forest. This site is an excellent example of a S. Sierra red fir forest.

Watershed Values: The site includes three distinct watersheds, each of which has a gauging station. Thus, watershed studies relating to ecosystem input and output could be undertaken easily.

Well-Developed Meadows: The area contains several meadows including wet and dry types. Some are being invaded by conifers, but many of the meadow-forest boundaries are sharp.

Rare Plants: *Raillardella muirii* (CNPS List 1B) has been collected adjacent to the study site and is probably in the area.

Physical Characteristics

The area covers 1250 acres (506 ha). Elevations range from 6400 to 8050 ft (1951-2454 m). The area is drained by Teakettle Creek, a tributary of Kings River. The creek flows to the SE. with slopes of E., NE., and SE. predominating. Slopes are generally gradual; the average gradient is about 720 ft/mile (136 m/km).

Most of the area is on Triassic metamorphics, mainly quartzite. Small areas of Miocene basalt overlie the quartzite. The lowest elevations are underlain by granitic rocks. The gentle topography and unglaciated surface have produced deep soils in some areas. The Corbett series predominates, with depths of 4-5 ft (1.2-1.5 m). Climate is not discussed, but precipitation is likely to average 50 inches (1270 mm) per year (Rantz 1972).

Association Types

Twenty 20-m by 50-m plots were sampled in the area. These are equally divided between red fir and mixed conifer vegetation. The remainder of the associations are qualitatively described.

White Fir-Red Fir Forest (85310, 84240): 295 acres (119 ha). This is a transitional forest between red fir and mixed conifer forests, occurring at the mid-elevations of the study area. Dominance is traded between red fir and white fir (*Abies concolor*). Stand structure is similar to the pure red fir forest of higher elevations. In general, there is more red fir than white fir regeneration. Unlike many other mid-montane areas in California, there seems to be no well-developed zone of white fir dominance here. Floristically, the scattered shrubs and herbs under the canopy are little different from those of the red fir forest. Three plots sampled in this association have tree densities, seedling densities, and basal area (respectively) ranging from 30 to 131/ha, 0 to 111/ha, and 25.7 to 104.5 m²/ha for white fir and 161 to 351/ha, 59 to 400/ha, and from 26.4 to 109.3 m²/ha for red fir.

Open Mixed Conifer-Brush (84230, 37510): 255 acres (103 ha). Parts of the higher-elevation mixed conifer stands are open with low shrub cover and may be considered a lower extension of the open red fir forest-brush association with similar understory composition. At lower elevations this association has many tall shrubs and may be dense. In rocky areas or on concave slopes *Prunus emarginata* dominates along with *Chrysolepis sempervirens* and *Ceanothus cordulatus*. The most exposed brush patches have considerable *Arctostaphylos patula* and colonies of shrubby California black oak (*Quercus kelloggii*) and *Chamaebatia foliolosa*. Portions of this area are dominated by Jeffrey pine (*Pinus jeffreyi*). These are very open stands (40 trees/ha, 9.6 m²/ha on one 0.1-ha sample).

Mixed Conifer Forest (84230, 85210): 236 acres (96 ha). This is an upper-elevation mixed conifer forest with white fir, Jeffrey pine, sugar pine (*Pinus lambertiana*), incense-cedar (*Libocedrus decurrens*), red fir, and occasional scrubby California black oak. The mixed conifer stands are more uneven-aged than the fir stands. White fir is the dominant seedling; red fir seedlings also are present



Figure 176—Teakettle Creek,
A closed-canopy stand of mature red fir representing the most highly productive type of red fir forest in the Teakettle Creek area. (1975)

over all but the shallowest soils and most xeric exposures. Ten plots were sampled in this association. Following is mean tree density, seedling density, and basal area (respectively) for the dominant trees: white fir: 350/ha, 346/ha, 31.6 m²/ha; incense-cedar: 57/ha, 17/ha, 13.3 m²/ha; Jeffrey pine: 25/ha, 10/ha, 13.1 m²/ha; sugar pine: 25/ha, 7/ha, 12.9 m²/ha; red fir: 40/ha, 49/ha, 5.7 m²/ha. Growth rates are slower in this forest (mean ring width = 1.38 mm) than in the following red fir association.

Red Fir Forest (85310): 200 acres (81 ha). This forest has a patchy distribution of closed stands where density and basal area are high (fig. 176). Much of the local red fir forest has many small openings with a senescent canopy. These openings contain scattered shrubs of *Chrysolepis sempervirens*, *Ceanothus cordulatus*, and occasional mats of *Arctostaphylos nevadensis*. Plots were all sampled in the denser areas; basal areas range from 71.9 to 168.5 m²/ha (mean 114.1 m²/ha, n=10). Maximum diameters of red fir are 6.5-7 ft (2.0-2.1 m) dbh; many trees are more than 4.25 ft (1.3 m) dbh. Variation is noted in growth rates, but ring-width averages 1.69 mm. Total tree density varies from 220 to 581/ha with an average of 341/ha. Red fir comprises an average relative density of 85 percent and an average relative cover of 84 percent. Average relative densities (per ha) and cover (m²/ha), respectively, of the two other sampled species are 49 and 18.3 (white fir) and 2 and 0.2 (sugar pine).

Open Fir Forest-Brush (37510, 85310): 167 acres (68 ha). Well-developed montane chaparral does not exist locally. All the chaparral has scattered red fir and white fir at mid- and upper elevations and other mixed conifer species at lower sites. These open "fir woodlands" average less than 50 percent canopy cover and are dominated by extensive understories of *Arctostaphylos nevadensis*, with *Chrysolepis sempervirens*, *Ceanothus cordulatus*, and *Arctostaphylos patula* locally common. Tall shrub cover is usually open enough to allow easy passage. These openings are being colonized by fir and may indicate areas of past intense fires.

Wet Meadow (45100): 56 acres (23 ha). More than 20 individual wet meadows were mapped in the area. They are characterized as well developed and, in general, diverse. All appear to be associated with streams and gullies, and thus, they may be classified as stringer-type meadows. A list of characteristic species is not provided, but photographs indicate species such as *Veratrum californicum*, *Senecio triangularis*, and *Lupinus polyphyllus* ssp. *supurbus* among the tall herbaceous dominants.

Dry Meadow (45120): 16 acres (7 ha). Several dry meadows are scattered on shallow soils. These are dominated by *Astragalus bolanderi*, with other species such as *Lupinus andersonii* locally common. They may be invaded by conifers, but many of the meadow borders are sharp and apparently stable.

Subalpine Fir-Pine Woodland (85210): 9 acres (4 ha). On the highest summit areas the open fir forest-brush association merges into a rocky situation with a discontinuous understory of *Arctostaphylos nevadensis* and several rock-outcrop herbs such as *Allium campanulatum*, *Hieracium horridum*, *Pellaea bridgesii*, *Sedum* sp., and *Stipa elmeri*. The scattered trees include red fir, Jeffrey pine, and western white pine (*Pinus monticola*).

Forest-Meadow Lodgepole Pine Ecotone (86100): 8 acres (3 ha). A sporadic fringe of lodgepole pine (*Pinus contorta* ssp. *murrayana*) exists along meadow margins. This association is not well developed in the study area, but becomes more extensive at slightly higher adjacent elevations.

Riparian (63500): No acreage is given. This association is mapped but not discussed in the report. Several species are listed as riparian. These include *Agastache urticifolia*, *Aquilegia formosa*, *Athyrium felix-femina* var. *californicum*,

Epilobium angustifolium, *Equisetum* sp., *Heracleum lanatum*, *Ledum glandulosum* var. *californicum*, *Lilium* sp., *Parnassia* sp., *Polygonum bistortoides*, *Salix* spp., and *Senecio triangularis*.

Plant Diversity

One hundred twelve taxa are given in a partial list (many meadow species not identified).

Conflicting impacts

Light cattle grazing in the meadows is mentioned. This candidate has been dropped because the current policy of the Pacific Southwest Region is not to establish RNAs within experimental forests.

89. Timbered Crater (Keeler-Wolf 1990f)

Location

This area is recommended for RNA establishment (rRNA) in the forest plan. It is on the Lassen National Forest, in Siskiyou County. The area lies on the W. and lowest elevation edge of the Modoc Plateau and includes all of sects. 23 and 14 and portions of the S. halves of sects. 11 and 12 T39N, R4E MDBM (41°13'N., 121°28'W.), USGS Timbered Crater quad (fig. 177). Ecological subsection - Medicine Lake Lava Flows (M261Dh) and Big Valley Mountains (M261Gn).

Target Element

Baker (Modoc) Cypress (*Cupressus bakeri*) and Northern Basalt Flow Vernal Pool

Distinctive Features

Baker Cypress: The Baker cypress stands at this site, the type locality for the species, sprawl over thousands of acres of broken lava flows that recently filled the bottom of a broad, structural valley in the SW. part of the Modoc Plateau. These stands represent a portion of the largest population of this species in the world, covering more than 7000 acres (2833 ha). These trees appear to differ in their physical and genetic characteristics from other Baker cypress stands, most likely due to differences in climate and substrate. Portions of the Timbered Crater stands have recently burned, resulting in abundant reproduction of cypress in much of the area.

Vernal Pools: Two pools at the NW. corner of the site are fairly large (10-20 acres, 4-8 ha) and complex. They occupy shallow depressions surrounded by raised basalt flows, and both exhibit a diverse flora and fauna of vernal-pool-adapted species, including two species listed by the CNPS as rare or endangered. The vernal-pool habitat at the rRNA differs from typical vernal pools of the Sacramento and San Joaquin valleys and surrounding foothills. It is at a substantially higher elevation, underlain by volcanic substrate instead of sedimentary rocks, and surrounded by coniferous forest and woodland as opposed to valley grassland and foothill woodland associations. Several species reach the limits of their elevational, latitudinal, and longitudinal ranges in this vicinity. The presence of plant species endemic to the Modoc Plateau vernal pools, uncharacteristic of foothill pools, and of widespread N. species, uncharacteristic of more S., low-elevation basalt flow pools, suggests that the Modoc Plateau pools may be reasonably differentiated as a distinct community type.

Knobcone Pine: The knobcone pine (*Pinus attenuata*) component is vigorous and healthy and an ideal representation of the species' typical density and stand structure.



Figure 177—Timbered Crater rRNA

Eastside Ponderosa Pine: Timbered Crater provides a transitional type of interior ponderosa pine (*Pinus ponderosa*) forest, which indicates its affinity to westside ponderosa pine and other related coniferous forests of the W. slopes of the Cascades. The ponderosa pine forest here differs significantly from the higher elevational stands at nearby Blacks Mountain RNA, with their more interior mix of Great Basin species.

Rocky Pools: The aquatic resources at Timbered Crater are not limited to vernal pools. Another type of pool occurs in the more recent basalt flow areas. These small pools usually have rocky bottoms with little aquatic vegetation, and they occupy the bottom of collapsed lava tubes. They may retain water well into the summer in wet years, much longer than the deepest parts of the two vernal pools. The smaller pools, despite the absence of a well-developed vascular flora, often have conspicuous invertebrate fauna, and their semi-permanence make them important watering holes for larger terrestrial vertebrates.

Modoc Plateau Endemic Flora: In addition to the vernal pool community, there is a unique floristic component on the xeric basalt flows of the Modoc Plateau ecological section. Several species common on the lava flows at this site are largely or completely restricted to the lava fields of this part of California and adjacent states.

Rare Plants: Several rare plants are known from the area. *Orcuttia tenuis* is on CNPS List 1B and *Thermopsis californica* var. *argentata* (*Thermopsis macrophylla* var. *argentata* in Hickman [1993]) is on List 4.

Figure 178—Timbered Crater, picturesque Baker cypress with *Letharia* and *Bryoria* lichens festooning branches, typical of open stands at edges of lava flats in the Timbered Crater rRNA. (1989)



Physical Characteristics

The rRNA covers 1777 acres (917 ha). Overall topographic relief is low, with elevations from 3520 to 3600 ft (1073-1097 m). Due to recent lava flows over much of the area, the microtopography is frequently rugged. The entire area is underlain by Quaternary volcanic rocks of either Pleistocene or recent (Holocene) origin; more specifically, they are basaltic flows that have emanated from Medicine Lake Highlands to the N. or from Brushy Butte to the S. These covered the N. floor of the Fall River Valley, a fault block structure separating the Big Valley Mountains to the E. from Soldier Mountain and other Cascade Range mountains to the W. Over a distance of several miles the valley dips gradually to the S. to the Pit River in the middle of Fall River Valley. There appear to be at least three different age groups of basalt flows in the area, although most are derived from the recent Medicine Lake flow.

Soils are divided into five mapping units: Lava Flow-Lithic Xerochrepts complex 0-35 percent slopes, lava flow, Supan family 0-15 percent slopes, Skalan-Holland families association 0-35 percent slope, and Holland-Skallan families association 0-35 percent slope.

Precipitation in the area is estimated at 25 inches (635 mm) with about 70 percent falling as snow. Unlike many other areas of cismontane N. California, this region receives about 0.25 inch (6.5 mm) or more precipitation per month even in the summer, primarily due to orographic thunderstorms associated with the relatively high elevations of the surrounding terrain. Highest temperatures usually occur in late July, and lowest temperatures are usually in early January. Mean July temperature range is 64.4-69.8 °F (18-21 °C), and January range is 26.6-32 °F (-3 to 0 °C). The frost-free period averages 120-180 days.

Association Types

Ten 100-m² plots were sampled in the northern interior cypress forest and in the knobcone pine forest. The associations are listed in order of decreasing size.

Eastside Ponderosa Pine Forest (84220): 1044 acres (422 ha). This ponderosa pine-dominated forest occurs in two forms in the rRNA.

Open Phase: The more extensive, open phase occupies the older of the two recent lava flows in the N. and W. parts of the site. It is characterized by an open canopy of ponderosa pine 60-100 ft (20-30 m) high and 18-37 inches (46-94 cm) in diameter. Beneath this canopy is a variable, poorly developed subcanopy made up of western juniper (*Juniperus occidentalis* ssp. *occidentalis*) and Oregon white oak (*Quercus garryana*). Both species are patchy in distribution: juniper is most common on relatively level, heavily weathered surfaces; oak on rough, undulating lava. The shrub cover is relatively uniform with *Arctostaphylos patula* and *Ceanothus cordulatus* dominant and other species such as *Cercocarpus ledifolius*, *Holodiscus boursieri*, *Cercis occidentalis*, *Ceanothus integerrimus*, and *Prunus emarginata* scattered throughout.

The distributions of the three cypress family members – western juniper, incense-cedar (*Libocedrus decurrens*), and Baker cypress – are negatively correlated. Baker cypress rarely occurs on flat, well-weathered flow areas where western juniper tends to codominate with ponderosa pine. Incense-cedar typically occurs on the well-developed soils of older lava flows where juniper and cypress do not grow.

The understory of the open ponderosa pine forest is well stocked with a variety of herbs, which in a normal to wet year may cover 10-25 percent of the ground in openings between shrubs. Common species include *Lomatium nudicaule*, *L. nevadense*, *Blepharipappus scaber*, *Horkelia tridentata*, *Zigadenus paniculatus*, *Bromus tectorum*, *Festuca idahoensis*, *Poa fendleriana*, *Collinsia parviflora*, and *Linanthus bakeri*. *Lomatium dissectum* and *Chamaebatiaria millefolium* are a conspicuous presence in the rougher lava areas.

Dense Phase: A small part of the rRNA adjacent to the vernal pools has a much denser and more well-developed ponderosa pine forest. This type occurs on much older soils of the Adobe Flat area. The forest is dominated by ponderosa pine, but it also has incense-cedar and occasional sugar pine (*Pinus lambertiana*) and California black oak (*Quercus kelloggii*). It has a higher stand density and an open understory of *Ceanothus integerrimus*, *C. prostratus*, and *Arctostaphylos patula*. Herb cover is substantially different from the open stands, with such species as *Astragalus pulsiferae* var. *suskdorfii*, *Wyethia angustifolia*, *W. mollis*, *Lupinus andersonii*, and *Calystegia* sp.

Northern Interior Cypress Forest (Baker Cypress Forest, 83220): 560 acres (227 ha). Baker cypress at Timbered Crater occupies the young, relatively unweathered lava flows (fig. 178), except for the most rugged recent flows where fire may not be able to spread. Baker cypress tends to occur in relatively dense, pure stands and only rarely as isolated individuals. Stands may consist of a few score to many thousands of individuals. Frequently, the highest-density stands are associated with raised lava ridges. Additional stands occur occasionally on relatively flat unbroken ground where they are interspersed with patches of open eastside ponderosa pine forest or brush fields dominated by *Arctostaphylos patula*. In general, most Baker cypresses in the rRNA are producing cones at a frequency no greater than one crop every 7-10 years.

The understory is dominated by *Arctostaphylos patula*, a widespread shrub characteristic of montane chaparral throughout N. and central California. Its tolerance of dry, rocky soil and resprouting ability make it an expected understory dominant for the fire-adapted Baker Cypress, knobcone, and open ponderosa pine forests. Additional shrubs include *Purshia tridentata*, *Ceanothus cuneatus*, *C. integerrimus*, *Cercocarpus ledifolius*, *Holodiscus boursieri*, and *Cercis occidentalis*. These shrubs are a mix of montane, foothill, and transmontane vegetation elements and underscore the transitional nature of the flora.

Understory herbs are diverse, and although they rarely account for more than trace cover, several small annual species are abundant and widespread.

These include *Madia minima*, *Epilobium minutum*, *Vulpia reflexa*, *Plagiobothrys tenella*, *Arenaria douglasii*, and *Collinsia parviflora*. Perennial species such as *Carex rossii*, *Penstemon deustus* ssp. *heterander*, *Horkelia tridentata*, and *Eriogonum* ssp. are widespread but scattered.

Knobcone Pine Forest (83210): 136 acres (55 ha). The most widespread of California closed-cone pines, this association is the most restricted of the forest types in the rRNA. The best-developed stands occur in hummocky areas where numerous sinuous lava ridges interdigitate with small interflow depressions or sinkholes formed by collapsed lava tubes. Although the pines may occur atop the ridges, they reach their greatest dimensions (up to 85 ft tall, 26 m) in depressions with a deep accumulation of soil and higher moisture availability. The rRNA's knobcone forest is characterized by a dense, even-aged canopy (dating back to the last extensive fire, about 1860) of spindly pines averaging 40-60 ft (12-18 m) in height and 9-13 inches (23-33 cm) dbh. Beneath the canopy is a relatively continuous subcanopy dominated by Baker cypress and suppressed knobcone pines. Understory species are similar to those in Baker cypress stands, but *Arctostaphylos patula* cover is lower than in most pure Baker cypress stands, perhaps as a result of the higher shading of the understory. The greater frequency of such relatively shade-tolerant mesophytic species as *Poa fendleriana*, *Claytonia spathulata*, *Cryopteris fragilis*, and *Collinsia parvifolia* compared to the cypress forest underscores the difference in understory conditions.

Northern Basalt Flow Vernal Pool (44131): 27 acres (11 ha). The two vernal pools at the rRNA are collectively known as the adobe vernal pools. They are similar in size and general characteristics and partially interconnected by a chain of small, narrow, moist (in May) meadows running along the border of the recent and Pleistocene flow.

The two pools are both underlain by clay pan soil derived from basaltic lava. Some vegetation differences may be the result of subtle soil differences between the two. Both pools have extensive flats associated with them. These are waterlogged for a much shorter period than the adjacent lower portion of the pools. At the S. pool the flats are alkaline with some evidence of salt deposit on the soil surface. Associated species are *Hesperochiron pumilis* and *Balsamorhiza hookeri*, known to be tolerant of alkaline soils. These species are absent from the N. pool flats. Other species common or abundant only at this S. pool flat area include *Allium lemmonii*, *Orthocarpus campestris*, *Lomatium piperi*, *Triteleia* sp., and *Perideridia* sp.

The main body of both pools, still moist to wet in May, contains the following dominants: *Eryngium mathiasiae*, *Plagiobothrys bracteatus*, *Cuscuta howelliana*, *Navarretia minima*, and *Psilocarphus brevissimus*. Later in the season such species as *Eremocarpus setigerus*, *Grindelia camporum*, and *Deschampsia danthonoides* are dominant. Three species of *Downingia*, all more strongly tied to lingering moisture than the above-mentioned species, are found lining the edges of the drying pools. *Downingia bicornuta* is the prevalent species at the N. pool, while *D. cuspidata* is prevalent at the S. pool. *Downingia bacigalupii* is a later flowering species.

Vernal pool species such as *Orcuttia tenuis* may have widely fluctuating population levels depending on yearly climatic and environmental conditions. Other species with infrequent distributions at the pools include: *Pogogyne zizyphoroides*, *Machaerocarpus californicus*, *Myosurus minimus*, *Mimulus tricolor*, *Gratiola ebracteata*, *Claytonia dichotoma*, *Lythrum hyssopifolia*, *Polygonum douglasii* var. *johnstonii*, *Eryngium alismaifolium*, *Boisduvalia glabella*, and *Polygonum* sp.

The deepest parts of both pools are dominated by *Heleocharis palustris*, *Polygonum amphibium* var. *stipulaceum*, and the emergent leaves of *Eryngium mathiasiae* at a time when water is 12-15 inches (31-38 cm) deep. The pools are dry by early July, even in the wettest years. The presence of an intermittent

fringe of Oregon ash (*Fraxinus latifolia*) along the sides of the S. pool may indicate a somewhat greater water availability there than at the N. pool, which has no riparian woody plants.

Rocky Bottomed Pools (no Holland equivalent): 10 acres (4 ha). Aquatic vegetation is developed only in the largest of the several small, rock-bound pools at the rRNA. Characterized by the presence of a relatively unbroken rocky bottom, they lack a clay pan and tend to retain water longer than the vernal pools. Despite the physical differences, species composition of the large rocky pool is similar to that of the deeper parts of vernal pools. The shallow portions are dominated by *Heleocharis palustris*, *Heleocharis* sp., *Eryngium* spp., *Polygonum amphibium*, and *Callitriche* sp. Deeper portions are up to 2 ft (61 cm) deep and have a much sparser cover of the same plants. The persistence of water in several of these pools suggests that their bottoms are close to the water table that presumably underlies the recent lava flows.

Plant Diversity

One hundred sixty-one taxa are listed.

Conflicting impacts

The impact from cattle and associated range-management activities in the pool areas is light, with no conflict with the sensitive plant habitat. Recreational use is limited to a jeep road that appears to be used occasionally by hunters in the fall. The lava flow features in the rRNA are not spectacular enough to attract public attention, except for some specimen rock collection at the Brushy Butte quarry.

Roads lead to within a few yards of both vernal pools but vehicular activity is extremely low. Some felling of widely scattered ponderosa pine was noticed on older dense stands adjacent to the two vernal pools. In all cases, the cutting was light and took place before 1965.

No evidence of fire suppression activity is apparent on the rRNA, but fire management is important to many of the target vegetation types.

Note: for Trelorita, see Manzanita Creek, #54

90. Twin Rocks (Jokerst 1987)

Location

This study area (dropped from RNA consideration in 1988) is on the Mendocino National Forest about 12 miles (19 km) ESE. of Covelo. It lies within sect. 1 T22N, R11W and sect. 6 T22N, R10W MDBM (39°47'N., 123°01'W.), USGS Newhouse Ridge quad (*fig. 179*). Ecological subsection – Eastern Franciscan (M261Ba).

Target Element

Foothill Woodland

Distinctive Features

Affinities of the Target Vegetation: The target vegetation of this area is best considered northern oak woodland (Oregon white oak woodland) and not foothill woodland. The dominant oak is Oregon white oak (*Quercus garryana*), which occurs in mixed hardwood stands, dominates mixed oak stands, and forms extensive pure stands. Although the typical California-foothill woodland dominants, blue oak (*Quercus douglasii*) and foothill pine (*Pinus sabiniana*), are present, blue oak is a subdominant of some phases of oak woodland, and foothill pine is uncommon.

Figure 179—Twin Rocks ecological survey area



The oak woodlands at Twin Rocks may be considered a mixing zone between xeric California-foothill woodland and the Oregon white oak woodlands of more N. and mesic areas. Such trees as Oregon white oak, California black oak (*Quercus kelloggii*), Pacific madrone (*Arbutus menziesii*), and ponderosa pine (*Pinus ponderosa*) are not typical foothill woodland species. Some relationship of this foothill woodland with the Oregon white oak woodlands of the more N. coastal mountains of California and Oregon is inferred by the presence of these Oregon white oak woodland species (see Soldier cRNA). However, most of the other species at Twin Rocks are typical of California-foothill woodland. These include most of the grasses and shrubs and the following trees: blue oak, foothill pine, and interior live oak (*Quercus wislizenii*).

The woody vegetation of the area is trending from open to dense stands of trees. In the past, frequent fire maintained an open oak woodland. However, with current reduced frequencies the vegetation in much of the area is gradually changing to a dense mixed oak-hardwood forest. Poor Oregon white oak regeneration may be related to browsing pressure from the large wintering mule deer herds.

Manzanita Hybrids: Several different forms of stump-sprouting manzanitas were collected from the site. These represent five taxa (*Arctostaphylos glandulosa* forma *cushingiana*, *A. manzanita*, *A. canescens*, *A. manzanita* ssp. *roofii*, and *A. stanfordiana*) and six different hybrid combinations. Although hybrid manzanita stands are not uncommon, the presence of a three-way hybrid and putative crosses between diploid and tetraploid species is unusual.

Physical Characteristics

This site (340 acres, 138 ha) is in the Black Butte River drainage, a tributary of the Middle Eel River. It lies on the SW.-facing slope of Twin Rocks Ridge. Elevations range from 1740 ft (530 m) along the Black Butte River to 3400 ft (1036 m) atop the ridge. Slopes range from 10 to 60 percent and average 30 percent. The river is confined to a steep, narrow channel with no pronounced terraces. The mid- and upper slopes are geomorphically active and contain several landslides.

Rocks are derived from the Franciscan assemblage and are primarily graywacke and shale. Soils are divided into three mapping units: Los Osos complex 10-50 percent slopes, Maymen gravelly loam 30-50 percent slopes, and Madonna Gravelly loam 30-50 percent slopes. The Los Osos unit is the most widespread; it is characterized by the most unstable slopes with the tendency to slide, slump, and produce severe erosion gullies. Mean annual precipitation is estimated between 40 and 60 inches (1016-1524 mm) with a frost-free season of 130-180 days per year. Most precipitation falls as rain.

Association Types

No quantitative sampling was conducted. However, estimates of tree density and cover were made.

Oregon Oak Woodland (71110, 71410, 41200, 42200): 263 acres (106 ha). This association is divided into pure and mixed phases. The pure phase covers 122 acres (49 ha). Oregon white oak is the sole dominant, with cover ranging from 60 to 100 percent. Blue oak is infrequent in the canopy. Understory species include California buckeye (*Aesculus californica*), *Arctostaphylos manzanita*, *Gallium porrigens*, and *Toxicodendron diversilobum*. Lower canyon slopes support *Lonicera hispidula* var. *vacillans*, madrone, bigleaf maple (*Acer macrophyllum*), and *Cercis occidentalis*; they indicate more mesic conditions than on upper slopes. Tree density ranges from 494 to 988/ha. Most trees are even-aged and under 12 inches (30 cm) dbh. Regeneration is significant only on steep slopes unused by livestock.

Grasses dominate the herb layer, comprising from 50 to 100 percent cover. Some understories are dominated by native bunchgrasses including *Festuca ida-*

hoensis, *Stipa pulchra*, *Melica californica*, *Poa scabrella*, and *Bromus marginatus*. Other herbs of the mixed grass and herb understories include *Iris macrosiphon*, *Ranunculus occidentalis*, *Eriophyllum lanatum* var. *achillaeoides*, *Lupinus nanus*, *Dodecatheon hendersonii*, *Brodiaea* spp., *Silene californica*, *Sanicula bipinnata*, and *Lathyrus vestitus*. The pure Oregon oak phase is largely restricted to the lower elevations of the area.

The mixed Oregon oak phase covers 141 acres (57 ha) of upper slopes. Oregon white oak is the most common species, comprising 40-60 percent of the total canopy cover. Cover varies from open savanna-like stands to 60-80 percent in woodlands (fig. 180). The other trees include interior live oak, blue oak, California black oak, and occasional madrone. Foothill pine is uncommon except for one small cluster. Oaks attain their largest size in and near the savanna openings. Some Oregon white oaks have dbh of 2-3 ft (0.6-0.9 m).

Shrub cover is higher than in the pure phase. *Arctostaphylos manzanita* predominates, often in dense thickets. The same bunchgrasses and herbs that occur in the pure phase also occur here, except in arid openings where annuals dominate. The arid openings range from 0.25 to several acres in size and are characterized by *Avena barbata*, *Bromus mollis*, *B. rubens*, *Vulpia* spp., *Stipa pulchra*, *Poa scabrella*, *Sitanion hystrix*, *Dichelostemma* (*Brodiaea*) *pulchellum*, *Erodium botrys*, *Lotus micranthus*, *L. subpinnatus*, *Lupinus bicolor*, *Orthocarpus attenuatus*, *Plagiobothrys tenellus*, *Trifolium ciliolatum*, *T. bifidum*, and *T. olivaceum*.

Two types of the mixed phase occur. One has a relatively open canopy (total canopy cover of 20-40 percent) dominated by Oregon white oak with large grassy openings (Holland 41200, 42200). The other type has higher canopy cover with about 30-50 percent composed of interior live oak. This type has a relatively shady understory and supports such species as *Calochortus coeruleus*, *Cynoglossum grande*, *Melica geyeri*, *Ranunculus occidentalis*, *Sanicula crassicaulis*, and *Torilis japonica*.



Figure 180—Twin Rocks, pure Oregon oak phase in the Twin Rocks study area. (1987)

Mixed North Slope Cismontane Woodland (71420): 51 acres (21 ha). This woodland has a dense canopy 40-60 ft (12-18 m) tall, dominated by madrone, interior live oak, California black oak, and ponderosa pine. Canopy cover ranges from 60 to 100 percent. Rocky sites are dominated by interior live oak, whereas steep sites with deeper soils are dominated by madrone. California black oak and ponderosa pine are scattered throughout, and bigleaf maple and Oregon white oak occur in low numbers. Shrubs are sparse to dense and dominated by *Arctostaphylos manzanita* and *A. stanfordiana*. Other species include *Cercocarpus montanus* var. *glaber* (*C. betuloides*), *Lonicera hispidula* var. *vacillans*, *Sanicula tuberosa*, and *Scutellaria tuberosa*.

North Coast Range Mixed Conifer Forest (84110): 13 acres (5 ha). This association is restricted to a narrow band of Madonna soils along the ridgeline. The nearly closed 80- to 120-ft (24- to 37-m) tall canopy is composed of a mix of ponderosa pine, Douglas-fir (*Pseudotsuga menziesii*), bigleaf maple, madrone, and California black oak. This forest has a mid-layer composed of saplings of the canopy species with interior live oak. The shrub layer ranges from sparse to dense, with *Arctostaphylos manzanita* and *Cercocarpus montanus* (*betuloides*) var.

glaber. Herbs are frequent and include *Agoseris retorsa*, *Carex multicaulis*, *Erythronium californicum*, *Hieracium albiflorum*, *Iris macrosiphon*, *Melica geyeri*, and *Viola purpurea* var. *dimorpha*.

Northern Mixed Chaparral (37110, 37B00): 13 acres (5 ha). This association occurs on thin, rocky soils of low, rounded spur ridges. Cover is open to very dense. The dominant on three isolated stands is *Arctostaphylos manzanita* with some *Adenostoma fasciculatum*. A larger stand entering the S. portion of the area includes mostly *Arctostaphylos glandulosa* with *A. manzanita* ssp. *roofii*, *A. stanfordiana*, *A. canescens*, and various hybrids. Also present are *Adenostoma fasciculatum*, *Ceanothus cuneatus*, *C. integerrimus*, *Eriodictyon californicum*, and *Quercus dumosa*.

Seeps, Intermittent Creeks, and Riparian Habitats (45400, 61510): These associations are lumped because they are poorly developed. Seep vegetation is strictly herbaceous and includes *Aquilegia formosa*, *Athyrium filix-femina*, *Brickellia californica*, *Cirsium vulgare*, *Delphinium nudicaule*, *Erigeron philadelphicus*, *Juncus patens*, *Limnanthes douglasii* var. *nivea*, *Phalaris tuberosa* var. *stenoptera*, *Scutellaria californica*, and *Trifolium obtusiflorum*. The very sparse vegetation along Black Butte River includes white alder (*Alnus rhombifolia*), bigleaf maple, *Brickellia californica*, and a species of willow (*Salix* sp.).

Plant Diversity

One hundred sixty-three taxa of vascular plants are listed from the area.

Conflicting impacts

The area was dropped from consideration by the RNA committee in 1988 primarily because of its small size, its history of disturbance (see below), and because the area is not representative of the foothill woodland target element as it is commonly understood.

A four-wheel drive road, an old cleared right-of-way pack trail, numerous small and large erosion gullies (probably initiated by the construction of the trails and roads), and livestock use all detract from the pristine conditions of the area. Although grazing pressure is light and mostly concentrated in the upper portion of the site, it may influence the poor oak regeneration. The area is still used by occasional off-road vehicles, and the erosion gullies are continuing to enlarge.

91. Upper Goose Creek (Keeler-Wolf 1987f)

Location

This recommended RNA (rRNA) is on the Six Rivers National Forest, Del Norte County. The study area includes two small units about 7 miles (11 km) NE. of Klamath Glen. The NE. unit lies in T13N, R3E sects. 29, 30, and 31. The SW. unit is in T13N, R3E, sect. 6 and in sect. 31 of T14N, R3E MDBM (41°33'N., 123°52'W.), USGS Summit Valley and Klamath Glen quads (fig. 181). Ecological subsection – Western Jurassic (M261Aa).

Target Elements

Selected as a representative of the Douglas-Fir-Western Hemlock type (*Pseudotsuga menziesii*-*Tsuga heterophylla*), but actually more representative of Port Orford-Cedar (*Chamaecyparis lawsoniana*)

Distinctive Features

Port Orford-Cedar-Douglas-Fir-Western Hemlock Forest:

This forest is poorly represented in California on Federal lands (most stands on private lands have been logged) and was once more widespread in SW. Oregon. However, root rot (*Phytophthora lateralis*) has decimated some of the best Oregon stands. The ravine-bottom stands are characterized by very large individuals of all three species: Port Orford-cedar (POC) that are 5-6 ft (1.5-1.8 m) dbh and 200-225 ft (61-69 m) tall; Douglas-fir, 6-6.5 ft (1.8-2 m) dbh and 240-250 ft (73-76 m) tall; and western hemlock, 2.5-3.5 ft (0.76-1.1 m) dbh and 160-175 ft (49-53 m) tall. These forests are remnants of moist Tertiary environments when western hemlock and POC coexisted over a much larger area. POC and western hemlock are climax species indicated by abundant regeneration in forest shade, whereas Douglas-fir is seral. Ages of some of the largest POC may exceed 1000 years. The Adorni RNA also contains similar vegetation, but has no hemlock, is dominated by Douglas-fir throughout, and has smaller and younger POC individuals.

Douglas-Fir-Hardwood Forests: These locally most extensive forest types are typical of many lower-elevation areas in the W. Klamath Mountains ecological section. The various slope aspects and successional states of the Upper Goose Creek forests will provide important baseline information on the ecology of this most economically important forest in the Klamath Mountains ecological section. The effects of fire and logging on succession of this forest type can be elucidated by studying these forests' composition, slope exposure, and history of disturbance.

Physical Characteristics

Both units occupy portions of two small side drainages of the East Fork of Goose Creek. The NE. unit covers 140 acres (57 ha), the SW. 320 (130 ha). Elevations range from 1830 to 2450 ft (558-747 m) at the NE. unit and 1840-3440 ft (561-1049 m) in the SW. unit. The NE. unit has the predominant NW.- and SE.-facing slopes about equally represented, whereas the SW. unit has virtually all slope aspects except due S. Inner gorges of both small drainages are steep, and both units have permanent streams.

The rock type is Late Jurassic metasediment (Galice formation). Soils belong to the Sheeitron and Hugo complexes, the former predominating. Very wet winters and occasional summer storms provide the area with an average annual rainfall of somewhat more than 100 inches (2540 mm). Coastal summer fog is occasional, and temperatures are moderate.

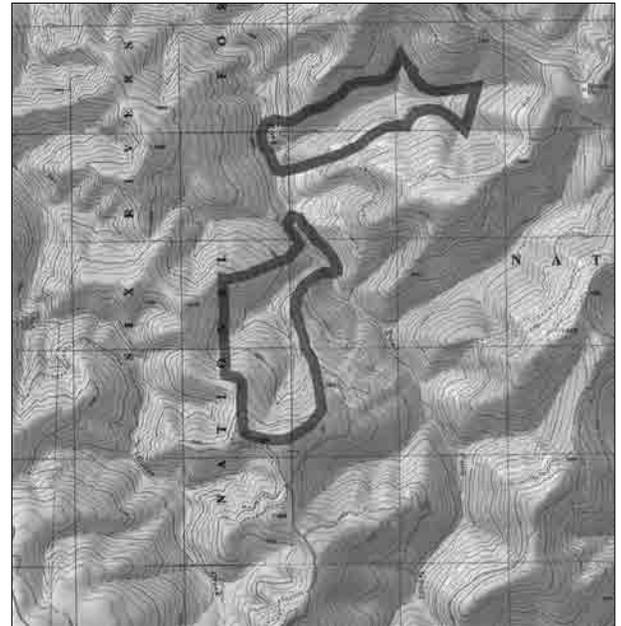


Figure 181—Upper Goose Creek rRNA

Association Types

Eighteen 100-m² plots were sampled in the POC-Douglas-fir-western hemlock forest. For additional vegetation sampling in this area, see Keeler-Wolf (1988b).

Douglas-Fir-Dominated Forests (82420): 111 acres (45 ha) NE. unit, 222 acres (90 ha) SW. unit. These forests cover the majority of the area. They occur in relatively xeric situations upslope from the POC-Douglas-fir-western hemlock types. They may be divided into N.- and S.-facing slope types.

The N.-facing type is characterized by a canopy of Douglas-fir with a subcanopy layer dominated by giant chinquapin (*Chrysolepis chrysophylla*) and a dense shrub layer dominated by *Rhododendron macrophyllum*. Other important understory species are tanoak (*Lithocarpus densiflorus*), *Vaccinium ovatum*, *Gaultheria shallon*, and *Xerophyllum tenax*. Total shrub and herb cover averages about 90 percent.

On S.- and W.-facing slopes without recent crown fire damage, the Douglas-fir canopy is more open relative to N.-facing slopes. There is a hardwood subcanopy dominated by tanoak, with Pacific madrone (*Arbutus menziesii*) and canyon live oak (*Quercus chrysolepis*). The understory also differs from N.-facing Douglas-fir forests with *Gaultheria shallon* frequently dominant in relatively low total cover, along with smaller amounts of *Berberis nervosa*, *Pteridium aquilinum*, *Rubus ursinus*, *Arctostaphylos cinerea*, *Toxicodendron diversilobum*, *Iris* sp., *Xerophyllum tenax*, and *Campanula prenanthoides*.

Port Orford-Cedar-Douglas-Fir-Western Hemlock (82200): 31 acres (13 ha) on SW. unit, 32 acres (13 ha) NE. unit. This association is restricted to very mesic ravines and bottomlands and may be divided into two subtypes: POC-Douglas-fir and western hemlock. Characterized by tall, dense trees with heights up to 250 ft (76 m) and dbh up to 6.5 ft (2 m), this forest averages 1440 trees/ha and a basal area cover of 204 m²/ha. POC has a higher overall importance value than Douglas-fir but a lower basal area. Western hemlock is third in importance. Small understory trees form a scattered layer including *Acer circinatum*, tanoak, bigleaf maple (*Acer macrophyllum*), Pacific dogwood (*Cornus nuttallii*), and giant chinquapin. *Ericaceous* shrubs dominate the understory, covering an average of 40 percent of the ground. *Gaultheria shallon*, *Rhododendron macrophyllum*, *Berberis nervosa*, *Vaccinium parvifolium*, and *V. ovatum* are the principal species. Although 25 species of herbs were recorded in the samples, only three (*Polystichum munitum*, *Blechnum spicant*, and *Coptis lacinata*) account for anything more than trace cover.

The second subtype is characterized by hemlock dominance and tends to be best developed on alluvial flats and relatively gentle slopes. The understory is sparser than the former type because of dense shade and litter. *Oxalis oregana* and *Polystichum munitum* are the most characteristic understory species. The western hemlock-dominated forest typically occurs on the most mesic sites with the deepest soils and the gentlest topography.

Successional Forest (81100, 81400, 37530): 43 acres (18 ha) SW. unit, 12 acres (5 ha) NE. unit. Large areas of surrounding vegetation have been disturbed by crown fire, clear-cutting, or both, over the past 60 or more years. Recent clearcuts are frequently dominated by *Ceanothus velutinus* var. *laevicaulis* with resprouts of tanoak, madrone, giant chinquapin, and canyon live oak along with shrubs such as *Rosa gymnocarpa*, *Rubus leucodermis*, and *Toxicodendron diversilobum*. Skid trails and more heavily disturbed areas are dominated by naturally seeding thickets of Douglas-fir saplings. In addition, Douglas-fir has been planted uniformly throughout most of these cuts. Older successional forests tend to have broad-leaved evergreens dominant in a low 35- to 40-ft (11- to 12-m) canopy with

occasional emergent survivor Douglas-fir. Tanoak and madrone tend to dominate on S.-facing exposures while giant chinquapin is an additional codominant on more N.-facing exposures.

Riparian Woodland (61130, 81A00): The low-volume side streams have a scattered bordering layer of red alder (*Alnus oregona*) up to 32 inches (81 cm) dbh and more than 100 ft (31 m) tall overlying a dense, largely deciduous shrub layer dominated by *Ribes bracteosum*, *Euonymus occidentalis*, *Rubus spectabilis*, and *Rhamnus purshiana*. Herbs of this association include *Boykinia elata*, *Mitella ovalis*, *Aralia californica*, *Athyrium filix-femina*, *Adiantum pedatum*, *Tellima grandiflora*, *Carex ormantha*, *Agrostis longiligula*, *Calamagrostis foliosus*, *Woodwardia fimbriata*, *Petasites palmatus*, and *Aquilegia formosa* (fig. 182).

The riparian zone along the main East Fork of Goose Creek is characterized by more sun, flooding, and alluvium than the riparian zone along the side streams. The red alder trees are relatively small, and many of the more shade-loving species are absent. *Phacelia bolanderi* is characteristic of the gravelly alluvium areas along this stream.

Plant Diversity

Ninety-six taxa are listed.

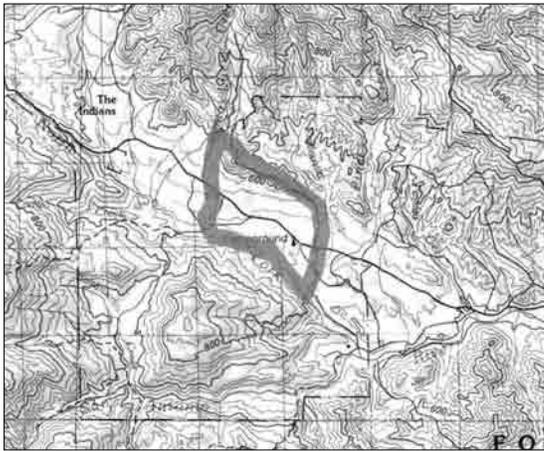
Conflicting impacts

Logging roads may potentially act as transport routes for *Phytophthora lateralis*, the root rot fungus lethal to POC. The SW. unit has more integrity because most of the drainage is within proposed boundaries of RNA. The NE. unit is more vulnerable because its drainage is heavily traversed by roads. Clearcuts and other human disturbances affect edges of both units but not core areas of the target element. There is no erosion associated with human-mediated impacts on side streams, but the main East Fork of Goose Creek shows some increased downcutting, probably resulting from clear-cutting upstream. Despite shortcomings, this rRNA probably contains the best available examples of POC-Douglas-fir-western hemlock forest in California.

Figure 182—Upper Goose Creek, plunge pool of small waterfall in western hemlock/Port Orford-cedar forest in northeast unit of Upper Goose Creek rRNA. *Adiantum pedatum* var. *aluticum* on cliff walls. (1986)



92. Wagon Caves (Keeler-Wolf 1989b)



**Figure 183—Wagon Caves
rRNA**

Location

Recommended for RNA establishment, this area is on the Monterey Ranger District of Los Padres National Forest. It is approximately 45 miles (72 km) SW. of King City, lying within the W. portion of the Las Milpitas Land Grant, which has not been divided into sections. It occurs within T21S, R5E (36°05'N., 121°24'W.), USGS Junipero Serra quad (*fig. 183*). Ecological subsection – North Coastal Santa Lucia Range (261Aj).

Target Element

Valley Oak Woodland (*Quercus lobata*)

Distinctive Features

Valley oak populations in California have declined significantly in recent years. Wagon Caves is the only area selected to represent valley oak in Region 5; it contains diverse stands of valley oak of varying ages and densities (*fig. 184*).

In addition, the area also contains a rich and diverse species of other vegetation types, such as chamise chaparral, riparian forests, wildflower fields, cliff and crevice vegetation, and blue oak savannas. The diversity and extent of the native grasslands in the recommended RNA (rRNA) are high, making it the best example of native grassland in any RNA in California.

Archeological: People of the Salinian culture (also known as the Antonianos) lived in the vicinity of the Wagon Caves, and at least two villages are thought to have been within or adjacent to the area. The overhangs and caves at Wagon Caves have fire-scarred roofs and other signs of use by these ancient people. Additionally, the valley oak groves likely were used by the Salinians as acorn foraging ground.

Fire History: Virtually the entire blue oak woodland SW. of the main road in the area sustained a ground fire in 1985 (known as the Rat Fire). The majority of the valley oak woodland was not affected by this fire. However, the entire stand of chaparral burned in the spring of 1975 (Indians Fire).

Rare Plants: Currently there are no Federally-, State-, or CNPS-listed rare plants occurring in the area.

Physical Characteristics

The study area covers 806 acres (326 ha) with an elevation of 1370-2465 ft (418-751 m). The San Antonio River and Santa Lucia Creek flow through the area.

Geology: The area is underlain by rocks of both sedimentary and granitic origin (Cretaceous age), the latter deposited primarily as alluvium in a broad terrace up to 1 mile (1.6 km) wide above the banks of the North Fork of the San Antonio River. The terrace is dissected by several small arroyos and minor rills.

The most conspicuous rocks in the area are shale and sandstone. Outcrops of Paleocene sandstone in the SW. corner form what are known as the Wagon Caves. The crest of a steeply sloping ridge of shale and sandstone (Miocene) forms the NE. boundary.

Soils underlying the old-growth valley oak are virtually all granitic and classified as Arroyo Seco (gravelly, sandy loam, 5-9 percent (3-5°) slopes, 60 inches [152 cm] deep). Soils underlying the younger, denser valley oak are primarily Lockwood shaley loam (9-15 percent [5-9°] slopes, 36-45 inches [91-114 cm] deep) and San Andreas fine sandy loam (15-30 percent [9-17°] slopes, 20-40

inches [51-102 cm] deep). Santa Ynez fine sandy loam (20-30 inches [51-76 cm] deep) supports the open savanna and grassland. The remaining five soil mapping units are: Santa Lucia-Reliz association, Rock outcrop, Psammets, Fluvents Stony, and Haire loam 15-30 percent slopes.

The general area receives 30 to 40+ inches (762-1016+ mm) of precipitation yearly. Average summer temperature is between 64 and 70 °F (18-21 °C), but highs can reach 110 °F (43 °C). The coldest temperature in the winter months averages 48-53 °F (9-12 °C). The area averages 300-330 frost-free days per year.

Association Types

Valley Oak Woodland (71130): 319 acres (129 ha). Valley oak vegetation occurs in two principal forms throughout California: as dense, closed-canopied forest in riparian areas and as open, park-like woodlands on alluvial deposits and rolling hills (fig. 184). The valley oak of the rRNA is in the open park-like form on alluvial terrace. The valley oak vegetation occurs as open old-growth savanna in the E. part of the rRNA, with trees attaining 5-7 ft (1.5-2.1 m) dbh, 100 ft (31 m) in height, and 550 years. Younger cohorts of trees (10-35 inches [25-89 cm] dbh, 50-60 ft [15-18 m] tall, 83-175 years old) occur in the NW. part of the rRNA along edges of rills and swales. Stand densities vary from open savannas with 5 trees/acre (13 trees/ha) to younger forests of 79 trees/acre (195 trees/ha). Average basal area cover in the old-growth stands is 57 ft²/acre (13.14 m²/ha); it is 139 ft²/acre (32 m²/ha) for the younger forests. Numerous seedlings occur (up to 1352 seedlings/acre [3340 seedlings/ha] in one plot), but saplings are very rare. Survival into sapling size seems hampered by seedling predation and recent drought.

The understories of both young, dense and old, open stands are similar. Both have relatively high cover and are dominated by annual introduced herbs and grasses with few native species. These introduced annuals include *Bromus diandrus*, *B. arenarius*, *B. rubens*, *Marrubium vulgare*, and *Urtica urens*. Dominant native species include *Stipa cernua*, *Lotus purshianus*, *Lupinus nanus*, and *Vulpia grayi*. The only woody understory member (occurring only in the younger stands) is *Toxicodendron diversilobum*.

Valley oak also co-occurs with blue oak (*Quercus douglasii*) and coast live oak (*Quercus agrifolia*) on slopes up to 20° (36 percent) in a small area in the N.-central portion of the rRNA. The valley oaks here are generally small, young, and restricted to mesic sites on N. exposures.

Blue Oak Woodland (71140): 99 acres (40 ha). This association type is limited to the San Andreas fine sandy-loam soils associated with the dendritic drainageways of the S.-central part of the rRNA. Blue oak woodland occurs generally on steeper and shallower soils than valley oak woodland. Occasional foothill pine (*Pinus sabiniana*) and scrubby interior live oak (*Quercus wislizenii*) are found as associates, but otherwise the woodland is completely dominated by blue oak.



Figure 184—Wagon Caves, view northeast through relatively dense, young valley oak stand in Wagon Caves rRNA. Trees in background are a little under 100 years old. (1988)

Most of the blue oak are small and of relatively uniform density and size, most likely as a result of the fire in 1985. Blue oak averages 66 trees/acre (162 trees/ha) with a mean basal area cover of 36.2 ft²/acre (8.3 m²/ha). The average dbh is 13.4 inches (334 cm). The largest individuals are more than 3 ft (1 m) dbh and at least 70 ft (21 m) tall. There is little evidence of recent reproduction (16 seedlings/acre [40/ha]).

The cover and diversity of native species are markedly higher than in the valley oak woodland, although overall herbaceous cover is slightly less for blue oak. Common understory herbaceous species include *Avena fatua*, *Stipa cernua*, *Lagophylla ramosissima*, *Daucus pusillus*, *Vulpia myuros*, and *Erodium cicutarium*.

Grassland (42110/42200/42300): 115 acres (47 ha). This association type is variable in the rRNA and contains elements of Holland's needlegrass grassland, non-native grassland, and wildflower field communities. Typically associated with the valley oak and blue oak woodlands, it also occurs adjacent to sage scrub on the steeper, lower slopes of the NE. ridge. The grassland is relatively open (averaging less than 60 percent cover) and dominated by different species depending on exposure and soil development.

Most of understory species listed for the valley oak and blue oak woodlands also occur in the grasslands. The native-grass-and-herb component of the grasslands at Wagon Caves is high. Native perennial species present include *Stipa cernua*, *Muhlenbergia rigens*, *Elymus glaucus*, *Koeleria macrantha*, *Poa scabrella*, *P. howellii*, *Melica californica*, and *M. imperfecta*. Native herbs include *Lotus purshianus*, *Agoseris retrorsa*, *Brodiaea jolonensis*, *Clarkia rhomboidea*, *C. purpurea*, *Daucus pusillus*, and *Lupinus nanus*. A rich and diverse assemblage of native herb species also occurs on the rRNA in the form of "wildflower fields." Important species in this wildflower type are *Linanthus linifolius*, *L. ciliatus*, *Clarkia purpurea*, *C. rhomboidea*, *Lotus subpinnatus*, *Lasthenia leptalea*, *Madia gracilis*, and *Chorizanthe staticoides*.

Other non-native dominant species include *Avena fatua*, *Bromus rubens*, *B. mollis*, *Vulpia myuros*, *V. dertonensis*, *Erodium cicutarium*, *Medicago hispida*, *Hypochoeris glabra*, *Centaurea melitensis*, and *Brassica nigra*.

Additional species occurring on shallow, rocky, sandstone-derived soil are *Cirsium proteanum*, *Convolvulus malacophyllus*, *Lupinus nanus*, *Centaurea melitensis*, *Orthocarpus densiflorus*, *Plantago hookeriana*, *Chorizanthe membrenacea*, *Corethrogyne filaginifolia*, *Eriophyllum confertiflorum*, and *Calochortus supurbus*.

Chamise Chaparral (37200): 99 acres (40 ha). This association type occurs on the upper slopes of the NE. boundary ridge. It is dominated by *Adenostoma fasciculatum*, which often composes 70 to 100 percent of the shrub cover. Pre-fire height of the chamise is estimated to be up to 10 ft (3 m). Presently, it averages about 4.5-6 ft (1.4-1.8 m). Shrubs of *Quercus dumosa* may be up to 20 ft (6 m).

Herb cover and diversity are very low. Shrubs occurring in the area include *Arctostaphylos glandulosa*, *Dendromecon rigida*, *Ceanothus papillosus*, *Pickeringia montana*, and *Heteromeles arbutifolia*. Coast live oak occurs as shrubby islands on the xeric upper ridge, in hollows and drainageways, and as scattered individuals on the slopes. A fuel break along the spine of the ridge provides opportunity for colonization by *Ceanothus papillosus*, *Pickeringia montana*, *Galium nuttallii*, *Camissonia contorta* var. *epiloboides*, *Cryptantha microstachys*, *C. muricata*, and other herbs typical of post-fire/recently disturbed chaparral.

Riparian (61200/61210/63310): 85 acres (34 ha). Several types of riparian vegetation occur within the rRNA. Along the upper banks of both Rattlesnake and Santa Lucia creeks is a band of coast live oak riparian woodland. In the alluvium of Santa Lucia Creek is a woodland with scattered white alder (*Alnus rhombifolia*) and California sycamore (*Platanus racemosa*). At the NE. corner of the rRNA, a dense white alder riparian stand occupies the small

stretch of permanent water along the Santa Lucia Creek. Along the North Fork of the San Antonio River is a well-developed riparian community dominated by white alder, willows (*Salix lasiandra*, *S. melanopsis*), mule fat (*Baccharis viminea*), and sycamore.

The understory is sparse and composed mainly of *Apocynum cannabinum*, *Datisca glomerata*, *Erigeron philadelphicus*, *Heleocharis palustris*, *Boisduvalia densiflorus*, *Castilleja* sp., and *Mentha spicata* in the San Antonio River area. Around the Wagon Caves area, *Cyperus eragrostis*, *Carex barbarae*, *C. densa*, *Veronica americana*, *Epilobium adenocaulon*, *Stachys pycnantha*, *Urtica holosericea*, *Gnaphalium palustre*, and *Trifolium variegatum* are common herbs.

Rock Outcrop (no Holland equivalent): 56 acres (23 ha). The Wagon Caves rock outcrops contain many crevice and rock-face species. These species include *Carex brevicaulis*, *Arctostaphylos pungens*, *Cercocarpus betuloides*, *Corethrogyne filaginifolia*, *Dudleya cymosa* ssp. *minor*, *Erigeron foliosus* var. *stenophyllus*, *E. petrophilus*, *Haplopappus squarrosus*, *Hiercium argentum* var. *parishii*, *Keckiella breviflora*, *Melica imperfecta* var. *flexuosa*, *Mimulus bifidus* ssp. *fascicularis*, *Pedicularis densiflorus*, *Pterostegia drymarioides*, *Selaginella bigelovii*, and *Silene californica*.

Sage Scrub (32600): 33 acres (13 ha). This association type forms an irregular zone between the grassland and chamise chaparral on the steep (30-70 percent [17-35°]) slopes of the NE. boundary ridge. Characteristic species include *Artemisia californica*, *Yucca whipplei* ssp. *percursa*, *Lotus scoparius*, *Avena fatua*, *Eriogonum fasciculatum*, *Galium nuttallii*, *G. californicum*, *Lupinus albifrons*, *Zauschneria californica* ssp. *mexicana*, *Stephanomeria virgata*, and *Monardella villosa*.

Rock outcrops are often associated with this vegetation and include many of the species previously listed for this type.

Plant Diversity

Two hundred twenty-seven species of vascular plants are listed.

Conflicting impacts

A paved, well-traveled, main county road passes through the rRNA. Shell casings and damaged tree bark are evidence of regular shooting and target practice. Camping, fishing, and rock climbing are common in the area.

Grazing occurs in the rRNA and is heaviest along the riparian zone (San Antonio River) and within the valley oak savannah.

93. Whippoorwill Flat (Keeler-Wolf and Keeler-Wolf 1976, Keeler-Wolf 1989o)

Location

This established RNA is on the Inyo National Forest about 18 miles (29 km) SSE. of the town of Big Pine. The RNA falls partly or wholly within sects. 23, 24, 25, 26, 35, and 36 of T10S, R36E MDBM and also within sects. 1 and 2 of T11S, R36E MDBM (37°3'N., 118°0'W.), USGS Waucoba Mtn. and Waucoba Spring quads (fig. 185). Ecological subsection – Inyo Mountains (341Fb).

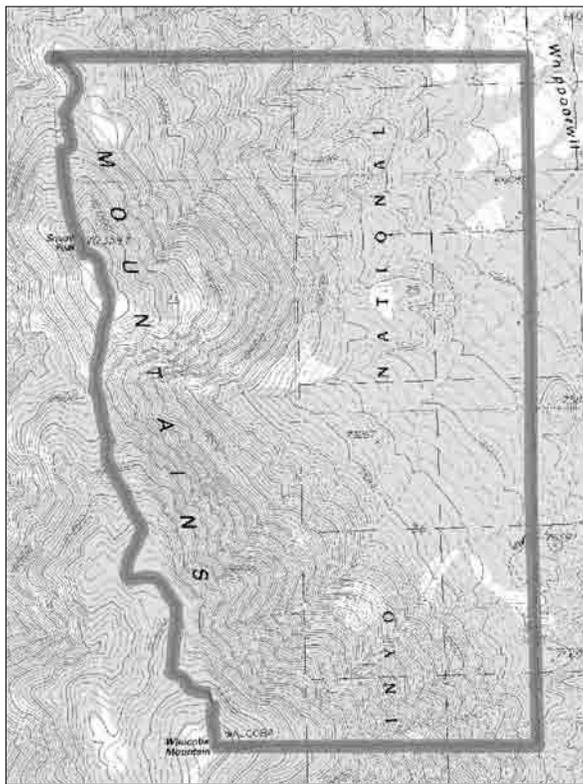


Figure 185—Whippoorwill Flat RNA

Target Elements

Pinyon-Juniper (*Pinus monophylla*-*Juniperus osteosperma*) and Limber Pine (*Pinus flexilis*)

Distinctive Features

Dense, Well-Developed Pinyon Forest: The granitic alluvium in the E.-central portion of the RNA appears to be optimal substrate for single-leaf pinyon pine. Numerous specimen trees exist with single, straight trunks and spreading crowns. Growth rates are relatively rapid (16 inches [41 cm] dbh in 100 years), and densities are high. The high density and large stature of the pinyon pines provide an excellent habitat for many animal species, some not typically found in high numbers in pinyon associations. For example, gray flycatchers (*Empidonax wrightii*), hermit thrushes (*Catharus guttatus*), western tanagers (*Piranga ludoviciana*), mountain chickadees (*Parus gambeli*), and pinyon mice (*Peromyscus truei*) are notable for their high densities.

Substrate Differences: The diverse rock types, ranging from granite through shale and limestone, provide a backdrop for comparative work on ecological amplitudes of many species within several communities of the Great Basin mountains, including bristlecone pine (*Pinus longaeva*) forest, sagebrush scrub, pinyon forest, and *Cercocarpus* scrub.

Effect of Climate on Vegetation Types: Although the area is notable for its large area of contact between the bristlecone-limber pine forest and the pinyon-juniper zone, several small bare zones – largely uncolonized by trees – separate the two coniferous associations. Upon close inspection, it appears that these zones, with a tendency towards NE. exposures, are a dynamic boundary between the two associations. At present, dead stems of limber and bristlecone pines are scattered through these bare patches, many dead and dying bristlecones and limbers occur above the bare areas, and numerous young pinyons occur at the lower edges of them. This suggests that over the past several hundred years there has been a trend for the local subalpine forest to retreat upslope, while pinyon forest has advanced somewhat to replace it. The long persistence of stands of dead bristlecone pine stems elsewhere has been shown to indicate climatic change (LaMarche and Mooney 1967, Mooney 1973).

Archeological: Pinyon pine nuts, in large supply in the dense forest on the E. side of the RNA, were an important source of food for the Paiute and Shoshone Indians. Many signs of their inhabitation have been discovered including wickiup circles, obsidian chips and tools, pinyon-nut storage cairns, and so forth. The name Waucoba (from the prominent mountain along the W. boundary of the RNA) means “pine” in Paiute.

Physical Characteristics

The area covers 3328 acres (1347 ha). Elevations range from about 6800 ft (2073 m) in the NE. corner of the area to 11,123 ft (3390 m) atop Waucoba Mountain. The area occupies the E. flanks and upper bajada slopes of Squaw Peak (10,358 ft, 3157 m) and Waucoba Mountain. Topography is steep and rugged on the upper slopes of the mountains, but it becomes moderate to gradual on the lower slopes.

The lower slopes are predominantly Quaternary granitic alluvium brought down from the slopes of Waucoba Mountain. The coarse alluvium is cut by several arroyos up to 35 ft (11 m) deep and broken by several small outcrops and ridges of Precambrian metasedimentary shale (Wyman formation). All of Squaw Peak is composed of Wyman formation, which also includes oolitic limestones locally transformed into marbles and dolomite. The main canyon separating Squaw and Waucoba has a conspicuous outcrop of this marble. The Papoose Flat quartz monzonite is the Cretaceous granitic rock in the area and underlies virtually all of Waucoba Mountain. A small amount of the Precambrian Reed Dolomite occurs in the E. portion of sect. 36.

Soil units include Abgese-Berent-MacKey families 2-15 percent slopes; Brad family-rock outcrop, granitic complex 15-30 percent slopes; Mescamp-Summing families-Rock outcrop, metasedimentary complex, 30-60 percent slopes; Rock outcrop-rubbleland complex, Rock outcrop, granitic-Brad-Hartig families complex, 30-60 percent slopes; Rock outcrop, granitic-Brad-Hartig families complex, 60 to 80 percent slopes; and Washoe-Checkett-Mulett families association, 30 to 60 percent slopes.

Precipitation is thought to be relatively high locally, between 15 and 22 inches (381-559 mm) per year, with the majority falling as snow in the winter and occasional significant summer thundershowers. Temperatures range from July maxima of 86-93 °F (30-34 °C) to January minima of about 0 °F (-18 °C).

Association Types

Seven 100-m² plots were sampled in the dense pinyon forest, and three 100-m² plots were sampled in the mixed pinyon-juniper phase.

Pinyon Forest and Pinyon-Juniper Woodland (72122, 72121): 1954 acres (791 ha). This association may be divided into two types: a mixed *Pinus monophylla* and *Juniperus osteosperma* woodland on the slopes and ridges underlain by Wyman formation and Papoose Flat granite, and a *Pinus monophylla* forest phase on the granitic alluvium (fig. 186) in sects. 25 and 36.

The sample from the dense pinyon forest on the alluvium has an average density of 730 pinyon pines/ha. Ten shrubs are typical of this association, the most important of which are *Artemisia tridentata*, *Lupinus palmeri*, *Ribes velutinum* var. *glanduliferum*, *Opuntia erinacea* var. *erinacea*, and *Chrysothamnus viscidiflorus*. Thirty species of grasses and herbs are enumerated in the sample, with such species as *Gilia ophthalmoides*, *Cryptantha echinella*, *Mimulus densus*, *Gayophytum diffusum* ssp. *parviflorum*, *Lomatium nevadense*, *Poa* sp., *Sitanion hystrix*, *Eriogonum panimentense*, *Cryptantha flavoculata*, and *Erysimum capitatum* among the most frequent.



Figure 186—Whippoorwill Flat, view south from small knoll just east of the Whippoorwill Flat RNA in the SW - sec. 31 showing dense, pure single-leaf pinyon pine forest on granitic alluvium. Inyo Mountains and Saline Valley in distance. (1987)

In the typical pinyon-juniper phase, pinyon pine dominates over juniper at a ratio of about 2:3. Total density of stems (including multiple trunks of juniper) on the small sample is 930 trees/ha. However, most areas appear substantially lower in density than the sample. Typical shrubs include *Artemisia arbuscula* ssp. *nova*, *Chrysothamnus nauseosus*, *Ribes velutinum* var. *glanduliferum*, and *Opuntia erinacea*. Herbs include *Penstemon floridus* ssp. *austinae*, *Petalostemum searlsiae*, *Gilia ophthalmoides*, *Cordylanthus helleri*, *Stanleya elata*, and *Astragalus minthorniae* var. *villosus*.

Sizes of the typical mature pinyon pine on the alluvium are 16-20 inches (41-51 cm) dbh and 35-45 ft (11-14 m) tall. These trees range between 100 and 150 years with occasional dominants slightly more than 200 years. Reproduction of both types of trees is good.

Nearly the entire elevational range of the local pinyon association is represented. At the NE. corner of the area, the pinyon-juniper association gives way to the sagebrush scrub of lower elevations, whereas between 8300 and 8600 ft (2530-2621 m), the pinyon forest commonly grades abruptly into the bristlecone-limber pine forest (on N. exposures) or *Cercocarpus* scrub (on S. exposures).

Bristlecone-Limber Pine Forest (86400, 86700): 711 acres (288 ha). This association covers the upper slopes of Squaw Peak and Waucoba Mountain and N.-facing limestone canyons from summits to about 8800 ft (2682 m) (as low as 8300 ft, 2530 m, in the canyon between Squaw Peak and Waucoba Mountain). Bristlecone pine dominates on steep N.-facing exposures, and limber pine tends to dominate on more gently sloping exposures. The two species also form extensive mixed forests on the upper E. exposures of Waucoba Mountain and on the NE. slope of Squaw Peak. Both species are replaced by sagebrush scrub on the exposed summits of Waucoba Mountain and Squaw Peak and tend to occur primarily on E.- and N.- facing slopes. At the lowest elevations, bristlecone pine appears restricted to calcareous soils. However, at upper elevations on Waucoba Mountain bristlecone pine grows exceptionally well on granitic soils.

No sampling was conducted in these forests. Tree densities are estimated as averaging between 300 and 700 trees/ha. Many of the limber and bristlecone pines are moderate-aged and reproducing well. The largest bristlecones noted are about 60 inches (1.5 m) dbh. No tree ring studies have been made, but a number of trees, particularly on the exposed lower S. slopes of Squaw Peak, appear to be at least in the 3000-year-old range. The largest limber pines are 40-44 inches (1-1.1 m) dbh. Typical canopy height is 40-45 ft (12-14 m) with dominants of both species up to 55 ft (17 m). The understory is moderately sparse to very sparse with occasional *Ribes cereum*, *Cercocarpus ledifolius*, *Artemisia tridentata*, and scattered subalpine herbs in low duff areas. Fire charring from lightning strikes is common, but fires rarely spread beyond one or a few trees, owing to the light duff and open understory.

Sagebrush Scrub (35210, 35220): 476 acres (193 ha). This association varies somewhat, depending on soil depth, substrate, and elevation. In general, however, it is dominated by either *Artemisia tridentata* (on deeper soils) or *Artemisia arbuscula* ssp. *nova* (shallower and calcareous soils) with *Purshia glandulosa*, *Ephedra viridis*, *Chrysothamnus viscidiflorus* ssp. *viscidiflorus*, *Chrysothamnus viscidiflorus* ssp. *pumilus*, and *Chrysothamnus nausiosus* ssp. *albicaulis*. At low and mid-elevations herbs include *Eriastrum wilcoxii*, *Gilia ophthalmoides*, *Eriogonum panamintense*, *Allium atrorubens* var. *inyoensis*, *Astragalus minthorniae*, *Lomatium nevadense*, *Mentzelia montana*, *Calyptidium roseum*, *Penstemon confusus*, *Cryptantha circumscissa*, *C. watsonii*, *Arabis holboellii* var. *retrofracta*, *Oxytheca dendroidea*, and *Sphaeralcea ambigua*.

The high-elevation sagebrush scrub on the summits of Squaw and Waucoba has many subalpine herb species intermixed and may be considered subalpine

sagebrush scrub (Holland 35220). This phase covers 114 acres (46 ha) and includes such species as *Astragalus lentiginosus* var. *semotus*, *A. calycosus*, *Cymopterus cinerarius*, *Oxytropis viscida*, *Erigeron clokeyi*, *Arenaria nuttallii* ssp. *gracilis*, *Eriogonum ovalifolium* var. *nivale*, *Castilleja nana*, *Artemisia norvegica* var. *saxatilis*, and *Ipomopsis congesta* ssp. *montana*.

Density of shrubs and herbs varies, with the lowest elevation and deepest soil stands typically having the highest shrub density while the subalpine ridgetop stands maintain lowest densities.

Cercocarpus Scrub (no Holland equivalent): 187 acres (76 ha). This minor association covers the upper rocky slopes of Squaw Peak and Waucoba Mountain on harsh S. and W. exposures as well as a few low-elevation outcrops of limestone in the E. portion of sect. 36. *Cercocarpus ledifolius* dominates on most sites except dry limestone or marble outcrops where *C. intricatus* is important. Shrub densities may be open to dense depending on slope steepness and rockiness. Associated species are relatively few and include *Chamaebatiaria millefolium*, *Holodiscus microphyllus*, and *Ribes cereum*. At lower elevations *Juniperus osteosperma* and occasional *Pinus monophylla* may occur with the mountain mahoganies and *Tetradymia canescens*, *Artemisia arbuscula*, *Eriogonum heermannii*, *Astragalus calycosus*, *A. purshii* var. *tinctus*, and *Cryptantha confertiflora*.

At higher elevations such as the saddle between Squaw Peak and Waucoba Mountain, more subalpine species such as *Lesquerella kingii*, *Trifolium andersonii* ssp. *monoense*, *Erigeron clokeyi*, *Ipomopsis congesta* ssp. *montana*, *Stipa comata*, *Poa epilis*, *P. incurva*, and *Sitanion hystrix* occur.

Plant Diversity

One hundred forty-five species are listed.

Conflicting impacts

Feral burros had an impact on the shrubby and herbaceous vegetation before the late 1970s, but they have been controlled, with good vegetation recovery. Some woodcutting and prospecting have taken place in the area adjacent to two poorly maintained dirt roads that just enter the extreme E. portion of the area. Litter and other disturbance around informal campgrounds are minimal.

94. White Mountain (White Mountain Natural Area) (Taylor 1979)

Location

This established RNA is on the Inyo National Forest, in Mono County. It lies in the S. White Mountains about 16 miles (26 km) NE. of Bishop. It occupies portions of sects. 1, 12, 13, 14 of T5S, R34E and sects. 6, 7, 8, 18 of T5S, R35E MDBM (37°31'N., 118°11'W.), USGS Mt. Barcroft quad (fig. 187). Ecological subsection – White Mountains (241Dj).

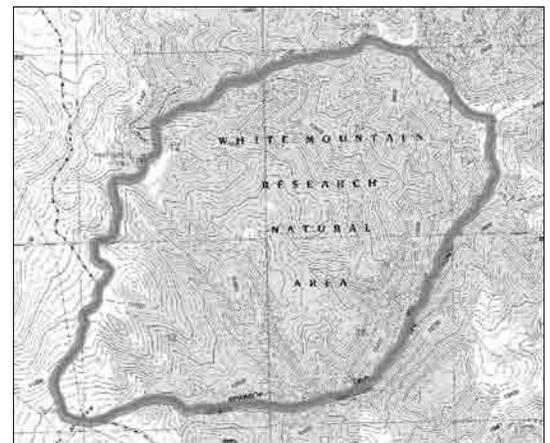
Target Element

Bristlecone Pine (*Pinus longaeva*)

Distinctive Features

Research in Bristlecone Pine Woodland: The area has been used extensively by scientists since the early 1950s as a site for dating ancient bristlecone pines (e.g., Schulman 1954). Additional studies on the vegetation patterns exhibited by the local bristlecone pine

Figure 187—White Mountain RNA



stands have also been done in the RNA (e.g., edaphic restrictions between woodland and *Artemisia* scrub, Wright and Mooney 1965), as has paleoclimatic work relating to fossil timberlines (LaMarche and Mooney 1967).

Rare Plants: The following species known from the RNA are listed by CNPS: *Astragalus kentrophyta* var. *danaus* (List 4), *Lomatium foeniculaceum* ssp. *inyoense* (List 4), bristlecone pine (List 4), and *Scirpus rollandii* (List 2). *Carex scirpiformis*, although not listed by CNPS, is apparently a first record for California.

Physical Characteristics

The area covers 2303 acres (932 ha) (listed as 2004 acres [811 ha] in the forest plan) and ranges in elevation from 9439 to 11,434 ft (2877-3485 m). The area lies on the E. side of the White Mountain crest and is drained by Poison Creek and the South Fork of Cottonwood Creek; both are ephemeral in the RNA. Slopes are steep, averaging 30° and are E.- to SE.-trending for the most part. No evidence of Pleistocene glaciation occurs within the area, although Pleistocene-patterned ground is evident at the summit area.

Bedrock varies from the Precambrian Reed dolomite and Wyman formation (also calcareous) to extensive outcrops of granitic rock (Jurassic quartz monzonite), which outcrop mostly N. of the area. Soils are shallow lithosols. Annual precipitation is about 14 inches (347 mm), and temperatures are cold, with the mean annual temperature about 34 °F (1.3 °C).



Figure 188—White Mountain, lower reaches of White Mountain RNA at junction of South Fork Cottonwood Creek with Poison Creek. *Pinus longaeva* – *Cercocarpus intricatus* vegetation is seen on the slopes in the background. *Pinus flexilis* – *Cercocarpus ledifolius* and *Artemisia tridentata* ssp. *vaseyana* vegetation is seen in the foreground slopes. Small meadow in foreground is bordered by *Artemisia cana* ssp. *bolanderi* and *Salix pseudocordata*. (1977)

Association Types

Seven 706-m² plots were sampled in the bristlecone pine association. No acreages are given for the associations.

Bristlecone Pine Association (86400): Bristlecone pine forms an open, subalpine woodland in the upper reaches of the area. Canopy cover is about 15-20 percent maximum. Bristlecone pines in this vegetation are almost always multi-trunked and massive. Basal area and density of bristlecone pine average 59.7 m²/ha and 128 stems/ha.

Bristlecone Pine/*Cercocarpus intricatus* Association (86400): Subalpine forests on dolomite below about 10,170 ft (3100 m) are an admixture of bristlecone pine with or without the shrub *Cercocarpus intricatus* (fig. 188). No sampling is provided, although there is a limited description.

Limber Pine/*Cercocarpus ledifolius* Association (86400, 86700): Limber pine codominates the tree canopy of the lower slopes in the area with bristlecone pine on rocky sites. Canopy cover is higher than in the upper-slope bristlecone pine woodland, approaching 50 percent, and bristlecone pine trunks are more tapered. *Cercocarpus ledifolius* replaces *C. intricatus*, and hybrids are common.

***Phlox covillei*/*Eriogonum gracillipes* Association (91140):** This type is limited to alpine sites underlain by Reed dolomite. Vegetation is sparse (<30 percent cover). *P. covillei* and *E. gracillipes* are diagnostic and dominant. Other common species include *Linum lewisii*, *Astragalus calycosus*, *A. kentrophyta* var. *danaus*, and *Hymenoxys cooperi*. The type is restricted to the upper slopes of the area just at timberline on N. slopes or snow accumulation areas. It covers about 10 percent of the area.

***Artemisia rothrockii* Association (35220):** Low shrubs dominate this type, predominantly *A. rothrockii* and *Chrysothamnus viscidiflorus*. Additional species include *Stipa pinetorum*, *Lupinus meionanthus*, *Agoseris glauca*, and *Cryptantha*

jamesii. This vegetation is limited to calcareous substrates at the upper elevations of the area. *A. rothrockii* dominates shallow depressions or drainages filled with colluvium. Cover is moderately high. This association covers about 10 percent of the area.

Aspen (*Populus tremuloides*) Association (81B00): Aspen forms dense clones on mesic lower sites along Poison and the South Fork of Cottonwood creeks. The understory is dense with such species as *Elymus cinereus*, *Agropyron trachycaulum*, and *Artemisia dracuncululus*.

Meadows (45210, 45220): Meadow vegetation occurs at the junction of Poison and the South Fork of Cottonwood creeks and on the SW. corner on rolling slopes. The latter locale is dominated by *Juncus balticus*, *Poa fendleriana*, *Muhlenbergia richardsonis*, and *Carex douglasii*. Meadows along the lower reaches of the area are perennially wet, whereas the upper meadow is dry by midsummer. The lower meadows have a willow border (*Salix leutea* and *S. pseudocordata*) with *Artemisia cana* dominant at high calcium sites along with *Carex praegracilis*, *Melica bulbosa*, and *Muhlenbergia richardsonis*. The meadow proper is dominated by *Deschampsia caespitosa*, *Carex nebrascensis*, *C. scirpiformis*, *Scirpus pumilis*, and *Sisyrinchium idahoense*.

Plant Diversity

One hundred seventy-six species of vascular plants are listed.

Conflicting impacts

A gravel road leading to the Patriarch Grove, a well-visited tourist site, forms the upper boundary. A short trail with rest benches enters the area for several hundred meters. However, direct human impact is negligible over most of the area except the nature trail, where some litter and cut snags are apparent. The meadow areas have been grazed fairly heavily (considered a serious threat to the populations of *Carex scirpiformis* and *Scirpus rollandii* in 1979), and there is some trespass of livestock into the upper edge of the area near Campito Meadow.

Note: for White Mountain Natural Area, see White Mountain, #94

Note: for White Mountain Summit, see McAfee, #56

95.Wilder Ridge (Rundel and Shultz 1992, Cheng 1996e)

Figure 189—Wilder Ridge RNA

Location

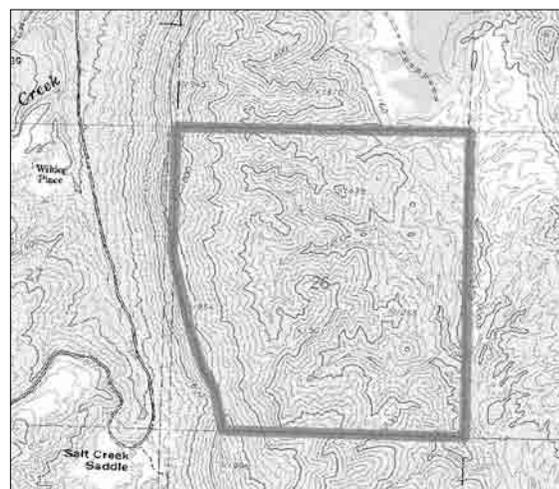
This established RNA is located on the E. edge of Corning Ranger District in Mendocino National Forest. It lies on the E. slope of the N. Coast Ranges in Tehama County and encompasses most of sec. 26 T23N, R7W MDBM (39°49'15"N., 122°37'30"W.), USGS Newville quad (fig. 189). Ecological subsection – Western Foothills (M261Ca).

Target Elements

Chamise (*Adenostoma fasciculatum*) Chaparral

Distinctive Features

Wilder Ridge, running N.-S. on the W. border of the RNA, is the dominant physical feature. It is on an outlying range E. of the main body of the Coast Range. The dominant botanical feature



is chamise chaparral, which covers most of the RNA. Intermingled with small areas of foothill pine (*Pinus sabiniana*)-oak woodland and non-native grassland, the chamise chaparral is typical for areas N. of the Carquinez Strait in the inner Coast Range (fig. 190).

Rare Plants: Two CNPS List 1B plants occur in the RNA, *Eriastrum brandegeae* and *Antirrhinum subcordatum*. Both are found in the chamise chaparral vegetation type.

Rare Fauna: The presence of Peregrine falcon (*Falco peregrinus anatum*, Federally- and State-listed endangered species) in the RNA has been confirmed, and that of prairie falcon (*Falco mexicanus*, State-listed species of special concern) has been suggested strongly by surveys conducted by Forest Service employees.

Fire History: The last fire to occur in the RNA was in 1952. It apparently started on private land N. of the RNA. There are no records of other fire events within the RNA. This relatively rare fire occurrence may be a result of the unique geological stratum, topographical position, and vegetation mosaic of the RNA. Fires from human ignitions are unlikely to spread into the RNA except from the N. side. The ridgetop along the W. edge of the RNA is underlain by a stratum that presents an unstable surface of very low fertility. This provides a broad firebreak of rocks almost bare of vegetation. Along the E. boundary, vegetation is extremely sparse and appears to act more as a fuel break than as a source of ignitions. Vegetation along the S. boundary is continuous, a mosaic of chaparral, woodland, and savannah similar to the RNA. Fire could spread into the RNA from this side, but there are no roads or habitations for many miles. Such conditions also allow the RNA to have an experimental fire regime because: (1) there is low risk of fire escaping out of the RNA, (2) it is protected from human-caused fires originating outside the RNA, and (3) it has clear, logical lines for controlling burns from within.

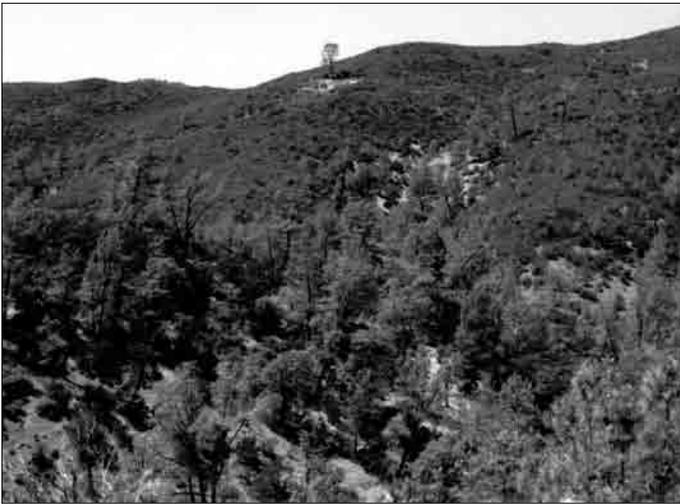


Figure 190—Wilder Ridge, dominant matrix of chamise chaparral with local populations of foothill pine in Wilder Ridge RNA. (around 1991)

Physical Characteristics

The total area in Wilder Ridge RNA is 570 acres (231 ha). From the valley bottom on the E. edge to the crest of Wilder Ridge on the W. of the RNA, the elevation range is about 854 ft (260 m). Several small ridges branch out from Wilder Ridge running toward the E. The slopes on the Wilder Ridge are extremely precipitous with some up to 80 percent (38°). The branching ridges are gentle, with 5-15 percent (3-8°) slopes on top and 20-30 percent (11-17°) on slopes between ridgetops and the drainages. In the RNA, several knobs exist. Elevations of the knobs range from 1200 ft (366 m) to just over 1500 ft (457 m).

Several unnamed ephemeral drainages can be found in the RNA, flowing to the E. These drainages meet Salt Creek and then flow SE. No perennial surface flow of water is present, but a subsurface flow is present throughout the year. Soils in the RNA are generally shallow to very shallow and highly eroded.

The climate is Mediterranean with wet, cool winters and warm, dry summers. More than 90 percent of the precipitation is concentrated between October and April. The nearest weather station is the Paskenta Ranger Station, from which complete precipitation data are available. Average annual precipitation is approximately 24 inches (61 cm). Other stations in the area with complete climatological data are Covelo and Orland, which represent the climatic extremes of Wilder Ridge RNA. Climate in the RNA is in the middle of

a gradient from coastal on the W. (Covelo, 55.3 °F [12.9 °C] average annual temperature) to inland (Sacramento Valley) on the E. (Orland, 61.4 °F [16.3 °C] average annual temperature).

Association Types

Pure chamise covers the upper third of the slope and all but the N. aspects of draws. The N.-facing slopes contain a mixed shrub type of manzanita (*Arctostaphylos* spp.), toyon (*Heteromeles arbutifolia*), California bay (*Umbellularia californica*), scrub oak (*Quercus dumosa*), and some interior live oak (*Quercus wislizenii*). The middle third of the area is predominantly chamise with small groups of young foothill pine and scattered, older foothill pine jutting through the shrubs. There are some small openings of annual grass occurring in this zone, with several varieties of small herbaceous and woody plants on the N. aspects. The E. edge of the area is grassland or savannah type; ground cover is predominantly annual grasses with sparse blue oak (*Quercus douglasii*) overstory.

Chamise Chaparral (37200): This is the major vegetation type in the RNA, covering approximately 340 acres (138 ha). *Adenostoma fasciculatum* is the dominant species. It occupies higher elevations of the W. third of the RNA, with nearly 100 percent cover and a height of 5.0 to 6.6 ft (1.5-2.0 m). In the center portion of the RNA, chamise chaparral is more open than that of the W. third of the RNA and interspersed with foothill pine and manzanita (fig. 190). In the E. third of the RNA, the chaparral is open with highly diversified annual and perennial herbaceous species. On steeply plunging slopes within this vegetation type, open woody populations of *Eriodictyon californicum*, *Ceanothus cuneatus*, *Eriogonum nudum*, and *Eriophyllum confertifolium* are often found. Understories are herbaceous species including *Avena barbata*, *Linanthus ciliatus*, and *Sanicula bipinnata*. Small areas of woodland associated with ephemeral riparian systems and subsurface flows also are included in this vegetation type. Interior live oak, cottonwood (*Populus fremontii*), willows (*Salix* spp.), toyon, California buckeye (*Aesculus californica*), mountain mahogany (*Cercocarpus betuloides*), western redbud (*Cercis occidentalis*), foothill pine, and poison oak (*Toxicodendron diversilobum*) are notable in these areas.

Foothill Pine-Oak Woodland (71410): Foothill pine and blue oak are the characteristic species of this vegetation type. Other species include *Ceanothus cuneatus*, *Haplopappus linearifolius*, *Elymus caput-medusae*, *Gilia tenerrima*, *Bromus rubens*, and *Bromus mollis*. Distribution of this woodland is fragmental, due to soil conditions. Soils here are shallow lithosols, classified as Millsholm clay loam, which support the chaparral community. However, in places where tree roots can penetrate (soils are deep or fracture planes occur in the parent material), the woodland community replaces the chaparral. The woodlands occur on a range of slopes and exposures but are most apparent on gently sloping, broad ridgelines, along drainage bottoms, and on N.-facing slopes.

Non-Native Grassland (42200): This vegetation type occurs on the E. margin of the RNA. It is the area where cattle grazing is concentrated and where human use may have occurred. Along with introduced annual grasses such as *Aira caryophylla*, *Avena barbata*, *Bromus rubens*, *Bromus mollis*, and *Festuca dertonensis*, there are also native grasses and forbs such as *Plantago hookeriana*, *Salvia columbariae*, *Melica californica*, and *Poa scabrella*. Rarely, on the ephemeral stream bank, small patches of deergrass (*Muhlenbergia rigens*) can be found. On the shallow soil in the NE. corner of sec. 26, *Eriogonum wrightii* ssp. *membranaceum* (undetermined, Isle personal communication 1996) grows.

Plant Diversity

At least ninety-five vascular plant species occur in the RNA.

Conflicting impacts

There is one grazing allotment in the RNA. Most of the grazing takes place in the main valley along the E. edge of the RNA, in the open savannah with moderate slopes. Cattle trails also are found in open chaparral, but the impacts of trampling and chiseling are limited to those routes only. The primary impact of grazing on the vegetation of Wilder Ridge RNA may have been the replacement of native grasses with introduced annuals. This is typical of much of California grasslands, and current grazing levels are not thought to alter this condition.

96. William B. Critchfield (Bourland Meadow) (Petersen 1994c, Talley 1976)

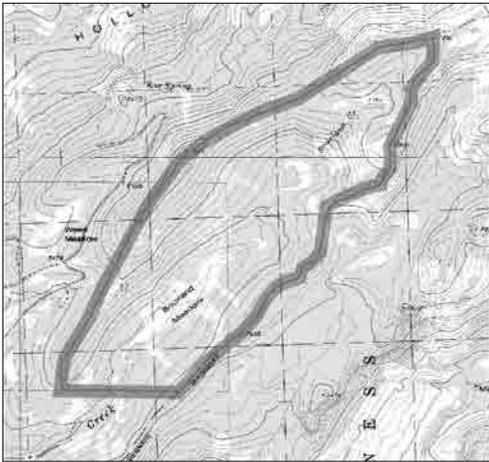


Figure 191— William B. Critchfield RNA

Location

This established RNA is on the Stanislaus National Forest about 7 miles (11 km) SE. of Pinecrest. It lies within sects. 8, 9, 16, and 17 T3N, R19E MDBM (38°6'N., 119°54'W.), USGS Pinecrest and Cherry Lake North quads (fig. 191). Ecological subsection – Upper Batholith and Volcanic Flows (M261Eh).

Target Element

Red Fir (*Abies magnifica*)

Distinctive Features

Red Fir Growth, Recruitment, and Succession: Growth rates of red fir vary widely, depending on exposure, with open S.-facing slopes providing the fastest growing conditions. There, height growth may attain 16 inches (41 cm) per year for trees between 20 and 100 years of age at breast height. Median growth rates are 14 inches (35 cm) per year for trees 30-110 years old at breast height on dense stands with S.-facing slopes, forested stands on gentle ridge crests, and young developing stands on N.-facing slopes.

The red fir forest at Bourland Meadow has a stable all age-class distribution. However, on a small scale, individual plots show marked gap-phase reproduction with thickets of young fir and pines developing in openings created by windfalls. The heavy shade of developing and mature stands suppresses saplings and seedlings, causing slow growth rates in the reproduction layer away from gaps.

There is evidence of primary succession in dry meadow sites. Here red fir is invading sites not characterized by porous sandy soil and also colonizing lodgepole pine (*Pinus contorta* ssp. *murrayana*) and aspen (*Populus tremuloides*) forest. In other areas, such as some *Quercus vaccinifolia* scrub, red fir also appears to be advancing. These types of invasions into adjacent habitats have been noted elsewhere (e.g., Oosting and Billings 1943) and appear to be a widespread phenomenon in the Sierra Nevada.

Unlike red fir sites in the extensive samples of Oosting and Billings (1943), those at Bourland Meadow appear to have lower relative basal area. This results from other important associated tree taxa such as white fir (*Abies concolor*), Jeffrey pine (*Pinus jeffreyi*), and western white pine (*P. monticola*). This added diversity of trees in this normally monospecific forest is possibly the result of a slightly warmer and more open nature of the Bourland Meadow red fir forests compared to other red fir locations sampled in the Sierra Nevada.

The lack of fire as an important influence on the local red fir forest is typical for this association. It is evidenced by the lack of pine saplings and such fire indicators as *Arctostaphylos nevadensis* in the understory as well as an absence of fire scars on mature trees.

Physical Characteristics

The area covers 1003 acres (406 ha) between 7240 and 7990 ft (2207-2435 m) on the W. slope of the Sierra Nevada. The site covers the uppermost watershed of Bourland Creek. The Emigrant Wilderness lies along the SE. boundary. About 75 percent of the area has either SE.- or NW.-facing exposures. The site is underlain by both Mesozoic granitic rock and Pleistocene volcanics, with volcanics predominating. Quaternary alluvium underlies the meadow area. Soils vary from nonexistent on granitic outcrops to deep, organic-rich meadow soils. Annual precipitation is 50-60 inches (1270-1524 mm).

Association Types

Nineteen 700-m² plots were sampled in the red fir forest.

Red Fir Forest (85310): 562 acres (228 ha). Four subdominants occur with red fir, not exceeding 25 percent of total tree stratum cover either singly or in combination. These are lodgepole pine, western white pine, Jeffrey pine, and white fir. Importance values on the sample plots average more than 200 for red fir, with red fir basal area from 30 to 80 m²/ha and density from 150 to 1808 stems/ha. Average basal area on 11 plots is 68.8 m²/ha, of which 80 percent is red fir.

Four subtypes are recognized: red fir-lodgepole pine, red fir-western white pine-lodgepole pine, red fir-white fir, and red fir-white fir-Jeffrey pine. Red fir-lodgepole pine forests cover 242 acres (98 ha) on well-drained NW.-facing exposures. Western white pine occurs as an additional associate at the head of Bourland Creek underlain by granitic rock. On SE.-facing slopes white fir is the principal associate within 76 acres (31 ha) of red fir forest. White fir is particularly common along ecotones between red fir and aspen forests. *Ceanothus cordulatus* is common in the understory of open red fir-white fir stands. Jeffrey pine occurs inside 62 acres (25 ha) of red fir-white fir forest with a S.-facing aspect.

Throughout the various phases of red fir forest, the most common herbs include *Viola purpurea*, *Pedicularis semibarbata*, *Smilacina amplexicaulis*, *Erigeron peregrinus* var. *angustifolius*, *Kelloggia galioides*, *Thalictrum fendleri*, *Chrysopsis breweri*, *Hieracium albiflorum*, *Phacelia hydrophylloides*, *Pyrola picta*, and *Pterospora andromedea*. In more open types of red fir forest, additional species such as *Collinsia parviflora*, *Bromus marginatus*, *Poa bolanderi*, *Monardella odoratissima*, *Streptanthus tortuosus*, and *Allium campanulatum* occur. There is no clear association between slope exposure and herb species composition.

Huckleberry Oak Scrub (37542): 130 acres (53 ha). This mountain chaparral covers open granitic outcrop with patches of soil, rocky ridges, or steep slopes with S.-facing exposures. The largest patch occurs on the granitic rock at the head of the Bourland Creek watershed. Some of this area supports Jeffrey pine. Total cover for both Jeffrey pine and *Quercus vaccinifolia* is usually less than 10 and 30 percent, respectively. One stand of *Q. vaccinifolia* on a S.-facing slope at 7350 ft (2240 m) had scrubby California black oak (*Quercus kelloggii*) growing near its upper elevational limits.



Figure 192—W. B. Critchfield, view looking south across Bourland Meadow. Jeep tracks are those of deer hunters who use two primitive camps along the Meadow. (L. Johnson, 1974)

Scrubby Lodgepole Pine and Red Fir (85300, 86100): Stands of this type occur over 80 acres (32 ha) of dry meadow terrain. Density of both species is limited by germination sites. Stem breakage is high. The understory is poorly developed because of the dry, sandy substrate. *Streptanthus tortuosus*, *Calyptridium umbellatum*, *Eriogonum* sp., and *Collinsia parviflora*, are among the most common understory species.

Wet and Dry Meadow (45100, 52430): These meadow types cover 80 acres (32 ha), most of which can be classified as wet type. Several shallow ponds with some aquatic vegetation are present (fig. 192). Cattle grazing was so heavy during the time of study that most plants were not identifiable.

Aspen Forest (81B00): 60 acres (24 ha). This association occurs on a SE. exposure and is surrounded by red fir forest on rocky soil at the lower half of a 0.6-mile- (1-km-) wide incline. The location probably concentrates subterranean water movement. Density of stems is high (670 stems/ha), although cover is low. A large assemblage of woodland and wet and dry meadow species is associated with the aspen grove.

Lodgepole Pine Forest (86100): 90 acres (36 ha). Lodgepole pine may occur as nearly pure stands adjacent to wet meadows (wet subtype) or as forests on slopes bordering meadows (dry subtype). Wet types cover 37 acres (15 ha) around Bourland Meadow with some aspen (*Populus tremuloides*) and white fir. Lodgepole pine is the clear dominant, with importance values of nearly 300.

Many wet meadow species occur in these forests, including *Dodecatheon alpinum*, *Senecio triangularis*, *Veratrum californicum*, and species of *Carex*, *Juncus*, *Melica*, *Viola*, *Bromus*, *Gentiana*, and *Erysimum*. The understory in the dry phase includes many species associated with red fir forests and also *Elymus glaucus*, *Galium aparine*, *Montia perfoliata*, *Ribes roezlii*, *Rumex pauciflorus*, *Calochortus leichtlinii*, *Lupinus densiflorus*, *Brodiaea exioides* var. *lugens*, *Castilleja lemmonii*, and *Ligusticum grayi*.

Plant Diversity

Approximately seventy-five taxa are listed in an association table; actual diversity is certainly much higher.

Conflicting impacts

A portion of the area was logged in 1967. The meadow area, although well-developed, shows strong evidence of overgrazing, with the upper portion of the meadow suffering rapid downcutting by Bourland Creek. Therefore, the area was once removed from the RNA system. However, in 1990 it was again recommended for candidacy for its aquatic (bog) values, largely undiscussed in the survey.

97. William's Point (Sawyer and Stillman 1977b)

Location

This study area (dropped from RNA consideration) is on the Klamath National Forest about 3 miles (5 km) E. of Happy Camp along the W. side of the Klamath River Canyon. It lies within portions of sections 7 and 8 T16N, R8E HBM (41°48'N., 123°19'W.), USGS Slater Butte quad (*fig. 193*). Ecological subsection – Western Jurassic (M261Aa).

Target Elements

Pacific Douglas-Fir (*Pseudotsuga menziesii*) and Mixed Evergreen Forest

Distinctive Features

This area is representative of inner Klamath River stands of Douglas-fir and tanoak (*Lithocarpus densiflorus*) on N.- and E.-facing slopes. The area is clearly a warmer coastal site than the Specimen Creek survey area, as indicated by the presence of tanoak, but is also somewhat drier than that area, as indicated by the lack of giant chinquapin (*Chrysolepis chrysophylla*).

Physical Characteristics

The area occupies 150 acres (61 ha). It includes N.- and E.-facing slopes of a promontory surrounded on three sides by the Klamath River. The fourth side is State Highway 96. Most slopes are steep (60–90 percent [31–42°]). Those at the E. end are moderate (30–50 percent [11–27°]). Elevations range from 1100 ft (335 m) at the edge of the Klamath River to 2250 ft (686 m) atop William's Point. The area is composed of pre-Silurian metasedimentary rock. Most soils are moderately developed except for the unstable thin, rocky soils of the central portion. Rainfall averages 46.7 inches (1186 mm) at Happy Camp. There are occasional winter snows and summer thundershowers. At Happy Camp the mean winter temperature is 42.2 °F (24.4 °C), and mean summer temperature is 76.3 °F (24.6 °C).

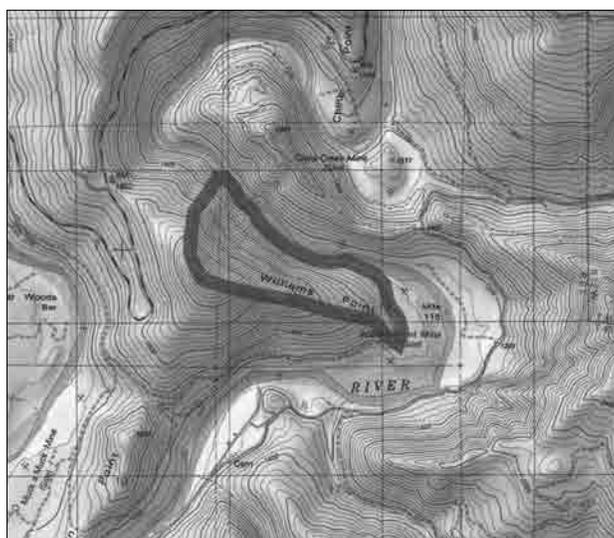


Figure 193—William's Point ecological survey area

Association Types

Forty releves were sampled as well as forty points (point-centered quarter method). Sizes of associations are not given.

Douglas-Fir (*Pseudotsuga menziesii*)/*Achlys triphylla* (81100, 82420): This is the major forest type in the area. The releves are analyzed with an association table, which divides the type into two phases: a lower slope, relatively mesic Douglas-fir/*Polystichum* phase and a relatively xeric upper slope Douglas-fir/*Ligusticum* phase.

1. The Douglas-fir/*Polystichum* phase is characterized by a dense lower canopy dominated by tanoak (100 percent presence, 440 trees/ha, basal area 20 m²/ha). Pacific yew (*Taxus brevifolia*) is restricted to this phase (27 percent presence, 27 trees/ha, 0.6 m²/ha). Pacific madrone (*Arbutus menziesii*) is the other major hardwood (73 trees/ha, 4.6 m²/ha). Douglas-fir is the major canopy dominant (100 percent presence, 257 trees/ha, 155.8 m²/ha). Productivity for Douglas-fir (measured from the outer 5 inches [13 cm] of trunk cored) in the Douglas-fir/*Polystichum* phase is similar to that in the Douglas-fir/*Ligusticum* phase (7.7 years/cm vs. 7.0 years/cm, respectively), while basal area is substantially higher.

Important shrubs of this phase include *Berberis nervosa*, *Corylus cornuta*, *Symphoricarpos mollis*, *Rosa gymnocarpa*, *Toxicodendron diversilobum*, and *Holodiscus*

discolor. Many herbs are common to both phases. Some of the most important include *Polystichum munitum*, *Achlys triphylla*, *Trientalis latifolia*, *Disporum hookeri*, *Pteridium aquilinum*, *Galium triflorum*, and *Lonicera hispidula*.

2. The Douglas-fir/*Ligusticum californicum* phase is dominated by Douglas-fir (198 trees/ha, 63 m²/ha) but with a higher cover of sugar pine (*Pinus lambertiana*) (6 trees/ha and 4.8 m²/ha) than in the previous phase. Tanoak is greatly reduced in the subcanopy compared to the previous phase (7 trees/ha, 0.1 m²/ha). Bigleaf maple (*Acer macrophyllum*) becomes relatively important in the lower canopy (80 percent presence, 83 trees/ha, 4.0 m²/ha), and Pacific madrone values remain similar to those of the previous phase (38 trees/ha, 5.0 m²/ha).

This phase has a more distinctive herb stratum with *Madia madioides*, *Ligusticum californicum*, and *Lathyrus polyphyllus* restricted to it, along with such common shared species as *Pteridium aquilinum*, *Disporum hookeri*, *Galium triflorum*, *Trientalis latifolia*, and *Arnica* sp. Shrubs are similar to those in the previous phase with the notable absence of *Berberis nervosa*.

Canyon Live Oak-Oregon White Oak/*Pityrogramma triangularis* (71110, 81320): This association occurs on dry, steep unstable slopes. Ten points were sampled in this type. It is characterized by an open woodland dominated by small canyon live oak (134 trees/ha, 5.5 m²/ha) and Oregon white oak (166 trees/ha, 2.4 m²/ha). Total basal area of this type averages 7.8 m²/ha, and total density is 316 trees/ha. The herb layer is distinct with xerophytic species such as *Pityrogramma triangularis*, *Heuchera micrantha*, *Selaginella wallacei*, *Aira praecox*, *Polypodium californicum*, and *Eriogonum umbellatum* predominating. The major shrub is *Toxicodendron diversilobum* with lesser species including *Holodiscus discolor*, *Ceanothus integerrimus*, *Lonicera ciliosa*, *Cercocarpus betuloides*, and *Philadelphus lewisii* ssp. *gordonianus*.

Plant Diversity

One hundred eleven taxa are listed.

Conflicting impacts

The area is small and does not represent a variety of slope aspects. This restricts research potential. A clear-cut block prevents enlargement of the area to the N. The area was partially burned in a 1987 fire.

Note: for Yolla Bolla, see Rough Gulch, #71

98. Yurok (Taylor 1982)

Location

This established RNA is on an isolated holding of the Six Rivers National Forest, Del Norte County. It occurs on the Yurok Experimental Forest, which lies just E. of Highway 101 about 4 miles (6 km) NW. of the town of Klamath near the mouth of Klamath River. The area lies within portions of sects. 21 and 28 T14N, R1E HBM (41°35'N., 124°05'W.), USGS Requa quad (fig. 194). Ecological subsection – Northern Franciscan (263Ab).

Target Element

Coast Redwood (*Sequoia sempervirens*)

Distinctive Features

This is the only Forest Service RNA in California representing the coast redwood forest. The RNA was established in 1976 and is now one of only three Federal Research Natural Areas designated specifically for coast redwood forest, the most productive forest type known in the world (Franklin 1988). The great biomass of this forest at Yurok compares favorably with other values obtained for mature redwood forest. The RNA's proximity to the experimental forest and to electrical and dormitory facilities will facilitate detailed long-term research on redwood-related projects.

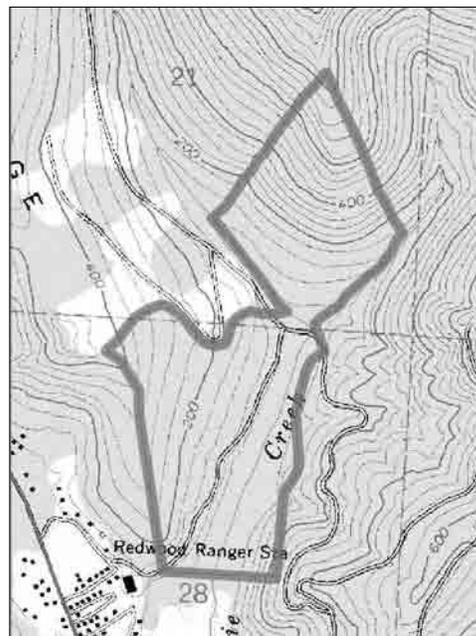


Figure 194—Yurok RNA

Physical Characteristics

The RNA covers about 150 acres (61 ha) on the coastal front of the N. Coast Ranges, about 2 miles (3 km) inland from the Pacific Ocean. High Prairie Creek flows through the area, forming a shallow valley. Exposures are primarily SW. and E. with a large area of valley bottom flat. Elevations range from less than 40 ft (12 m) along the Creek to 920 ft (280 m) at the N. end of the RNA.

Rocks are Franciscan assemblage soft sediments and metasediments, and soil development is good with unweathered parent material reached at about 4 ft (1.2 m). Typical soils are sandy loams with moderate fertility and include the Melbourne series and an undescribed alluvial series. Climate is humid-coastal with much fog during the relatively dry summer months. Annual precipitation is estimated to average 87 inches (2210 mm). The mean annual temperature is about 53 °F (11.5 °C).

Association Types

The coast redwood forest was sampled with one hundred points (point center-quarter method, with 10 points/transect). Areal extent of the associations is not given.

Coast Redwood-*Polystichum munitum* (82320, 82310): This is the most common vegetation type of the RNA (fig. 195). It occurs on upland soils and is uniform in species composition. Redwood is clearly dominant, with western hemlock (*Tsuga heterophylla*) the only other constant tree associate. Douglas-firs (*Pseudotsuga menziesii*) are occasional as outliers or following habitat disturbance. Other occasional seral species include red alder (*Alnus oregona*), grand fir (*Abies grandis*), tanoak (*Lithocarpus densiflorus*), and bigleaf maple (*Acer macrophyllum*). Total canopy cover is 80-100 percent. Average basal area of coast redwood is 231 m²/ha (94 percent relative basal area). Relative basal area of Douglas-fir and western hemlock is less than 10 percent in most stands. Stem density averages about 200/ha, with coast redwood comprising 23 percent of the stems. Some

transects have high densities of sapling and pole-size seral tree species. Total wood volume from a cruise plot within the RNA is very high (4500 m³/ha). Tree heights for coast redwood regularly exceed 250 ft (76 m).

The shrub understory is well developed in some stands, with 6-8 species represented, and poorly developed in others. The dominant shrub in all stands is *Vaccinium ovatum*, with *V. parvifolium*, *Gaultheria shallon*, and *Ribes sanguineum* as important codominants. *Rubus spectabilis*, *R. parviflorus*, *Corylus cornuta* var. *californica*, and *Sambucus callicarpa* are more typical of disturbed areas (e.g., windfalls).

Herbs of the understory are few, with *Polystichum munitum* dominant. Other typical species include *Vancouveria planipetala*, *Oxalis oregana*, *Viola sempervirens*, and *Hierochloa occidentalis*.

Total shrub and herb cover is often >80 percent. Shrubs and herbs exhibit a mosaic distribution. Where *Vaccinium ovatum* is dominant, there is a tendency for other species to be less common. Where dense shrub cover occurs without *V. ovatum*, a fairly rich herb layer develops. *Oxalis oregana* and *Chimaphila umbellata* are typical of areas of low shrub cover, often in dense shade of the canopy.

Red Alder-*Rubus spectabilis* (61130, 81A00): This type occurs along the alluvial soils adjacent to High Prairie Creek. Trees are primarily red alder and bigleaf maple in about equal proportions. Port Orford-cedar (*Chamaecyparis lawsoniana*) is a subdominant. Shrub understory is dense and dominated by deciduous species such as *Rubus spectabilis*, *R. parviflorus*, *Sambucus callicarpa*, and *Menziesia ferruginea*. Herbaceous cover is mostly dominated by *Polystichum munitum*, *Blechnum spicant*, *Equisetum laevigatum*, and *Epilobium angustifolium*. Other characteristic species include *Salix lasiolepis*, *Myrica californica*, *Polypodium scouleri*, and *Mimulus dentatus*. *Polypodium scouleri* and *P. glycyrrhiza* often occur as epiphytes on mossy bigleaf maple trunks.

Figure 195—Yurok, redwood overstory and the dense, lush understory vegetation in the Yurok RNA. (around 1976)



Plant Diversity

Eighty-two species are listed. Only about thirty-six species occur in the undisturbed forest; the additional species are mostly from disturbed habitats.

Conflicting Impact

A gravel road runs along the valley bottom within the RNA, and the area is surrounded by variously managed lands within the Yurok Experimental Forest. The small area of the undisturbed forest may not be sufficient for extensive studies.

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Glossary

- altern:** an abrupt boundary between plant communities or associations
- aplite:** a granitic rock without biotite and related to pegmatites, with which it is often found
- association table:** a method of describing plant communities by summarizing results from a releve sample in matrix form, grouping species which tend to occur together into associations
- bajada:** a type of plain in arid regions formed by deposition of debris in fan-shaped spreads at the base of mountains
- Botanical Areas:** USDA Forest Service areas managed for their unique botanical values, a type of Special Interest Area
- calcareous:** rocks containing much calcium such as limestone, marble, and dolomite
- charnockitic:** containing charnockite, a coarse granular rock similar to granite which resulted from crystallization of magma at great depths or by ultra-metamorphism of basic igneous rock
- climax:** the end-product of a successional sequence, characterized by the lack of significant (directional) changes in species composition
- colluvium:** weathered rocky material brought down by gravity from mountain slopes (including scree and talus)
- congeliturbation:** freeze-thaw sorting of soil into rings with coarser rocks and boulders surrounding sand and gravel
- depauperate:** poorly developed
- dis-climax:** an arrested climax, the result of some periodic environmental disturbance, such as fire, that prevents further succession
- ecotone:** a gradual boundary between plant communities or associations
- edaphic:** relating to soil
- edaphic climax:** an association of plants which has attained its highest possible successional state given its present soil conditions; e.g., mountain chaparral may be successional to mixed conifer forest on deep soils, but on dry rocky soils it may be an edaphic climax
- endemic:** a taxon restricted to a certain area or habitat, may be divided into neo-endemics (evolutionarily recent) or paleoendemics (relicts which may have once been more widespread)
- ericaceous:** referring to members of the heath family (Ericaceae)
- establishment site-limited:** limited to small favorable sites for germination within a community
- even-aged stand:** a forest stand composed of trees of all essentially the same age
- gap regeneration species:** tree species which tend to regenerate in openings in the forest are said to have this type of regeneration; also called gap-phase regeneration
- graywacke:** a type of sandstone characterized by rather angular and poorly sorted grains, thought to have originated from off-shore turbidity flows. It is widespread in the Franciscan assemblage of the Coast Ranges.
- hydrophilic:** water-loving
- hydrophyte:** a plant that grows in wet conditions
- importance value:** a synthesized measurement for rating the representation of a plant species in a stand of vegetation. It is based on a sum of sampling values (e.g., relative density + relative frequency + relative cover). This value is given as a multiple of 100. Thus if three values are synthesized, the highest possible value is 300. If two values are added, the maximum would be 200.
- line intercept method:** a plotless vegetation sampling method counting all species touched by a line of predetermined length and determining their dominance by measuring the portion of the line that they cover

- liana:** a woody vine such as California wild grape (*Vitis californica*)
- lithosol:** well-drained, shallow, stony soils over bedrock
- management indicator species:** a type of plant or animal whose presence in a habitat or area is a fairly certain sign or symptom that particular environmental conditions are also present
- mass wasting:** a type of gravity transport of rock and soil with sliding taking place either on a definite plane which may be related to the structure of the rock, or on a curved shear surface as in clay-rich soils
- mesic:** moist, midway between xeric and hydric in moisture conditions
- mesophyte:** a plant growing in moderate (moist) moisture conditions
- mesophilic:** referring to species preferring moderate moisture conditions, typical of sheltered mid-slope to lower-slope locations in California
- oolitic limestones:** limestones having numerous spherical rock particles that have grown by accretion around a nucleus
- paternoster lakes:** glacially formed lakes arranged in a stepping-stone manner down a glacially carved valley
- point-center(ed) quarter method:** a plotless vegetation sampling technique in which points are chosen in a plant community. Each point represents the center of a four-cornered area. From each quadrant the nearest tree is sampled and calculations on density, frequency and cover can be made.
- regosolic:** having characteristics of regosols, typically poorly developed well-drained soils derived from recent deposits of deep volcanic ash
- releve:** a sample quadrat (plot) used for vegetation analysis, the size of which is based on a minimal area in which the species of a community are adequately represented. On relevés each species is recorded and several parameters are estimated (in size classes, not by absolute measurements), most typically including cover of each species, slope exposure, slope angle, and other environmental characteristics.
- rupicolous:** rock-inhabiting, rock-loving
- sclerophyll:** a plant characteristic of Mediterranean climates with a thickened cuticle on the leaves
- seral:** referring to vegetation that is changing, a transitory stage in an ecological succession
- serpentine:** the California state rock. More properly referred to as serpentinite, peridotite, dunite, etc. Serpentine is the lay person's generic term for these ultramafic rocks poor in calcium and high in magnesium, which create a harsh environment for vegetation. Most serpentine areas have unique floras with a high percentage of specially adapted, endemic taxa.
- serotinous:** late in opening, as in serotinous cones of closed-cone cypresses and pines
- site class:** a measure of productivity for forests, usually measured in cubic feet/acre/year. There are seven site classes with 1 the highest (225+ ft³/acre/yr) and 7 the lowest (<20 ft³/acre/yr).
- site index:** a measurement of tree growth potential for a given area based on the rate of growth of certain dominant tree species. Generally based on the length of time the dominant timber species takes to reach 100 ft (31 m) in height.
- size classes:** recognizable cohorts of trees in a forest representing different ages, e.g., saplings and seedlings, pole size, and mature trees
- solifluction lobes:** saturated soil slumping in alpine zone
- special interest area:** areas established and managed by the USDA Forest Service for their unique special features. These include geological, historical, archeological, botanical, and other noteworthy features.
- vertisol:** a clay-rich soil which usually has alternating wet and dry periods and tends to form large cracks in the dry season.
- xeric:** dry
- xerophyte:** a plant growing in dry conditions
- xerophilic:** dry-adapted (dry loving)

Symbols and Abbreviations

- cm** centimeter
- CNPS** California Native Plant Society
- cRNA** candidate research natural area, formally nominated and approved for establishment but not incorporated in land management plans
- dbh** diameter(s) at breast height (4.5 ft, 1.4 m)
- ft** feet
- E.** east or easterly
- ESE.** east-southeast
- ha** hectare
- HBM** Humboldt Baseline and Meridian
- IV** importance value
- km** kilometer(s)
- m** meter(s)
- m²/ha** square meter(s) per hectare (the standard measurement for basal area cover of trees in this report)
- MDBM** Mount Diablo Baseline and Meridian
- mm** millimeter(s)
- N.** north or northerly
- n** sample size
- NE.** northeast
- NNW.** north-northwest
- NW.** northwest
- pRNA** proposed research natural area, recognized but not yet fully reviewed or approved
- R** Range, as in Township and Range land divisions
- rRNA** recommended research natural area, recognized in current National Forest land management plans
- RNA** Research Natural Area
- S.** south or southerly
- SAF** Society of American Foresters; used herein to designate a forest cover type classified in the SAF system (Eyre 1980)
- SBBM** San Bernardino Baseline and Meridian
- SD** standard deviation
- SE.** southeast
- sect.(p.s.).** section(s) within Township and Range land divisions
 - sp.** an unidentified species (following a genus name)
 - spp.** several species of a genus
 - ssp.** subspecies
- ssp. nov.** undescribed subspecies
 - SSE.** south-southeast
 - SSW.** south-southwest
 - SW.** southwest
 - T** Township
 - var.** variety of a species

Symbols and Abbreviations

- W.** west or westerly
- WSW.** west-southwest
- x** indicates a taxon of hybrid origin as in *Quercus x morehus*
- >** greater than
- <** less than
- '** minutes as in degrees and minutes of latitude or longitude
- ±** plus or minus, or in conjunction with a number indicating confidence limits

Appendix I—California plant community types represented in Forest Service research natural areas

Community types and codes (Holland 1986) are in boldface; research natural area names (with ecological survey names in parentheses, if different from the research natural area names) are in plain type.

Scrub and Chaparral

Central coastal scrub (32200): Cone Peak Gradient (Limekiln Creek)

Venturan coastal sage scrub (32300): Cone Peak Gradient (Limekiln Creek)

Diegan coastal sage scrub (32500): Cahuilla Mountain, King Creek

Diablan sage scrub (32600): Wagon Caves

Riversidian sage scrub (32700): Millard Canyon, Organ Valley

Great basin scrub (35100): Broom Flat (Broom Flat Ridge), Sentinel Meadow

Big sagebrush scrub (35210): Babbitt Peak, Cahuilla Mountain, Indiana Summit, Mud Lake (Mud Lake-Wheeler Peak), Raider Basin (Raider Creek), Sentinel Meadow, Whippoorwill Flat

Subalpine sagebrush scrub (35220): McAfee (White Mountain Summit), Raider Basin (Raider Creek), Whippoorwill Flat, White Mountain (White Mountain Natural Area)

Sagebrush steppe (35300): Devil's Garden

Rabbitbrush scrub (35400): Cahuilla Mountain, Cub Creek, Devil's Garden, Indiana Summit

Northern mixed chaparral (37110): American Canyon, Big Pine Mountain, Cahuilla Mountain, Cleghorn Canyon, Cone Peak Gradient (Limekiln Creek), Devil's Basin, Devil's Rock-Hosselkus (Devil's Rock, Hosselkus Limestone), Fern Canyon, Frenzel Creek, Grizzly Mountain (Big Grizzly Mountain), Guatay Mountain, Hale Ridge, Indian Creek, Jawbone Ridge, Millard Canyon, Organ Valley, Twin Rocks

Southern mixed chaparral (37120): Cleghorn Canyon, Organ Valley

Chamise chaparral (37200): Black Butte, Cahuilla Mountain, Cleghorn Canyon, Cone Peak Gradient (Limekiln Creek), Fern Canyon, Guatay Mountain, Hale Ridge, Jawbone Ridge, Junipero Serra Peak, Millard Canyon, Organ Valley, Wagon Caves, Wilder Ridge

Semi-desert chaparral (37400): Cleghorn Canyon, Long Canyon

Montane chaparral (37500): Big Pine Mountain

Mixed montane chaparral (37510): Antelope Creek Lakes, Babbitt Peak, Bishop Creek Ponderosa Pine (Merced River), Cedar Basin, Clark Fork, Cub Creek, Falls Canyon, Green Island Lake, Haypress Meadows, Horse Meadow, Indian Creek Brewer Spruce, Manzanita Creek (Trelorita), Moses Mountain, Mount Pleasant, Mud Lake (Mud Lake-Wheeler Peak), North Trinity Mountain, Onion Creek, Pearch Creek, Red Butte-Red Fir Ridge (Shasta Red Fir), Rock Creek Butte, Ruth, Shasta Mud Flow (Mount Shasta Mud Flow), Soda Ridge, South Mountaineer Creek (Mountaineer Creek), Sugar Creek, Sugar Pine Point, Teakettle Creek

Montane manzanita chaparral (37520): Aqua Tibia (Eagle Crag), Bishop Creek Ponderosa Pine (Merced River), Broom Flat (Broom Flat Ridge), Cahuilla Mountain, Grizzly Mountain (Big Grizzly Mountain), Hall Canyon, Iron Mountain (Graham Pinery), Junipero Serra Peak, Mayfield, Millard Canyon, Mount Pleasant, Peavine Point, Red Butte-Red Fir Ridge (Shasta Red Fir), Rock Creek Butte

Montane ceanothus chaparral (37530): Cleghorn Canyon, Fern Canyon, Hale Ridge, Hall Canyon, Lyon Peak/Needle Lake, Shasta Mud Flow (Mount Shasta Mud Flow), Upper Goose Creek

- Shin oak brush (37541):** Devil's Rock-Hosselkus (Devil's Rock, Hosselkus Limestone), Doll Basin, Indian Creek, Iron Mountain (Graham Pinery), Long Canyon, Ruth
- Huckleberry oak chaparral (37542):** Cedar Basin, Mount Pleasant, Onion Creek, Peach Creek, Rock Creek Butte, William B. Critchfield (Bourland Meadow)
- Bush chinquapin chaparral (37550):** Lyon Peak/Needle Lake
- Serpentine chaparral (37600):** Frenzel Creek, L. E. Horton (Stone Corral-Josephine Peridotite), Smoky Creek
- Buck brush chaparral (37810):** Grizzly Mountain (Big Grizzly Mountain), Indian Creek, Iron Mountain (Graham Pinery), Manzanita Creek (Trelorita), Smoky Creek
- Blue brush chaparral (37820):** Cone Peak Gradient (Limekiln Creek)
- Scrub oak chaparral (37900):** Cahuilla Mountain, Cleghorn Canyon, Indian Creek, King Creek
- Interior live oak chaparral (37A00):** Backbone Creek, Black Butte, Cahuilla Mountain, Cleghorn Canyon, Fern Canyon, Indian Creek, Millard Canyon
- Upper Sonoran manzanita chaparral (37B00):** Twin Rocks
- Mesic north slope chaparral (37E00):** Frenzel Creek, Hale Ridge, Iron Mountain (Graham Pinery)
- Coastal sage-chaparral scrub (37G00):** Cone Peak Gradient (Limekiln Creek)
- Lava flow scrub (no Holland equivalent):** Mayfield
- Mountain mahogany (*Cercocarpus*) scrub (no Holland equivalent):** Babbitt Peak, Crater Creek, Raider Basin (Raider Creek), Sentinel Meadow, Sugar Creek, Whippoorwill Flat

Grassland, Vernal Pools, Meadows, and other Herb Communities:

- Coastal terrace prairie (41100):** Cone Peak Gradient (Limekiln Creek)
- Bald hills prairie (41200):** Soldier, Twin Rocks
- Valley and foothill grassland (42000):** Big Pine Mountain
- Valley needlegrass grassland (42110):** American Canyon, Cahuilla Mountain, Cone Peak Gradient (Limekiln Creek), Fern Canyon, Indian Creek, King Creek, Organ Valley, Wagon Caves
- Non-native grassland (42200):** Cahuilla Mountain, Cleghorn Canyon, Cone Peak Gradient (Limekiln Creek), Indian Creek, Jawbone Ridge, Long Canyon, San Joaquin Experimental Range, Soldier, Twin Rocks, Wagon Caves, Wilder Ridge
- Wildflower field (42300):** Wagon Caves
- Northern basalt flow vernal pool (44131):** Devil's Garden, Timbered Crater
- Montane meadow (45100):** Antelope Creek Lakes, Bell Meadow, Cedar Basin, Cub Creek, Doll Basin, Grass Lake, Green Island Lake, Haypress Meadows, Home Camp Creek, Horse Meadow, Lyon Peak/Needle Lake, Mount Eddy, North Trinity Mountain, Onion Creek, Preacher Meadows, Raider Basin (Raider Creek), Red Butte-Red Fir Ridge (Shasta Red Fir), San Emigdio Mesa, Sawmill Mountain, Smoky Creek, Soda Ridge, South Mountaineer Creek (Mountaineer Creek), Sugar Creek, Teakettle Creek, William B. Critchfield (Bourland Meadow)
- Wet montane meadow (45110):** Moses Mountain, Mount Pleasant, Mud Lake (Mud Lake-Wheeler Peak)
- Dry montane meadow (45120):** Bell Meadow, Haypress Meadows, Moses Mountain, Mount Pleasant, Mud Lake (Mud Lake-Wheeler Peak), Red Butte-Red Fir Ridge (Shasta Red Fir), Teakettle Creek
- Subalpine and alpine meadow (45200):** Snow Canyon
- Wet subalpine or alpine meadow (45210):** Antelope Creek Lakes, Clark Fork, Grass Lake, Harvey Monroe Hall, Highland Lakes, Last Chance

Meadow, Lyon Peak/Needle Lake, McAfee (White Mountain Summit), Mount Pleasant, Mount Eddy, Red Butte-Red Fir Ridge (Shasta Red Fir), Sugar Creek, White Mountain (White Mountain Natural Area)

Dry subalpine or alpine meadow (45220): Clark Fork, Harvey Monroe Hall, Highland Lakes, Last Chance Meadow, Lyon Peak/Needle Lake, White Mountain (White Mountain Natural Area)

Freshwater seep (45400): Bridge Creek, Cahuilla Mountain, Church Dome, Doll Basin, Indian Creek, King Creek, Millard Canyon, Rock Creek Butte, Rough Gulch (South Fork Mountain, Yolla Bolla), Ruth, Smoky Creek, Soda Ridge, Station Creek (Bald Mountain), Twin Rocks

Bog and Marsh:

Sphagnum bog (51110): Grass Lake, Mount Pleasant, Sugar Creek

Darlingtonia bog (51120): Cedar Basin, L. E. Horton (Stone Corral-Josephine Peridotite), Mount Eddy, Preacher Meadows

Fen (51200): Grass Lake, Mount Pleasant, Sugar Creek

Montane freshwater marsh (52430): Antelope Creek Lakes, Bell Meadow, Cedar Basin, Grass Lake, Green Island Lake, Harvey Monroe Hall, Mud Lake (Mud Lake-Wheeler Peak), Smoky Creek, Sugar Creek, William B. Critchfield (Bourland Meadow)

Riparian and Bottomland Habitat:

Red alder riparian forest (61130): Rough Gulch (South Fork Mountain, Yolla Bolla), Upper Goose Creek, Yurok

Central coast riparian forest (61200): Wagon Caves

Central coast cottonwood-sycamore riparian forest (61210): Cone Peak Gradient (Limekiln Creek), Wagon Caves

Central coast live oak riparian forest (61220): American Canyon, Big Pine Mountain

Southern coast live oak riparian forest (61310): Aqua Tibia (Eagle Crag), Fern Canyon, Guatay Mountain, King Creek, Organ Valley

Southern cottonwood-willow riparian forest (61330): Big Pine Mountain, Falls Canyon, Fern Canyon

Montane riparian forest (61500): Big Pine Mountain

White alder riparian forest (61510): Adorni, Big Pine Mountain, Bridge Creek, Cleghorn Canyon, Devil's Rock-Hosselkus (Devil's Rock, Hosselkus Limestone), Doll Basin, Falls Canyon, Fisherman's Camp, Grizzly Mountain (Big Grizzly Mountain), Hennessy Ridge, Indian Creek, Junipero Serra Peak, King Creek, Long Canyon, Manzanita Creek (Trelorita), Peach Creek, Peavine Point, Rough Gulch (South Fork Mountain, Yolla Bolla), Ruth, Shasta Mud Flow (Mount Shasta Mud Flow), Smoky Creek, Twin Rocks

Aspen riparian forest (61520): Bell Meadow, Grass Lake, Mud Lake (Mud Lake-Wheeler Peak), Onion Creek

Montane black cottonwood riparian forest (61530): Bell Meadow, Raider Basin (Raider Creek), Shasta Mud Flow (Mount Shasta Mud Flow), Soda Ridge

Southern sycamore-alder riparian woodland (62400): Cleghorn Canyon

Mule fat scrub (63310): Wagon Caves

Southern willow scrub (63320): Cleghorn Canyon

Montane riparian scrub (63500): Antelope Creek Lakes, Bell Meadow, Big Pine Mountain, Bridge Creek, Clark Fork, Doll Basin, Grass Lake, Green Island Lake, Hall Canyon, Harvey Monroe Hall, Haypress Meadows, Lyon Peak/Needle Lake, Manzanita Creek (Trelorita), Moses Mountain, Mount Pleasant, Mud Lake (Mud Lake-Wheeler Peak), Onion Creek, Peach Creek, Rock Creek Butte, Shasta Mud Flow (Mount Shasta Mud Flow),

Snow Canyon, Soda Ridge, South Mountaineer Creek (Mountaineer Creek), Station Creek (Bald Mountain), Sugar Creek, Sugar Pine Point, Teakettle Creek

Serpentinite riparian and valley bottom (no Holland equivalent): Frenzel Creek

Non-serpentinite riparian (no Holland equivalent): Frenzel Creek

Rocky bottomed pools (no Holland equivalent): Timbered Crater

Woodland:

Oregon oak woodland (71110): Devil's Rock-Hosselkus (Devil's Rock, Hosselkus Limestone), Manzanita Creek (Trelorita), Ruth, Soldier, Twin Rocks, William's Point

Black oak woodland (71120): Cahuilla Mountain, Devil's Basin, Devil's Rock-Hosselkus (Devil's Rock, Hosselkus Limestone), Grizzly Mountain (Big Grizzly Mountain), Indian Creek, Iron Mountain (Graham Pinery), Ruth, Sugar Pine Point

Valley oak woodland (71130): Wagon Caves

Blue oak woodland (71140): American Canyon, Devil's Basin, Indian Creek, Jawbone Ridge, Wagon Caves

Interior live oak woodland (71150): Cahuilla Mountain, Fern Canyon, Indian Creek, Millard Canyon

Coast live oak woodland (71160): Black Butte, Cone Peak Gradient (Limekiln Creek), Fern Canyon, Guatay Mountain, Organ Valley

Open Engelmann oak woodland (71181): King Creek, Organ Valley

Dense Engelmann oak woodland (71182): Organ Valley

Foothill (Digger) pine woodland (71300): Long Canyon

Open foothill (digger) pine woodland (71310): Jawbone Ridge

Serpentine foothill (digger) pine-chaparral woodland (71321): Frenzel Creek

Non-serpentine foothill (digger) pine-chaparral woodland (71322): Bishop Creek Ponderosa Pine (Merced River), Frenzel Creek, Indian Creek, Iron Mountain (Graham Pinery), Jawbone Ridge, Manzanita Creek (Trelorita)

Foothill (Digger) pine-oak woodland (71410): Indian Creek, Jawbone Ridge, San Joaquin Experimental Range, Soldier, Twin Rocks, Wilder Ridge

Mixed north slope cismontane woodland (71420): Devil's Rock-Hosselkus (Devil's Rock, Hosselkus Limestone), Twin Rocks

Northern juniper woodland (72110): Devil's Garden, Raider Basin (Raider Creek)

Great basin pinyon-juniper woodland (72121): Broom Flat (Broom Flat Ridge), Whippoorwill Flat

Great basin pinyon woodland (72122): Church Dome, Whippoorwill Flat

Mojavean pinyon woodland (72210): Long Canyon, San Emigdio Mesa

Mojavean juniper woodland and scrub (72220): San Emigdio Mesa

Cismontane juniper woodland and scrub (72400): Long Canyon

Madrone/Canyon live oak (no Holland equivalent): Aqua Tibia (Eagle Crag)

Forest:

Mixed evergreen forest (81100): Adorni, Black Butte, Bridge Creek, Cone Peak Gradient (Limekiln Creek), Cone Peak Gradient (South Fork of Devil's Canyon), Craig's Creek, Devil's Rock-Hosselkus (Devil's Rock, Hosselkus Limestone), Hennessy Ridge, L. E. Horton (Stone Corral-Josephine Peridotite), Manzanita Creek (Trelorita), Peach Creek, Rough Gulch (South Fork Mountain, Yolla Bolla), Ruth, Upper Goose Creek, William's Point

- California bay forest (81200):** Cone Peak Gradient (Limekiln Creek)
- Coast live oak forest (81310):** Cone Peak Gradient (Limekiln Creek), Fern Canyon, Organ Valley
- Canyon live oak forest (81320):** Aqua Tibia (Eagle Crag), Big Pine Mountain, Bridge Creek, Cone Peak Gradient (Limekiln Creek), Cone Peak Gradient (South Fork of Devil's Canyon), Craig's Creek, Devil's Basin, Devil's Rock-Hosselkus (Devil's Rock, Hosselkus Limestone), Doll Basin, Falls Canyon, Fern Canyon, Grizzly Mountain (Big Grizzly Mountain), Hall Canyon, Indian Creek, Iron Mountain (Graham Pinery), Jawbone Ridge, Junipero Serra Peak, King Creek, Millard Canyon, Pearch Creek, Peavine Point, Specimen Creek, William's Point
- Interior live oak forest (81330):** Cahuilla Mountain, Fern Canyon, Indian Creek, Millard Canyon
- Black oak forest (81340):** Cahuilla Mountain, Devil's Rock-Hosselkus (Devil's Rock, Hosselkus Limestone), Grizzly Mountain (Big Grizzly Mountain), Hall Canyon, Iron Mountain (Graham Pinery), Peavine Point, Ruth, Sugar Pine Point
- Tan-oak forest (81400):** Adorni, Bridge Creek, Cone Peak Gradient (Limekiln Creek), Hennessy Ridge, Pearch Creek, Upper Goose Creek
- Cherry forest (81800):** Broom Flat (Broom Flat Ridge), Raider Basin (Raider Creek)
- Red alder forest (81A00):** Craig's Creek, Upper Goose Creek, Yurok
- Aspen forest (81B00):** Babbitt Peak, Bell Meadow, Sentinel Meadow, White Mountain (White Mountain Natural Area), William B. Critchfield (Bourland Meadow)
- Western hemlock forest (82200):** Upper Goose Creek
- Alluvial redwood forest (82310):** Cone Peak Gradient (Limekiln Creek), Yurok
- Upland redwood forest (82320):** Cone Peak Gradient (Limekiln Creek), Craig's Creek, Yurok
- Douglas-fir forest (82400):** Craig's Creek
- Upland Douglas-fir forest (82420):** Bridge Creek, Hennessy Ridge, L. E. Horton (Stone Corral-Josephine Peridotite), Manzanita Creek (Trelorita), Pearch Creek, Rough Gulch (South Fork Mountain, Yolla Bolla), Soldier, Specimen Creek, Upper Goose Creek, William's Point
- Port-orford-cedar forest (82500):** Cedar Basin, L. E. Horton (Stone Corral-Josephine Peridotite)
- Knobcone pine forest (83210):** Black Butte, Bridge Creek, Craig's Creek, Frenzel Creek, Hale Ridge, Manzanita Creek (Trelorita), Mayfield, Pearch Creek, Rock Creek Butte, Timbered Crater
- Northern interior cypress forest (83220):** Frenzel Creek, Mud Lake (Mud Lake-Wheeler Peak), Timbered Crater
- Southern interior cypress forest (83330):** Guatay Mountain, King Creek, Long Canyon
- Coast range mixed coniferous forest (84110):** Cone Peak Gradient (South Fork of Devil's Canyon), Cub Creek, Devil's Basin, Devil's Rock-Hosselkus (Devil's Rock, Hosselkus Limestone), Doll Basin, Hale Ridge, Junipero Serra Peak, Manzanita Creek (Trelorita), Pearch Creek, Rock Creek Butte, Ruth, Smoky Creek, Specimen Creek, Twin Rocks
- Santa Lucia fir forest (84120):** Cone Peak Gradient (Limekiln Creek), Cone Peak Gradient (South Fork of Devil's Canyon)
- Upland coast range ponderosa pine forest (84131):** Cone Peak Gradient (Limekiln Creek), Devil's Rock-Hosselkus (Devil's Rock, Hosselkus Limestone), Manzanita Creek (Trelorita)
- Coulter pine forest (84140):** American Canyon, Big Pine Mountain, Cahuilla Mountain, Cone Peak Gradient (Limekiln Creek), Fisherman's Camp, Hall Canyon, King Creek, Millard Canyon

- Bigcone spruce-canyon oak forest (84150):** Aqua Tibia (Eagle Crag), Big Pine Mountain, Cleghorn Canyon, Falls Canyon, Fern Canyon, Millard Canyon
- Ultramafic white pine forest (84160):** L. E. Horton (Stone Corral-Josephine Peridotite), Mount Eddy
- Northern ultramafic Jeffrey pine forest (84171):** L. E. Horton (Stone Corral-Josephine Peridotite), Smoky Creek
- Ultramafic mixed coniferous forest (84180):** Cedar Basin, Green Island Lake, Preacher Meadows
- Westside ponderosa pine forest (84210):** Bishop Creek Ponderosa Pine (Merced River), Fern Canyon, Fisherman's Camp, Grizzly Mountain (Big Grizzly Mountain), Hall Canyon, Iron Mountain (Graham Pinery), Peavine Point, Soda Ridge, Sugar Creek
- Eastside ponderosa pine forest (84220):** Blacks Mountain, Mayfield, Shasta Mud Flow (Mount Shasta Mud Flow), Timbered Crater
- Sierran mixed coniferous forest (84230):** Big Pine Mountain, Cub Creek, Doll Basin, Falls Canyon, Hale Ridge, Hall Canyon, Millard Canyon, Moses Mountain, Mud Lake (Mud Lake-Wheeler Peak), Peavine Point, Ruth, Shasta Mud Flow (Mount Shasta Mud Flow), Soda Ridge, Station Creek (Bald Mountain), Sugar Creek, Sugar Pine Point, Teakettle Creek
- Sierran white fir forest (84240):** Babbitt Peak, Bell Meadow, Bridge Creek, Clark Fork, Cub Creek, Doll Basin, Haypress Meadows, Home Camp Creek, Indiana Summit, Manzanita Creek (Trelorita), Moses Mountain, Mount Pleasant, Mud Lake (Mud Lake-Wheeler Peak), North Trinity Mountain, Onion Creek, Peach Creek, Raider Basin (Raider Creek), Ruth, Shasta Mud Flow (Mount Shasta Mud Flow), Soda Ridge, South Mountaineer Creek (Mountaineer Creek), Station Creek (Bald Mountain), Sugar Creek, Sugar Pine Point, Teakettle Creek
- Big tree forest (84250):** Moses Mountain
- Jeffrey pine forest (85100):** Bell Meadow, Big Pine Mountain, Broom Flat (Broom Flat Ridge), Church Dome, Grass Lake, Indiana Summit, Long Canyon, Sawmill Mountain, Sentinel Meadow, Smoky Creek, Sugar Creek
- Upper montane mixed coniferous forest (85200):** South Mountaineer Creek (Mountaineer Creek)
- Jeffrey pine-fir forest (85210):** Babbitt Peak, Bell Meadow, Church Dome, Grass Lake, Horse Meadow, Indiana Summit, Lyon Peak/Needle Lake, Sawmill Mountain, Sugar Creek, Teakettle Creek
- Washoe pine-fir forest (85220):** Babbitt Peak, Raider Basin (Raider Creek)
- Upper montane fir forest (85300):** William B. Critchfield (Bourland Meadow)
- Red fir forest (85310):** Antelope Creek Lakes, Babbitt Peak, Bell Meadow, Cedar Basin, Clark Fork, Cub Creek, Doll Basin, Grass Lake, Green Island Lake, Haypress Meadows, Home Camp Creek, Indian Creek Brewer Spruce, Moses Mountain, Mount Pleasant, Mud Lake (Mud Lake-Wheeler Peak), North Trinity Mountain, Onion Creek, Peach Creek, Red Butte-Red Fir Ridge (Shasta Red Fir), Rock Creek Butte, South Mountaineer Creek (Mountaineer Creek), Sugar Creek, Teakettle Creek, William B. Critchfield (Bourland Meadow)
- Southern California white fir forest (85320):** Hall Canyon, Horse Meadow, Sawmill Mountain
- Siskiyou enriched coniferous forest (85410):** Indian Creek Brewer Spruce, Rock Creek Butte
- Salmon-Scott enriched coniferous forest (85420):** Cedar Basin, Sugar Creek
- Lodgepole pine forest (86100):** Bell Meadow, Grass Lake, Harvey Monroe Hall, Home Camp Creek, Indiana Summit, Last Chance Meadow, Lyon

- Peak/Needle Lake, Mount Pleasant, Mud Lake (Mud Lake-Wheeler Peak), Sentinel Meadow, South Mountaineer Creek (Mountaineer Creek), Sugar Creek, Teakettle Creek, William B. Critchfield (Bourland Meadow)
- Sierran mixed subalpine coniferous forest (86200):** Home Camp Creek, Snow Canyon
- Whitebark pine-mountain hemlock forest (86210):** Antelope Creek Lakes, Cedar Basin, Crater Creek, Harvey Monroe Hall, Highland Lakes, Lyon Peak/Needle Lake, Red Butte-Red Fir Ridge (Shasta Red Fir), Sugar Creek
- Whitebark pine-lodgepole pine forest (86220):** Crater Creek, Harvey Monroe Hall, Sentinel Meadow
- Foxtail pine forest (86300):** Crater Creek, Last Chance Meadow, Mount Eddy, Sugar Creek
- Bristlecone pine forest (86400):** Whippoorwill Flat, White Mountain (White Mountain Natural Area)
- Southern California subalpine forest (86500):** Horse Meadow
- Whitebark pine forest (86600):** Antelope Creek Lakes, Crater Creek, Harvey Monroe Hall, Raider Basin (Raider Creek), Sentinel Meadow, Sugar Creek
- Limber pine forest (86700):** Last Chance Meadow, Sentinel Meadow, Whippoorwill Flat, White Mountain (White Mountain Natural Area)
- Brewer spruce woodland (no Holland equivalent):** Sugar Creek
- Incense-cedar gully forest (no Holland equivalent):** Doll Basin
- Western white pine (no Holland equivalent):** Babbitt Peak, Snow Canyon, South Mountaineer Creek (Mountaineer Creek)

Alpine Habitats:

- Sierra Nevada fell-field (91120):** Clark Fork, Harvey Monroe Hall, Highland Lakes, Lyon Peak/Needle Lake
- Southern California fell-field (91130):** Sawmill Mountain
- White Mountains fell-field (91140):** McAfee (White Mountain Summit), White Mountain (White Mountain Natural Area)
- Alpine talus and scree slope (91200):** Antelope Creek Lakes, Cedar Basin, Church Dome, Clark Fork, Harvey Monroe Hall, Highland Lakes, Lyon Peak/Needle Lake, McAfee (White Mountain Summit), Moses Mountain, Mount Eddy, Mount Pleasant, Onion Creek, Red Butte-Red Fir Ridge (Shasta Red Fir), Snow Canyon, Sugar Creek
- Alpine snowbank margin (91300):** Harvey Monroe Hall, McAfee (White Mountain Summit), Red Butte-Red Fir Ridge (Shasta Red Fir), Sugar Creek
- Alpine dwarf scrub (94000):** Snow Canyon
- Artemisia cana* ssp. *bolanderi*-*Carex douglasii* (no Holland equivalent):** Indiana Summit
- Haplopappus bloomeri*-*Gayophytum diffusum* (no Holland equivalent):** Indiana Summit

Others (no Holland equivalent):

- Holodiscus microphyllus* (no Holland equivalent):** Manzanita Creek (Trelorita)
- Limestone outcrop (no Holland equivalent):** Long Canyon
- Mountain talus (no Holland equivalent):** Falls Canyon
- Rock outcrop (no Holland equivalent):** Big Pine Mountain, Craig's Creek, Home Camp Creek, Indian Creek Brewer Spruce, Junipero Serra Peak, Millard Canyon, Mount Eddy, Peach Creek, Rock Creek Butte, Wagon Caves
- Rock outcrop and talus slopes (no Holland equivalent):** Soda Ridge
- Rocky herbaceous association (no Holland equivalent):** Sugar Pine Point
- Serpentinite barrens (no Holland equivalent):** Frenzel Creek
- Shale barrens (no Holland equivalent):** Big Pine Mountain
- Subalpine barren and bedrock (no Holland equivalent):** Snow Canyon

Appendix 2—Explanation of rare species protection status

Federal listing: species listed under the Endangered Species Act (Federal Register, 50 CFR 17.11 & 17.12)

Endangered - listed as endangered by Federal government

Threatened - listed as threatened by Federal government

Proposed - proposed for listing, rule-making is in effect

State listing: species protected under the state law: the California Endangered Species Act, The Native Plant Protection Act, the California Environmental Quality Act, and the Natural Communities Conservation Planning Act

Endangered (E) - the prospect of survival and reproduction is in immediate jeopardy from one or more causes

Threatened (T) - although not presently threatened with extinction, it is likely to become an endangered species in the foreseeable future in the absence of the special protection and management efforts

Rare (R) - although not presently threatened with extinction, it occurs in such small numbers throughout its range that it may become endangered if its present environment worsens

Candidate (C) - a taxon that has been officially noticed by the California Fish and Game Commission as being under review by the Department of Fish and Game for addition to the rare, threatened, or endangered species list

Other State listing: Species of Special Concern (for animal species only) – an informal designation used by the California Department of Fish and Game

Forest Service listing:

Sensitive - species known or highly suspected to occur on Forest Service lands that are considered valid candidates for Federal threatened or endangered classification under the Endangered Species Act

California Native Plant Society (CNPS) listing: based on California Native Plant Society Inventory of Rare and Endangered Vascular Plants (Skinner and Pavlik 1994)

List 1A: plants presumed extinct in California

List 1B: plants rare, threatened, or endangered in California and elsewhere

List 2: plants rare, threatened, or endangered in California, but more common elsewhere

List 3: plants about which CNPS needs more information

List 4: plants of limited distribution

United States
Department
of Agriculture

Forest Service

Pacific Southwest
Research Station

General Technical Paper
PSW-GTR-188

Forest Service

Research Natural Areas in California

