
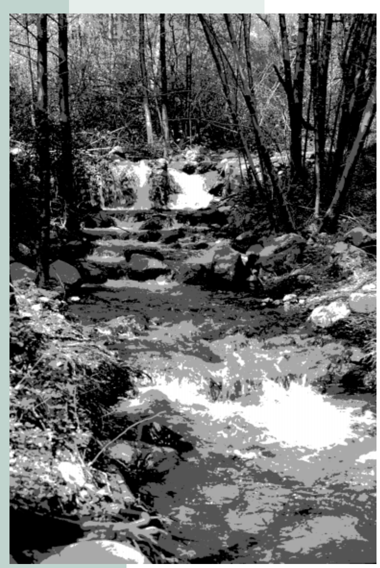

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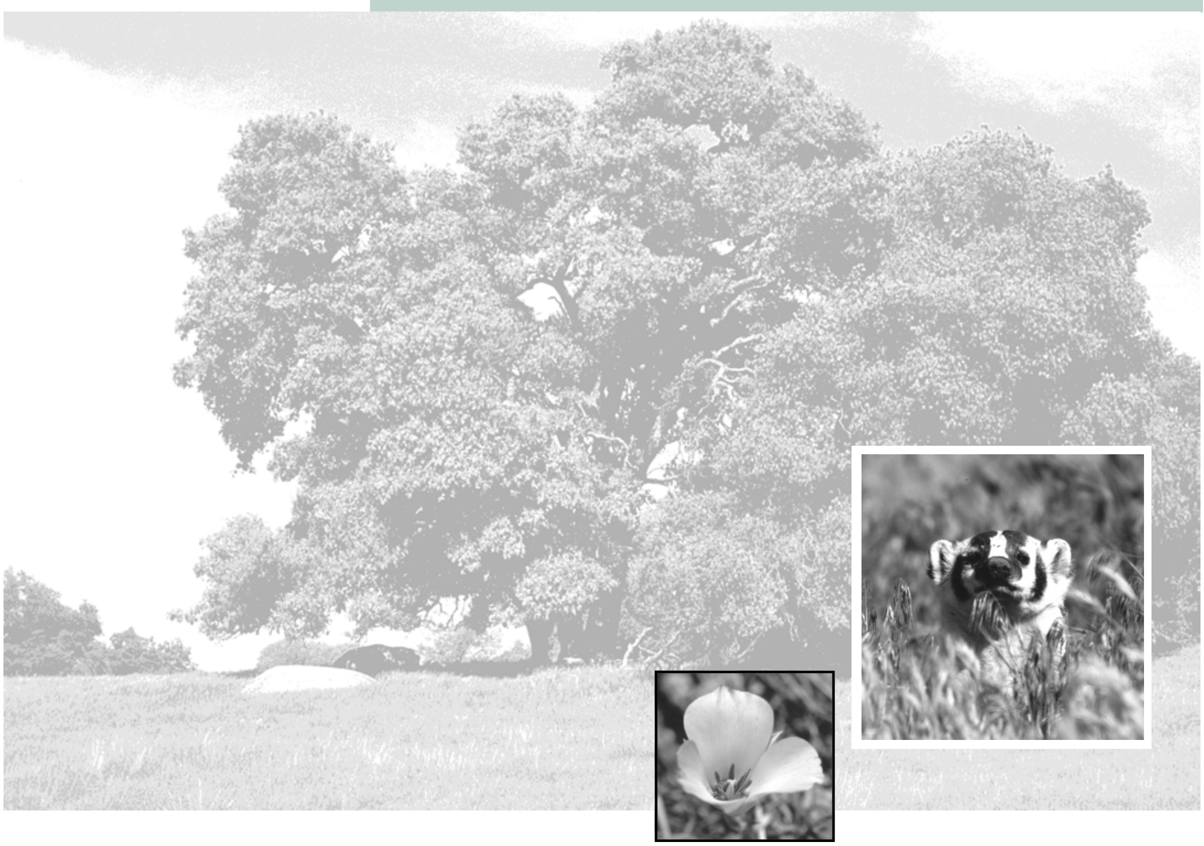
Southern California Mountains and Foothills Assessment

Habitat and Species Conservation Issues

General Technical Report
PSW-GTR-172



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Abstract

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The *Southern California Mountains and Foothills Assessment: Habitat and Species Conservation Issues* provides detailed information about current conditions and trends for ecological systems and species in the region. This information can be used by land managers to develop broad land management goals and priorities and provides the context for decisions specific to smaller geographic areas. The assessment area covers 6.1 million acres, of which 56 percent are national forest system lands. Over eighteen million people live in the coastal basin bordering the assessment area. As compared to historic conditions, mountain and foothill ecosystems in this region have undergone dramatic changes. Forested landscapes are more susceptible to stand-replacing fires. Invasive non-native species have become widely established, causing a decline in habitat capability for many native plants and animals. An extensive network of dams and diversions has altered aquatic systems. Some areas of high ecological integrity remain and can serve as building blocks for restoration. Biological diversity is not uniformly distributed across the landscape; rare species in particular tend to be concentrated in certain habitats. Key areas of high ecological integrity and rare species assemblages are identified in this report. This assessment provides a rich information base, including over eighty mapped themes with associated models and databases, from which future decisions can benefit.

Retrieval Terms: Southern California, ecosystem, biodiversity, land management

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Southern California Mountains and Foothills Assessment

Habitat and Species Conservation Issues

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Preface

This document provides a synthesis of ecological information on the mountains and foothills of southern California. The information comes from a wealth of sources, many of which are unpublished or in technical reports that are difficult to find. By compiling this information in a single reference, we hopefully have furthered its usefulness and heightened awareness of the key issues affecting the ecological integrity of this region. It is our belief that to effectively move forward we must first assemble and understand the existing foundation of knowledge and then build off it.

We thank the Southwest Ecoregion Planning Group (SWEPG) for identifying and promoting the need for this Assessment and the Ecosystem Conservation Staff of the USDA Forest Service, Pacific Southwest Region for providing the funding. The four Forest Supervisors of the southern California national forests – Anne Fege, Jeanine Derby, Michael Rogers, and Gene Zimmerman – provided the leadership to initiate and sustain this effort. The Assessment never would have been completed were it not for their guidance and support.

Many people assisted in the development of this Assessment, but a few were particularly instrumental. Deveree Volgarino provided a great deal of leadership in the compilation of information on botanical issues. Her ever upbeat and helpful demeanor also inspired us. Greg Nichols was instrumental in the development of our GIS database and provided invaluable assistance in conducting spatial analyses and mapmaking. Milan Mitrovich gathered, synthesized, and analyzed all kinds of information for us; his ability to be equally effective at strenuous field work, library research, repetitious data entry, and challenging statistical analysis was outstanding.

Other individuals generously contributed material that was directly used in the report. Laura Merrill wrote the sections on forest insects and diseases. Leigh Sevy synthesized information on the role of defensible fuel profiles in fire management. Melody Lardner, Diane Freeman, Mike Foster, and Kirsten Winter contributed sensitive species evaluations that were used extensively in the species accounts. Thanks to all of you.

The Assessment Analysis Team played a key role in identifying, describing, and prioritizing land management issues. The multidisciplinary and interagency composition of this group helped provide a wide range of perspectives, which led to a balanced evaluation of the subject matter. We greatly appreciate the work of this group and the guidance they provided. A special thanks to Tom White for outlining a structured process to work through the issues as a group and for facilitating many of the discussions.

Many reviewers contributed their thoughtful evaluations to various chapters. Their comments greatly improved the accuracy of the document and we thank them all. We would like to particularly recognize the efforts of Joe Copp, who painstakingly identified corrections to the amphibian and reptile accounts, and Dieter Wilken, who performed a similar service for the plant accounts.

In the course of this project we conducted several field studies to gather additional data. We thank the National Biological Survey (now the Biological Resources Division of the U.S. Geological Survey) and Bat Conservation International for providing grants that made this field work possible. We especially thank the people who spent long days and nights in the field collecting data. Diana Simons, Drew Stokes, Karen Miner, Patricia Brown, Robert Berry, and Lisa Underwood collected data on the distribution and abundance of bats. Robert Fisher, Ed Ervin, Lisa Underwood, and Sharon McKelvey monitored pitfall traps to gather information on the distribution and abundance of amphibians and reptiles. Jack Levy examined the distribution and habitat associations of the Laguna Mountain skipper butterfly. Milan Mitrovich and Zarine Dorabji resampled historic vegetation plots to assess change in forest structure and composition.

Finally, we extend a special thanks to Lark Burkhart for her editorial assistance and for making this document pleasant to look at and easy to read.

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Chapter 6 – Game and Other High-Interest Species

The childhood training of hunters is not so much practical training as the opening of spiritual doors.... Hunting had put a premium on physical good health, on sensitivity to environment and to the nuances and clues in a delicate and beautiful world, on independence, confidence, persistence, generosity, and had given them a powerful sense of the non-human creation.

— Paul Shepard (1973)

There is a value in any experience that exercises those ethical restraints collectively called 'sportsmanship.' Our tools for the pursuit of wildlife improve faster than we do, and sportsmanship is a voluntary limitation in the use of those armaments... a peculiar virtue of wildlife ethics is that the hunter ordinarily has no gallery to applaud or disapprove of his conduct. Whatever his acts, they are dictated by his own conscience rather than by a mob of onlookers. It is difficult to exaggerate the importance of this fact.

— Aldo Leopold (1966)

Key Questions

- **What is the current status of major game and other high-interest animal populations in the coastal mountains of southern California?**
- **What are the primary management issues for these species?**

This chapter examines the current status and trends of the most popular game animals in the region as well as several other species that are of particularly high interest to people. Hunting and fishing are popular activities in the assessment area. State and federal land and resource management agencies invest considerable time and effort managing habitats and monitoring populations of game species. Many of the same habitats that are important to rare and at-risk species are also important to game animals.

Fish

The majority of anglers who go to the mountains and foothills of southern California head for the lakes, where a variety of popular sport fish are planted. These lake fisheries are primarily managed by local water districts and the California Department of Fish and Game (CDFG), usually with minimal involvement from the public land management agencies. For this reason we do not address lake sport fish in this report. For those who prefer flowing waters, there are many fishable mountain streams. The primary sport fish in these streams is the rainbow trout.

Rainbow Trout *(Oncorhynchus mykiss)*

Status and Distribution: Rainbow trout occur throughout the assessment area. A few populations of native steelhead remain (an anadramous or ocean-going rainbow trout; see "Fish" section, chapter 4) primarily in the Los Padres National Forest where some are now landlocked by downstream barriers to the ocean. However, most of the trout found in southern California today are stocked hatchery fish. Many streams in the region are regularly restocked to maintain a recreational fishery.

A few local streams that support productive, self-sustaining trout populations have been designated as "wild trout streams" by the CDFG. These include Sespe Creek and Piru Creek in the southern Los Padres, the West Fork of the San Gabriel River in the San Gabriel Mountains, and Deep Creek and Bear Creek in the San Bernardino Mountains (Deinstadt et al. 1990). These streams have special fishing regulations, including catch-and-release requirements and barbless hooks. Wild trout management plans have been developed for Deep Creek and Bear Creek (Hoover 1983; Hoover and Deinstadt 1989).

Several other local trout streams have the special catch-and-release and barbless hooks regulations. These include the San Antonio River, South Fork of the San Jacinto River, and Pauma Creek and the West Fork of the San Luis Rey River on Palomar Mountain.

Habitat: Rainbow trout can tolerate a variety of water conditions but prefer cool waters. They do best in streams that have deep pools and a well-developed canopy of riparian trees that shade the water (Deinstadt et al. 1990). Aquatic vegetation provides excellent cover for trout.

Management Issues: The biggest issue for the region's trout streams is maintaining adequate stream flows. Most of the wild trout streams lie below dams, and their survival is dependent on sustained water releases from those impoundments. Organizations such as Cal Trout, Trout Unlimited, and San Diego Trout have played a major role in persuading water agencies to commit to sustained water releases in these systems. Trout stocking programs must increasingly consider the effects of this activity on native fish and amphibians, many of which are rare and declining. The special regulations applied to keep wild trout waters from being overfished generally seem to be working. Many of these streams are in back-country areas that are relatively difficult to access. This helps reduce fishing pressure on these waters.

Birds

Quail, turkeys, and pigeons are addressed in this section because they are the most commonly hunted game birds in the assessment area. Waterfowl and doves are not addressed because, although they do occur in the mountains, they are not found in large numbers and few people go to the mountains to hunt them.

California Quail *(Callipepla californica)* and Mountain Quail *(Oreortyx pictus)*

Status and Distribution: California quail and mountain quail are native gallinaceous birds found throughout the assessment area in a wide variety of habitats. California quail range from sea level to about 5,000 feet, while mountain quail extend from below 2,000 to over 9,000 feet (Garrett and Dunn 1981). The range of these two species overlaps broadly, but they have distinct habitat and behavioral differences. Mountain quail occur in more densely vegetated habitats and are dispersed in relatively small coveys of fewer than fifteen birds. California quail prefer more open habitats and typically form coveys of forty to sixty birds, with some containing well over one hundred (Leopold et al. 1981). California quail tend to burst into flight to escape a threat, while mountain quail have a greater tendency to flee on foot. The larger coveys, propensity to fly, and occurrence in open habitats make the California quail more desirable to hunt and thus a much more popular game bird.

Habitat: Mountain quail typically inhabit forested habitat and dense chaparral, while California quail tend to frequent openings and edge habitats (Leopold et al. 1981). Prime habitat for mountain quail is extensive and well represented on public lands within the assessment area. This is less true for California quail; commonly called "valley quail," they reach peak abundance in valley and foothill bottom lands where there is a good mix of openings, brushy cover, and water. These productive bottom-land habitats are predominantly in private ownership and many acres have been converted to croplands and subdivisions that support few quail. California quail do occur in the chaparral-covered hills but mostly at low densities. Biswell et al. (1952) found 100 quail per square mile in unbroken chaparral, with numbers increasing to 250 per square mile in areas where small openings had been created by burning.

Management Issues: The California quail's popularity as a game bird, combined with the fact that much of its prime low-elevation habitat has been converted for other uses, make it a higher priority for management attention than mountain quail. California quail do best in habitat mosaics that contain a mix of open feeding areas and protective brushy cover. Small clumps of trees and shrubs scattered among open feeding areas provide a maximum of "edge" and are ideal for quail when water is available (Leopold 1977). Large, continuous blocks of a single vegetation type provide poor habitat. Thus large stands of unbroken chaparral support low numbers of quail.

The most commonly encountered habitat limitations for quail on national forest system lands are lack of water and lack of suitable openings in the chaparral. Over the years, a large number of water developments (e.g., guzzlers and catchments) have been installed to improve habitat for quail. Local chapters of Quail Unlimited have been particularly instrumental in organizing and implementing these projects. Prescribed burning has been used to create openings and increase age-class diversity in the chaparral.

Wild Turkey *(Meleagris gallopavo)*

Status and Distribution: This popular game bird is native to much of North America but was not present in California at the time of its discovery and settlement by Europeans (Burger 1954). Believing that the distribution of the wild turkey was restricted by geographical barriers and not by a lack of suitable habitat in California, the State Division of Fish and Game began, in the early 1900s, to experiment with introductions of turkeys in various parts of the state (Burger 1954). Most of the early introductions failed, often because the planted birds were too tame to survive for long in the wild. Yet, transplant and release techniques have improved substantially over the last thirty years and wild turkey populations are now established in many parts of California, particularly along the west side of the Sierra Nevada and in the northern and central coast ranges (CDFG 1990).

Turkey populations have been well established for many years in the foothills of Monterey, San Luis Obispo, and northern Santa Barbara counties (Smith and Browning 1967; Garrett and Dunn 1981). The southernmost mountains of California are some of the last areas of potential habitat in the state to have self-sustaining wild turkey populations. A population was successfully established in the San Bernardino Mountains north of Lake Arrowhead in 1988. It is now a very popular resource that attracts hunters from throughout southern California and Nevada (S. Loe, San Bernardino NF, pers. comm). In 1993, turkey populations were established on private lands at several locations in the mountains of San Diego County. Introductions are also proposed for the Cleveland National Forest but have been delayed by litigation over the potential impact on native species. However, the turkeys planted on private lands have dispersed widely and some presently occur on the Cleveland National Forest.

Habitat: Turkeys can occur in a variety of habitats but are found primarily in pine, oak, and mixed hardwood/conifer woodlands. Important habitat components include large roost trees, openings that contain herbaceous plants, and the production of mast crops, especially acorns. Water is a critical habitat requirement for turkeys; they need to drink at least once a day and thus require a dependable year-round water supply (Schorger 1966). In southern California, the limited availability of year-round water substantially reduces the amount of suitable habitat for this species. It is perhaps significant that the turkey's native range corresponds quite closely with portions of the country that receive appreciable and dependable rainfall in the summer months.

Management Issues: Little is known about the effect of introduced turkey populations on California's native flora and fauna. There are no published scientific studies that directly address the subject; research on turkeys in California has focused on their numbers, movements, and food habitats (Schorger 1966; Smith and Browning 1967; Grenfell et al. 1980). On one hand, it can be accurately argued that there is no evidence that turkeys are imperiling native species. However, it can be equally well argued that there is no evidence demonstrating that they do not cause harm. This uncertainty has led to recent controversy over the appropriateness of introducing turkeys into areas where there are rare plants and animals that could potentially be harmed (via increased competition or direct consumption).

A California Department of Fish and Game plan to introduce turkeys on public lands in San Diego County has been stalled by a lawsuit, filed by the California Native Plant Society, over concerns about the impact on native species. These concerns have also triggered opposition from the California Department of Parks and Recreation. Turkeys that wander onto Cuyamaca Rancho State Park from nearby private lands are now being trapped and relocated outside the park's boundaries (LaRue 1995). CDFG is currently conducting a study to assess the effect of introduced turkeys on native species. Hopefully the results will be sufficiently conclusive to resolve this controversy.

This has been a frustrating process, particularly for those who have long sought a huntable turkey population in the San Diego area. It evokes deep-seated concerns among sportsmen who have watched the wildlife management agencies increasingly shift their focus to threatened and endangered species, often at the expense of game management programs. Unfortunately, this understandable frustration has caused some individuals to publicly suggest that an anti-hunting agenda is driving the land management agencies handling of the issue (Zieralski 1996). These baseless allegations only serve to polarize relationships between individuals, organizations, and agencies that should be working together to gather the necessary information and find workable solutions.

Band-tailed Pigeon *(Columba fasciata)*

Status and Distribution: The only pigeon native to California—and not to be confused with rock pigeons found in urban areas—band-tails occur throughout the assessment area and can be abundant in lower montane woodlands. The word "palomar" is Spanish for "pigeon roost," and thus Palomar Mountain is named for this species. There is little current information on the status of band-tailed pigeon populations in southern California. Statewide Breeding Bird Survey (BBS) data indicate a slight declining population trend since 1980, but it is not statistically significant (Sauer et al. 1997).

Habitat: Band-tailed pigeons are closely tied to oaks, occurring both in pure stands and in conifer/oak woodlands. They spend the summer months primarily in montane woodlands but commonly move downslope into the foothills in winter (Garrett and Dunn 1981).

Management Issues: Band-tailed pigeons do not receive a lot of management attention. A fast-moving bird found primarily in densely wooded areas, the band-tailed pigeon is often difficult to shoot. This probably explains why the birds do not experience a lot of hunting pressure in the assessment area. Protection of oak and conifer/oak woodlands is important to this species.

Mammals

The most popular game and nongame animals tend to be large mammals. Those that generate the most interest in the assessment area are addressed below.

Mule deer *(Odocoileus hemionus)*

Status and Distribution: The mule deer is the most important big game animal in southern California. The annual fall deer hunt attracts thousands of people to the mountains and foothills. The California Department of Fish and Game's management of this harvest is aimed at providing a sustained yield and keeping the deer population within the food supply of its natural habitat, thus preventing damage to native habitats, agricultural crops, and orchards.

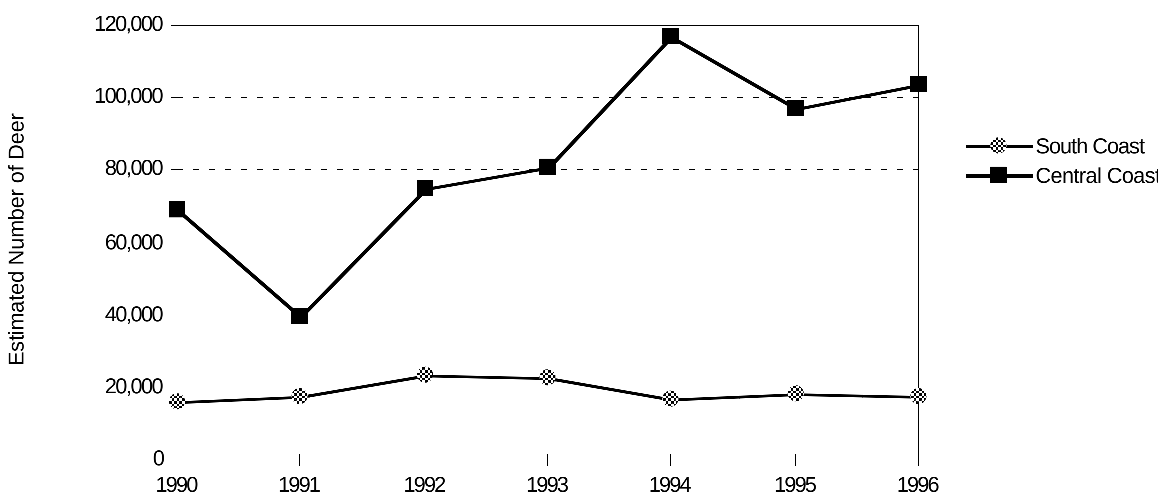
Recent harvest rates and CDFG population estimates (fig. 6.1) suggest that the deer population is relatively stable in the southern half of the assessment area and increasing in the northern half (Loft et al. 1998). CDFG estimates populations by geographic deer assessment units (DAUs). The northern half of the assessment area is in the "central coast (south)" unit or DAU #9, and the southern half is in the "south coast" unit or DAU #10 (Loft et al. 1998). The central coast (south) unit is the only one in the state that showed an increasing population trend from 1990 to 1996 (Loft et al. 1998). No explanation is given for this increasing trend.

The central coast unit is 15,600 square miles in size and the south coast unit encompasses 7,800 square miles. The central coast unit is twice the size of the south coast unit but reportedly has over four times as many deer (fig. 6.1) (Loft et al. 1998). Longhurst et al. (1952) estimated that there were 79,000 deer in the south coast unit in the late 1940s, but 1990s estimates range from 16,000 to 24,000 (Loft et al. 1998). This decline is attributed primarily to large-scale habitat loss on private lands as southern California's human population has grown.

Habitat: Characteristics of deer habitat use vary geographically. Deer are essentially nonmigratory in the low-elevation mountain ranges that lack extensive conifer forests (i.e., the Santa Ana Mountains, San Diego County's mountains, and most of the Los Padres National Forest). In these areas deer reach their highest densities in oak woodlands, riparian areas, and along the margins of meadows and grasslands. They occur in lower densities in open scrub and young chaparral but tend to avoid dense brushfields. In chaparral habitats, deer thrive on early successional vegetation that is prevalent for a period of one to ten years after a fire (Bowyer 1981).

Bowyer (1984, 1986) studied habitat use of mule deer in a low-elevation mountain

Figure 6.1. Deer population estimates for 1990–1996 by deer assessment unit (DAU)(from Loft et al. 1998). These units extend beyond our assessment area boundaries, but the Central Coast DAU encompasses the four northern mountain subareas (southern and northern Santa Lucia Ranges, southern Los Padres ranges, and Castaic Ranges) and the South Coast DAU encompasses the five southern subareas (San Gabriel, San Bernardino, San Jacinto and Santa Ana mountains, and San Diego ranges).



range—on 4,900-foot East Mesa in the Cuyamaca Mountains of San Diego County. He concluded that these southern mule deer are primarily a species of meadows, oaks, and pines. Meadows were found to be particularly important fawning habitat. Deer grass *(Muhlenbergia ridgens)*, a tall bunch grass, was used extensively by fawns for concealment cover. Adult deer typically bedded down in oak and pine stands.

The availability of free water during summer was also a major factor regulating the distribution of mule deer on East Mesa. Areas farther than 0.6 miles from free water received limited summer use. Areas without sources of summer water typically were devoid of fawns. Thus, habitat manipulations greater than 0.6 miles from summer water sources are unlikely to increase populations of mule deer (Bowyer 1996).

In the higher elevation mountain ranges (i.e., Mount Pinos and the San Gabriel, San Bernardino, and San Jacinto mountains), deer commonly undertake altitudinal migrations between summer and winter ranges. Nicholson (1995) and Nicholson et al. (1997) studied tradeoffs associated with migration in a mule deer population within the upper Santa Ana River watershed in the San Bernardino Mountains. In this area, deer exhibit a mixed pattern of migration—some migrate every year, others migrate in some years, and others never migrate.

Migratory deer move upslope for the summer months, into well-watered habitats on north-facing slopes. These areas are dominated by pine forest but also contain openings, meadows, and riparian habitats that the deer utilize. Nonmigratory deer spend the summer on lower slopes, primarily utilizing the limited pine forests that occur there as well as oak woodlands. In winter, deer congregate on lower, south-facing slopes where they heavily utilize oak woodlands. Use of chaparral and sagebrush also increases in winter (Nicholson et al. 1997).

Nicholson et al. (1997) suggest that migration presents a tradeoff between optimizing habitat quality and increasing risk of predation. The upper-elevation summer habitats were of higher quality, but moving to and from them each year increases the risk of predation. Monitoring of radio-collared deer found that migratory females did have higher mortality rates than nonmigratory females and the mortality occurred exclusively during migration (Nicholson et. al. 1997).

The partial deer migration pattern observed by Nicholson in the San Bernardino Mountains probably occurs in the other high-elevation mountains as well. Vaughn (1954) and Cronemiller and Bartholomew (1950) note the occurrence of upslope migrations in the San Gabriel Mountains.

Management Issues: During all seasons, Nicholson (1995) found that deer largely avoided areas regularly occupied by humans (e.g., campgrounds and summer cabins), to the extent that they did not utilize habitats that would otherwise be of high quality (e.g., riparian and meadows). He concluded that mule deer primarily avoid negative features of the environment and consequently often avoid potentially valuable resources at the same time.

The tendency of mule deer to avoid areas where there is frequent human use is a significant management issue. Of particular significance are meadow and riparian habitats that are preferred fawning areas and extremely limited in extent. Such habitats are also desirable locations for recreationists and, as the number of recreationists increase, it becomes more difficult to find areas that do not receive frequent human use. In the San Jacinto Mountains, Schaefer (1999) reported that deer reproductive rates in 1994 and 1995 were representative of a nutritionally stressed population. This could be because they are selecting remote areas that do not contain high-quality foraging habitat.

Bowyer and Bleich (1984) studied the effects of cattle grazing on mule deer in the mountains of San Diego County. They used spotlight transects and pellet group counts to compare deer abundance in two areas of similar meadow habitat, one which was grazed (Laguna Mountain) and one which was not

(Cuyamaca Rancho State Park). They found deer to be significantly more abundant in the ungrazed meadows, with mean densities of two deer per 100 hectares (240 acres) in the cattle grazed meadows and twenty-two deer per 100 hectares in the ungrazed meadows (Bowyer and Bleich 1984). The deer pellet group analysis had a similarly significant result.

Bowyer and Bleich (1984) attribute the reduced densities of deer in cattle-grazed areas to changes in habitat condition. Important forage plants for deer were either absent or reduced on the grazed range, and these areas also lacked dense stands of deer grass, which are known to provide valuable cover for does with fawns. Bowyer and Bleich (1980, 1984) used old photographs to determine that deer grass was also scarce in Cuyamaca's meadows when they were grazed by livestock prior to the state park's establishment. The deer grass recovered after cattle were removed. It should be noted that when this study was done in 1979, the intensity of grazing on Laguna Mountain was much higher than it is now. It would be useful to repeat this study to compare ungrazed conditions with the more moderate grazing regime that is in place today.

North of the assessment area, in the San Francisco Bay region, there is now considered to be a deer over-abundance problem in many suburban areas (McCullough et al. 1997). Evidently, deer in this area have become increasingly tolerant of human development and no longer avoid valuable resources in their vicinity. While this type of behavior has long been a management issue for white-tailed deer *(Odocoileus virginianus)* in the eastern United States, it is rarely reported for mule or black-tailed deer.

There are several reasons why it is unlikely that the tolerance of human disturbance exhibited by deer in the San Francisco Bay area will spread to more remote areas. First, the remaining wildland habitats in the bay area are highly productive for deer but very limited in size and surrounded by development. Thus, carrying capacity is easily exceeded and deer move outside natural habitats into developed areas to survive. If they had other options on where to go, they presumably would try to avoid developed areas. Nicholson's study indicates that in remote areas, where they have the ability to avoid developed areas, they tend to do so even if it means living in lower-quality habitat.

Second, the habitat reserves in the bay area are not open to hunting; thus, for many years now, deer in those areas have not been hunted. This undoubtedly increases their ability to habituate to nonthreatening human activities. Studies have shown that mule deer can habituate to predictable events such as highway traffic, which they learn is not dangerous (Yarmoloy et al. 1988). However, in remote areas where deer are annually hunted and they have choices on where to go, it is highly probable that they will continue to avoid areas where there is high human use.

Habitat Management: The most common habitat manipulation used to benefit deer is prescribed burning, usually in chaparral. Burning creates openings in the brush and temporarily increases the quality of deer forage (Dasmann and Dasmann 1963). After observing marked increases in deer harvested in San Diego County following the Laguna fire in 1970, Bowyer (1981) developed deer management guidelines that emphasize burning to rejuvenate browse.

Bowyer (1986) points out that the proximity of burned areas to other vegetative types preferred by mule deer may be a critical factor in determining the response of deer populations to alterations in old-growth chaparral. Short-lived increases in forage quality in areas with few deer will do little to promote population growth. Thus, chaparral burns will be most effective when they are conducted in areas that adjoin meadow, oak, or pine vegetation types that contain summer water sources.

Based on the aforementioned work of Nicholson et al. (1997) and Bowyer and Bleich (1984), additional consideration should probably be given to management of recreation facilities and livestock grazing in key deer fawning areas.

Nelson's bighorn sheep
(Ovis canadensis nelsoni)

Status and Distribution: The Nelson's bighorn sheep is an animal of high public interest and is considered both a viability concern and a game animal in various parts of its range. Southern California populations are concentrated in the eastern San Gabriel Mountains and eastern San Bernardino Mountains, with a small reintroduced population around San Rafael Peak and Cobblestone Mountain in the southern part of the Los Padres National Forest (fig. 6.2) (Torres et al. 1994).

The San Rafael Peak/Cobblestone Mountain population was established in the 1980s but is believed to be declining (Torres et al. 1994). Originally considered to be a population of twenty-five to fifty animals, it is now believed to support fewer than twenty-five animals (fig. 6.3) (Torres et al. 1996a). Sheep in the San Bernardino Mountains are considered to be two separate populations, the larger in the vicinity of San Gorgonio Mountain and the other on the northern edge of the range in desert-facing canyons such as Furnace, Bousic, Arctic, and Marble canyons.

The bighorn sheep population in the San Gabriel Mountains is, or at least was, considered the largest single sheep population in California (DeForge 1980; Torres et al. 1994).

Figure 6.2. The distribution of Nelson's bighorn sheep in the southern Los Padres, San Gabriel and San Bernardino mountains.

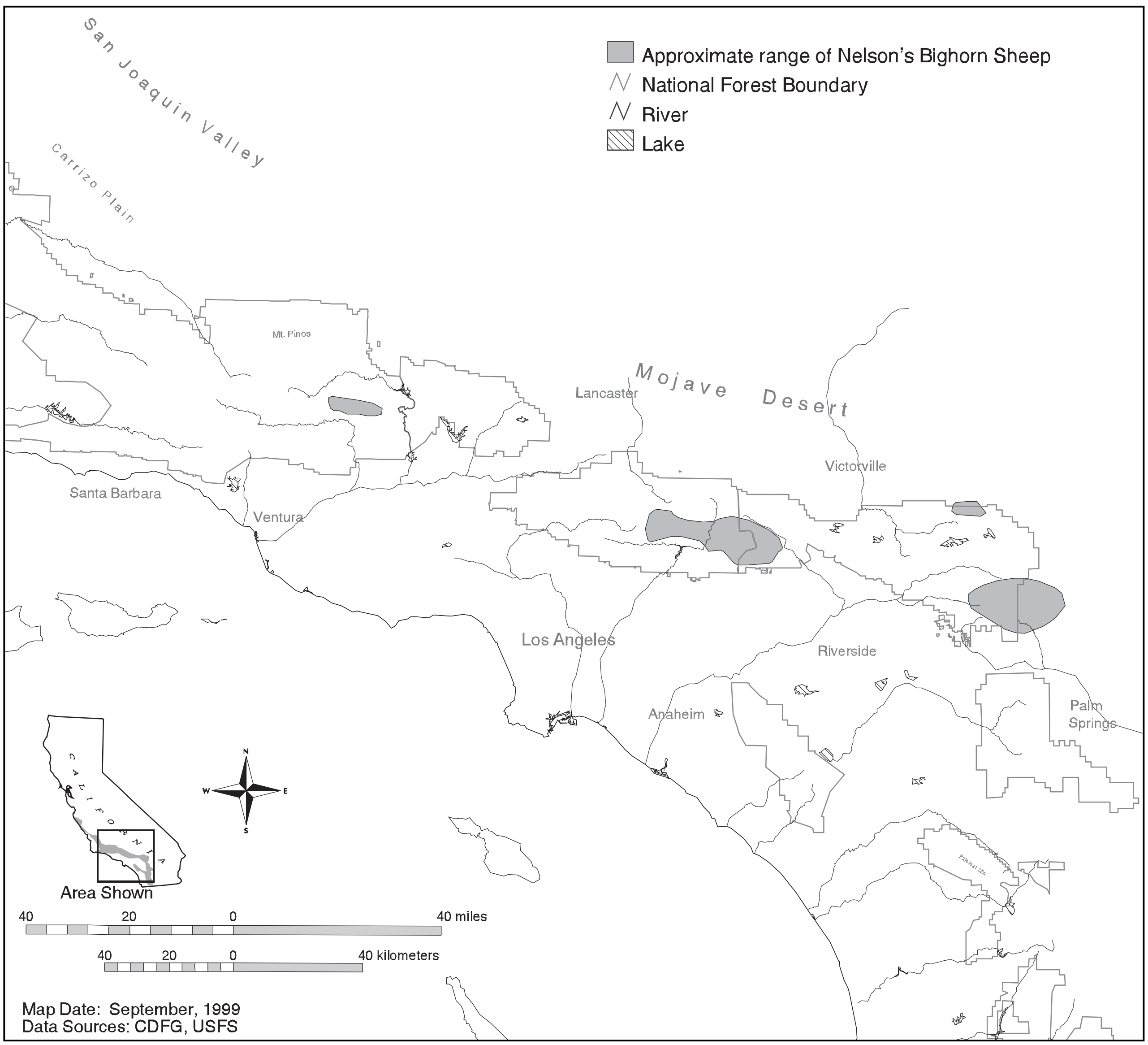


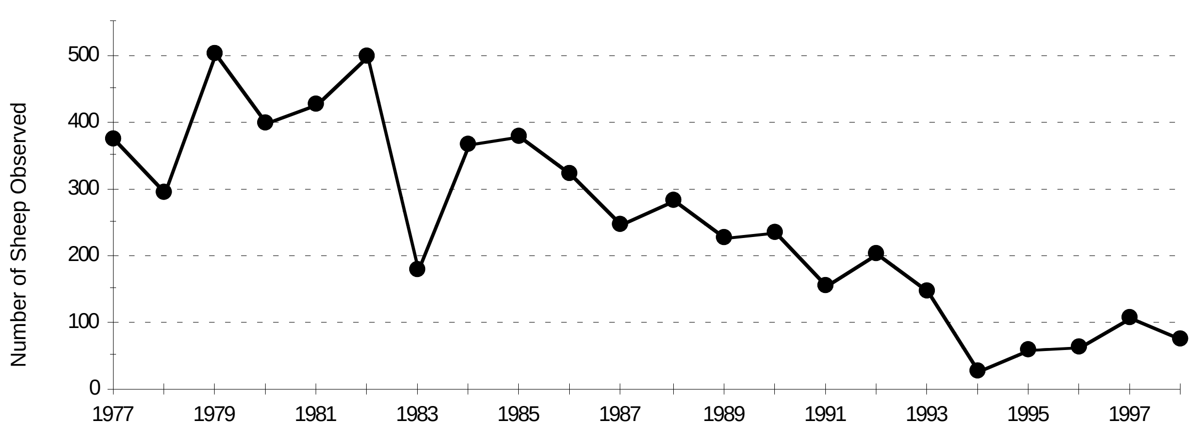
Figure 6.3. The estimated size of Nelson's bighorn sheep populations in the assessment area as reported by Torres et al. (1994, 1996).

		Population Size Class	
Population	**Status**	**1993**	**1995**
San Gabriel Mountains	Native	> 300 (400-600)	101-150
San Gorgonio (San Bernardino Mts.)	Native	101-150	101-150
Northern San Bernardino Mts.	Native	< 25	< 25
San Rafael Pk./Cobblestone Mtn.	Reintroduced	25-50	< 25

Several research projects in the 1970s and early 1980s generated detailed information on the distribution, abundance, and habitat relationships of sheep in this range (Weaver et al. 1972; Light and Weaver 1973; DeForge 1980; Harlacher 1980; Holl and Bleich 1983). Several distinct herds have been identified, with primary concentrations in the Bear Creek drainage (San Gabriel Wilderness), the upper East Fork of the San Gabriel River and Cattle Canyon (both in the Sheep Mountain Wilderness), San Antonio Canyon, Cucamonga Canyon, and the South and Middle Forks of Lytle Creek. Population estimates across this area ranged from 665 to 740 animals between 1976 and 1982 (Holl and Bleich 1983). These estimates were extrapolated from aerial census data. However, census data collected since the early 1980s suggest that the San Gabriel Mountains' bighorn sheep population has declined substantially over the last twenty years (fig. 6.4).

Habitat: For detailed analyses of bighorn sheep habitat utilization in the San Gabriel Mountains, see Light and Weaver (1973) and Holl and Bleich (1983). Escape terrain is identified as the single most important habitat component for sheep in these mountains. Escape terrain is defined as steep slopes (80 percent or greater) with abundant rock outcrops and sparse shrub cover (canopy cover of 30 percent or less) (Holl and Bleich 1983). Sheep in the San Gabriel Mountains range widely in elevation—from 3,000 to 10,064

Figure 6.4. Bighorn sheep census data collected from 1977 to 1998 in the eastern San Gabriel Mountains. These data come primarily from annual aerial surveys conducted by the California Department of Fish and Game, although they also include some ground survey results.



feet (i.e., the summit of Mount San Antonio). During winter and spring, they are primarily distributed in lower canyons between 3,000 and 6,000 feet, where they occupy escarpment chaparral, particularly ceanothus-mountain mahogany associations. In summer, bighorn sheep use all elevations. Their distribution within an area is dependent on escape terrain and open vegetation types.

Management Issues: The primary factors affecting Nelson's bighorn sheep populations in the assessment area are human disturbance, vegetation condition, water availability, and predation. Bighorn sheep are considered sensitive to the presence of humans, particularly high levels of human activity in their line of sight, and may abandon habitat due to human encroachment (Light and Weaver 1973). The effects of human activity on sheep in the San Gabriel Mountains have been studied by Light and Weaver (1973), Hamilton (1983), and Holl and Bleich (1983) with varying findings and conclusions. Light and Weaver (1973) suggest that increased human use in the Baldy Notch area, particularly summer use concentrated around the Mount Baldy Ski Area base facility, has caused sheep to avoid areas that were previously utilized. Conversely, Holl and Bleich (1983) suggest the absence of sheep in that area may be more related to habitat condition. However, both agree that increased summer use on the north-facing side of Mount San Antonio would have a negative effect on bighorn sheep.

Torres et al. (1996a) attribute the pronounced decline of sheep in the San Gabriel Mountains to lack of recent fires, resulting in habitat succession that has altered the abundance of suitable sheep habitat and enhanced the vulnerability of sheep to mountain lion predation. The high sheep numbers observed in the late 1970s coincide with recent fires in those areas. As vegetation matures it becomes less palatable and there is a reduction in the amount of open, escape terrain. CDFG is currently conducting an analysis of factors that are potentially related to the population decline. These factors include changes in winter range, disease, human activity, and drought (Torres et al. 1996a).

The apparent stability of the bighorn population around Mount San Gorgonio may be related to the remoteness of the area. Most of the occupied sheep habitat is within the San Gorgonio Wilderness Area, and the surrounding area to the east and south is largely unroaded. This population is deemed stable enough to support an extremely limited annual hunt. Since 1997, CDFG has issued one tag per year to hunt bighorn sheep in the San Gorgonio area.

Tule elk *(Cervus elaphus nannodes)*

Status and Distribution: Tule elk were once abundant in California's Central Valley and adjacent valleys and foothills. However, the fertile valley habitats they preferred have been almost entirely converted to agricultural land, and the tule elk now occurs only in established reserves and in areas outside or on the fringe of its native range where introduced populations have persisted (e.g., the Owens Valley and Point Reyes) (McCullough et al. 1996). Approximately twenty-two tule elk populations can currently be found in scattered areas across California, three of which are in or near the assessment area in San Luis Obispo and Monterey counties (McCullough et al. 1996).

Tule elk herds occur (1) in valleys on both sides of the southern half of the La Panza Range, (2) on Camp Roberts along the Salinas River, and (3) within Fort Hunter Liggett on the eastern side of the northern Santa Lucia Range. (fig 6.5). Population estimates from 1994 indicate that the La Panza herd is the biggest in the state, with between 550 and 600 animals. There are an estimated 200 to 250 elk on Fort Hunter Liggett and 90 to 100 on Camp Roberts (McCullough et al. 1996). All three of these populations were established in the 1980s through relocation of elk from the Tupman Reserve, Owens Valley, and Potter Valley.

Habitat: Tule elk prefer open habitats and, where available, they tend to congregate in marshy or ephemerally flooded areas that provide high-quality forage. Historically, tule elk

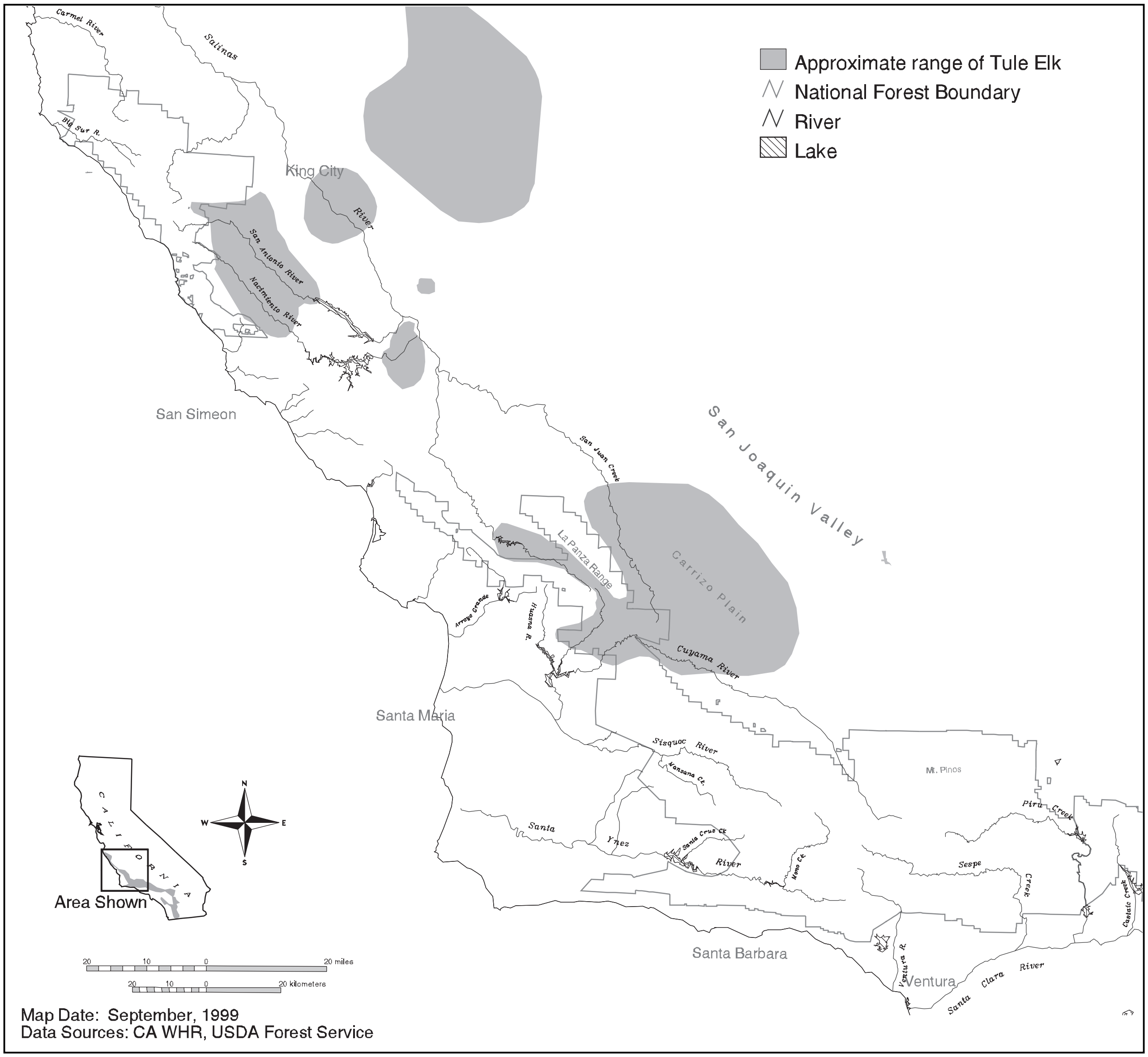


Figure 6.5. The general areas where tule elk occur in the central Coast Ranges.

used upland foothill areas during favorable plant-growth periods, and most calves were born in those areas in March and April. As the upland plants dried up, the elk returned to bottom lands where they remained for most of the year (McCullough et al. 1996). This pattern still occurs today in a few of the larger areas where elk can make seasonal movements. However, agricultural crops such as alfalfa are often utilized now in place of marshy bottom lands.

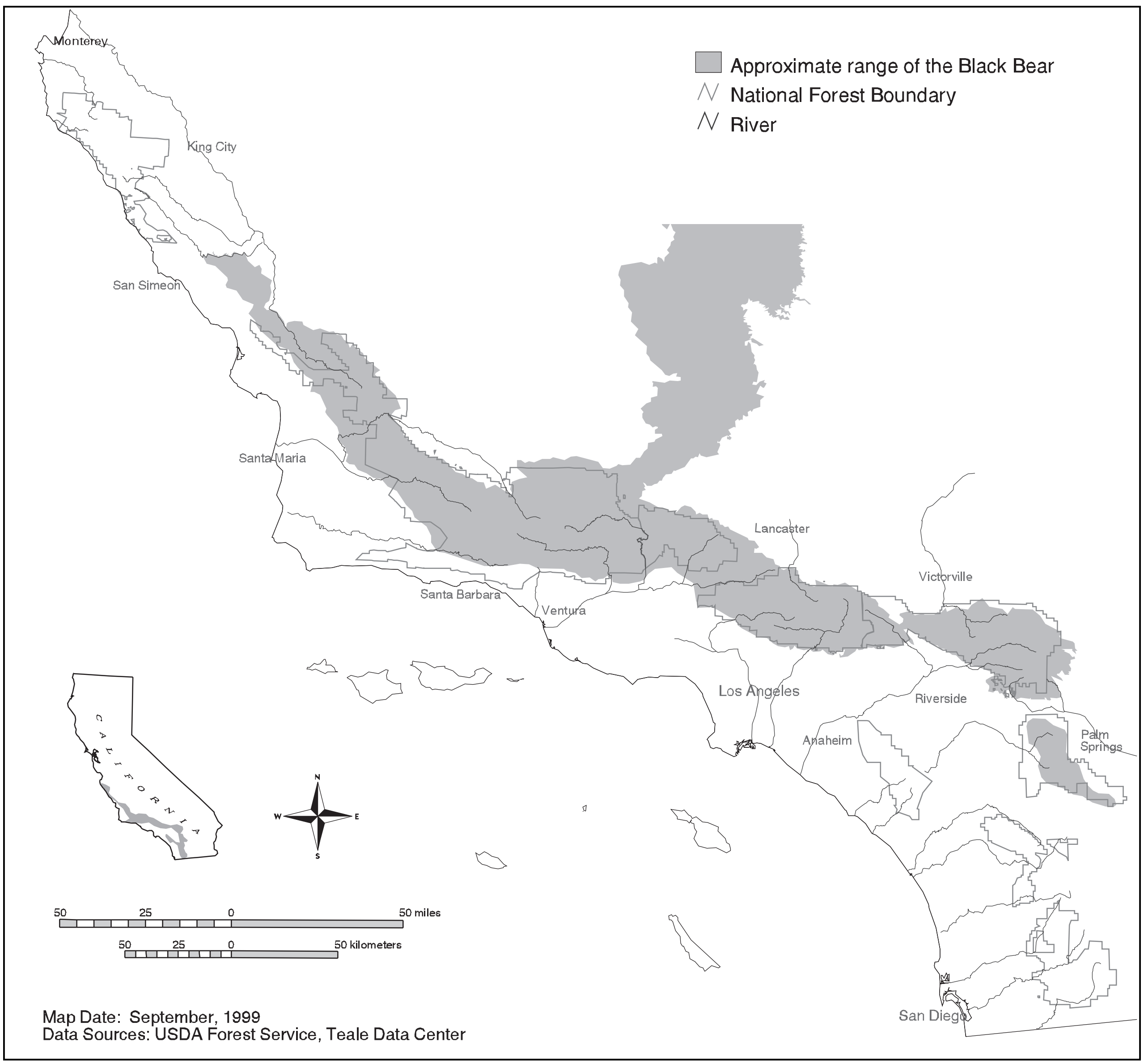
Management Issues: The primary management issues for tule elk are (1) ensuring the long-term availability of large enough blocks of suitable habitat, (2) managing herd sizes in those areas to minimize habitat degradation and damage to agricultural products, and (3) maintaining genetic diversity in the remaining populations, which are relatively small and isolated (McCullough et al. 1996). The La Panza herd utilizes valley habitats that are on private lands. Carefully regulated fall hunts are held at La Panza and Fort Hunter Liggett to maintain herd sizes at levels the available habitat can support.

Black bear *(Ursus americanus)*

Status and Distribution: Black bears reportedly did not occur in the assessment area when the California grizzly bear still inhabited the region (Storer and Tevis 1978). After the grizzly was extirpated around the turn of the century, black bears started to appear in Ventura and Santa Barbara counties (Grinnell et al. 1937). The Department of Fish and Game supplemented this natural range expansion by moving twenty-eight black bears from the Sierra Nevada into the San Gabriel and San Bernardino mountains during the early 1930s (Burgduff 1935; Vaughan 1954). The current black bear population in the San Gabriel and San Bernardino mountains is believed to be primarily descended from those supplemental introductions. Black bears apparently migrated across San Gorgonio Pass into the San Jacinto Mountains, where a small bear population remains.

Black bears now occur throughout the assessment area with the exception of the Santa Ana Mountains and the mountains in San Diego County (fig. 6.6). They are most common in montane conifer forests in the San Bernardino Mountains, San Gabriel Mountains, and the Mount Pinos/Pine Mountain region. Black bear populations are reported to be increasing statewide (CDFG 1998), and

Figure 6.6. Distribution of black bears in the coastal mountains of southern California.



hunter take figures from southern California suggest they are either stable or increasing in most of the assessment area (fig. 6.7) (CDFG 1998). Some recent bear sightings in the mountains of San Diego County suggest that they may be dispersing south from the San Jacinto Mountains.

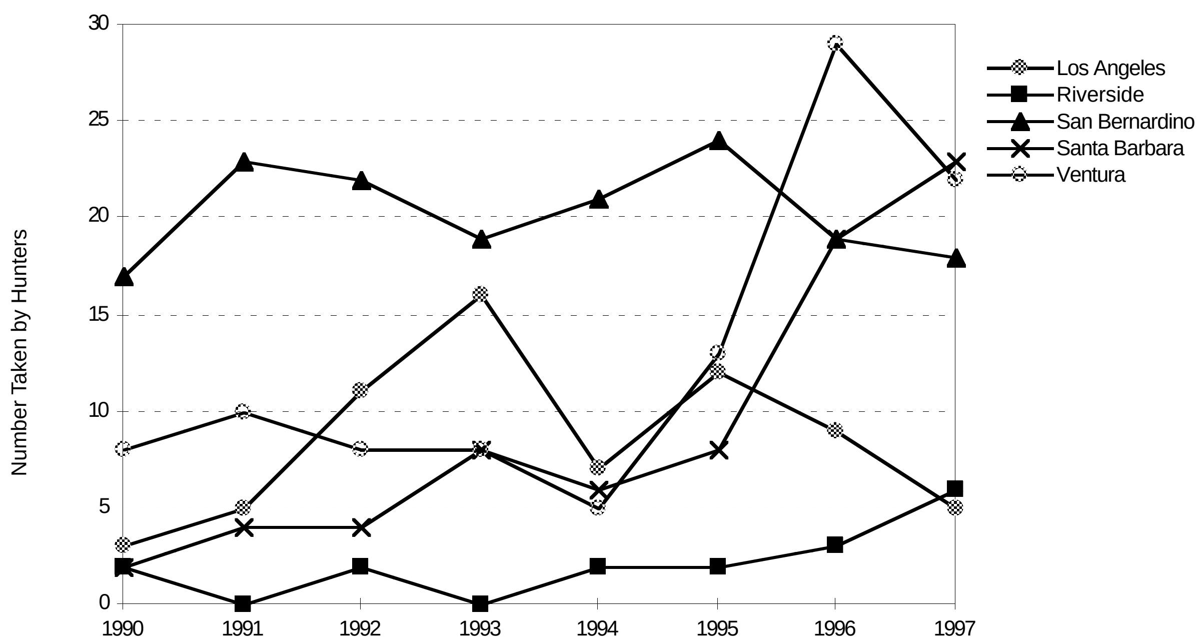
Habitat: Black bears occupy a variety of habitats, but populations are densest in montane forests with a wide variety of seral stages (CDFG 1998). In the southern California mountains, black bears will also follow riparian corridors down into low-elevation habitats. Habitat diversity is important to bears, which eat herbaceous vegetation in the spring, carrion and invertebrates in down woody material in the summer, and mast from shrubs and oaks in the fall.

A number of studies of black bear habitat utilization have been done in the assessment area, all by graduate students at California State Polytechnic University, Pomona. Moss (1972) and Stubblefield (1992) studied black bear ecology in the San Gabriel Mountains. Novick investigated habitat preferences and denning characteristics of black bears in the San Bernardino Mountains (Novick 1979; Novick et al. 1981), and Boyer (1976) studied food habitats of black bears in the Banning Canyon area of the San Bernardino Mountains.

Management Issues: Black bears have become a management problem in some recreation areas (e.g., Forest Falls and Barton Flats in the San Bernardino Mountains). Individual bears become habituated to feeding in these areas, particularly where food and trash are not properly managed and kept in bear-proof containers. This has led to increased human-bear encounters and even several well-publicized "attacks" where people were threatened or injured by bears who were exhibiting aggressive behavior or entering occupied tents in search of food.

Black bears also periodically wander into residential areas at the base of the mountains, particularly along the front of the San Gabriel Mountains. These incidents generate a lot of media attention and are potentially dangerous, particularly if a disoriented bear becomes cornered and reacts aggressively. However, the incidents which have occurred to date have not resulted in human injuries and Fish and Game wardens are usually able to scare the bear back up into the mountains.

Figure 6.7. Hunter take of black bear from 1990 to 1997 in southern California counties (data from CDFG 1998).



Mountain lion *(Puma concolor)*

Status and Distribution: Mountain lions occur in all of the mountain ranges within the assessment area. Circumstantial evidence suggests that lions have become more numerous in California in the past several decades (Torres et al. 1996b). This widely suspected, but poorly documented, population increase has been linked to increased predation of bighorn sheep and deer and increases in human-lion encounters. On the other hand, mountain lions are considered imperiled in some of southern California's highly fragmented wildlands. Beier (1993) conducted a radio-tracking study of mountain lions in the Santa Ana Mountains and Chino Hills. He found that the cougar population in this area consists of only about twenty adults and is in danger of dying out if movement corridors are not sustained to allow immigration from Palomar Mountain. Termed the "Pechanga Corridor," this habitat linkage between mountain ranges is primarily private land.

Habitat: Mountain lions are habitat generalists. They tend to be most common in the habitat types preferred by their primary prey—mule deer. Within these habitat types, lions tend to prefer rocky cliffs, ledges, and other areas that provide cover (Dixon 1982). They have extremely large area requirements; in the Santa Ana Mountains, only about twenty adult lions occupy over 800 square miles of wildland habitat (Beier 1993).

Management Issues: Management of mountain lions in California has become a controversial and politicized issue. Much of the controversy centers on whether regulated mountain lion hunts should be allowed. Mountain lion hunting has not occurred in California since 1972 (Torres et al. 1996b). In 1990, a state ballot initiative (Proposition 117) was passed into law designating the mountain lion as a "specially protected mammal." This designation allows for the issuance of depredation permits but does not permit a hunting season.

There has recently been an increase in depredation incidents and in the number of mountain lion attacks on humans (Torres et al. 1996b). From 1910 through 1985, there were no verified mountain lion attacks on humans in California. Since 1986, there have been nine verified attacks on humans, with two fatal attacks on adult women in 1994 (Torres et al. 1996b). At the same time, there is legitimate concern about the long-term viability of some mountain lion populations (e.g., in the Santa Ana Mountains) that are being isolated by urban encroachment (Beier 1993).

Nowhere is the management dilemma better exemplified than in the mountains and foothills of southern California. While their continued existence is threatened in some parts of the region, lions are also causing some serious problems. In 1986, two nonfatal lion attacks on small children in Caspers Wilderness Regional Park (Santa Ana Mountains) resulted in the closure of that park to children for several years. In 1994, a woman was attacked and killed by a mountain lion while hiking in Cuyamaca Rancho State Park (San Diego County). In 1995, a man was attacked but escaped injury while mountain biking in the Angeles National Forest (San Gabriel Mountains). Pet depredations have also increased along the wildland-urban interface (Torres et al. 1996b) and there is evidence that lion predation is having a negative impact on Peninsular Ranges' bighorn sheep populations (USDI Bureau of Land Management et. al. 1996).

Wild pig *(Sus scrofa)*

Status and Distribution: The wild pig is an introduced species that has become well established in Monterey, San Luis Obispo, and Santa Barbara counties (fig. 6.8). In Monterey County, wild pigs have been reported at densities of 1.3 to 2.1 per square mile (Pine and Gerdes 1973). Increases in hunter take over the past six years (fig. 6.9) suggest that the pig population may be gradually increasing.

Habitat: Wild pigs occur in riparian areas, oak woodlands, grasslands, and mixed hardwood-conifer forests. Mast crops

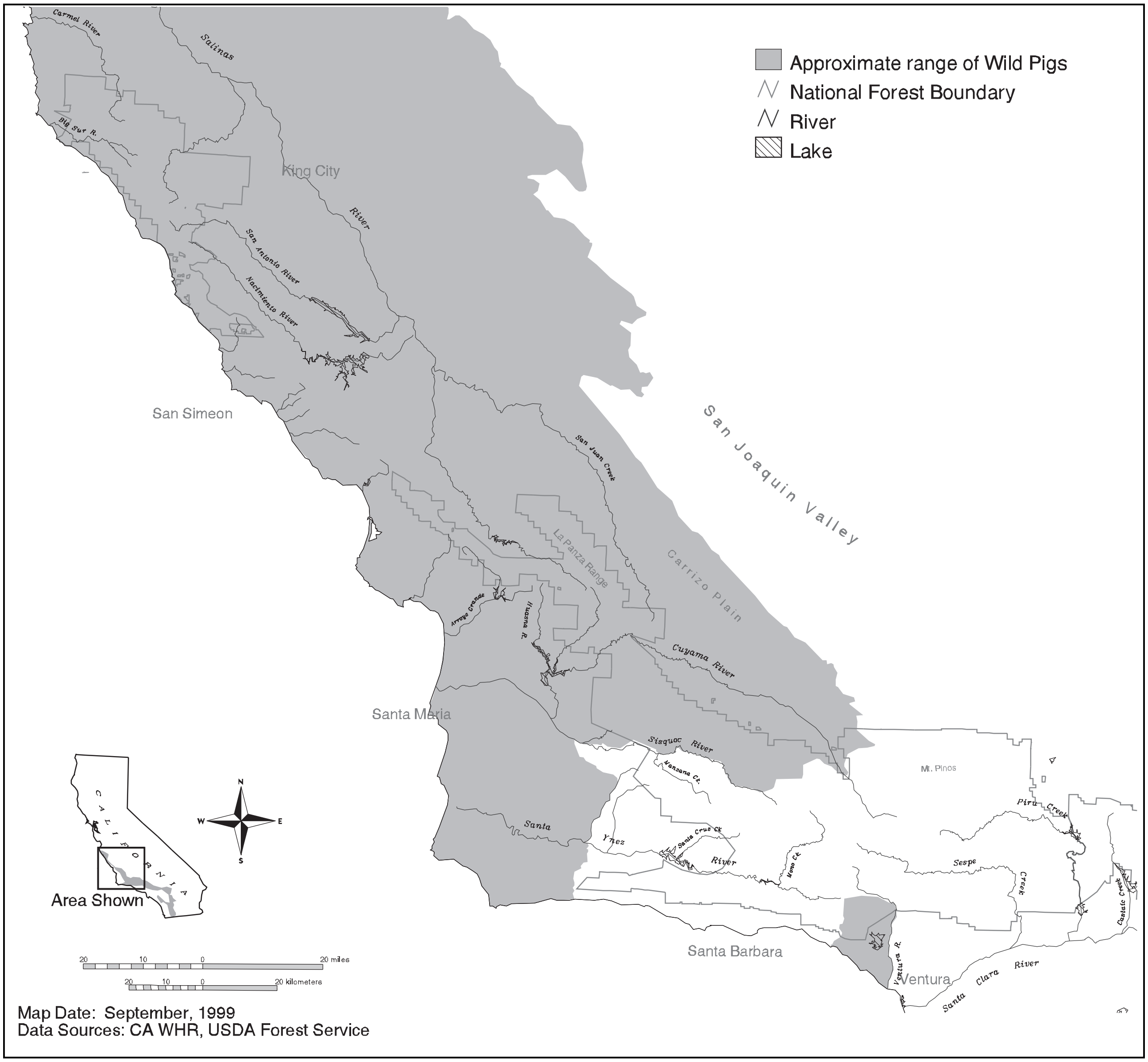


Figure 6.8. Distribution of wild pigs in and around the assessment area.

particularly acorns, are an important food (Zeiner et al. 1990).

Management Issues: Wild pigs are a fairly popular game animal, but there is also concern about the habitat damage they cause in some areas. Pigs can become abundant in some habitats. Where they occur in high numbers, their tendency to dig up the ground in search of food can cause major disturbance to soil and vegetation. They also compete with native wildlife for food, particularly for mast crops such as acorns. Wild pigs can become difficult to manage in areas where they have become abundant. A year-round hunting season, with no limits on the number that can be taken, typically has little effect on the population size.

Wild horse *(Equus caballos)*

Status and Distribution: A wild horse population exists in the interior valleys on the east side of the southern Santa Lucia Range (fig. 6.10). Referred to as the Black Mountain herd, in 1996 it reportedly consisted of eighty-one horses (BLM 1996).

Habitat: Wild horses can occur in a variety of habitats, but they typically prefer open grasslands.

Management Issues: The Wild Horse and Burro Protection Act of 1971 provides

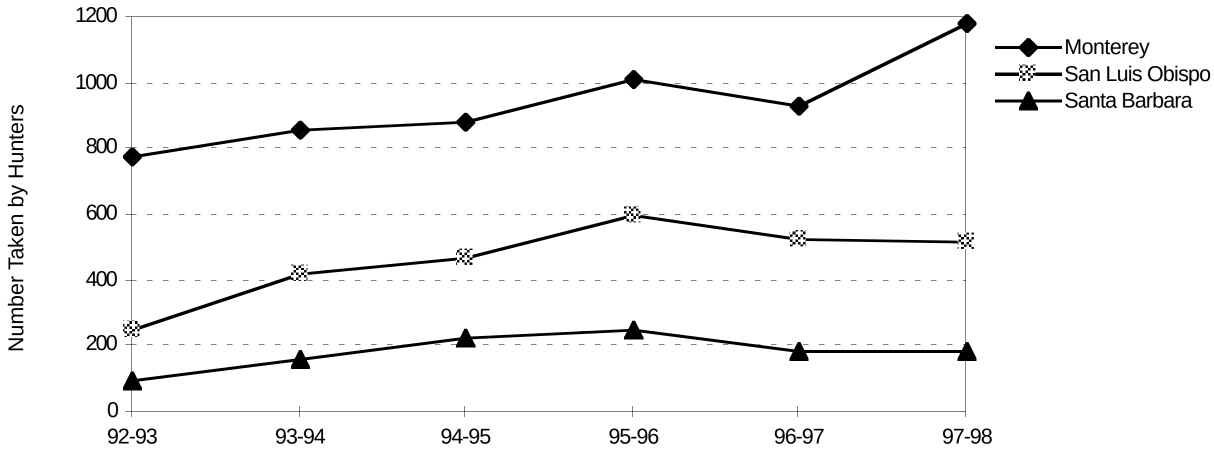


Figure 6.9. Hunter take of wild pigs from 1992 to 1998 in southern California counties (data from CDFG 1999b).

direction for managing wild horse populations. This legislation directs federal land management agencies to maintain herd sizes at sustainable levels while minimizing resource and property damage. When herds become too large, animals are captured, transported to holding facilities, and ultimately sold at public auctions. The Bureau of Land Management (BLM) is in charge of the wild horse and burro adoption program.

Because of the limited amount of suitable habitat at Black Mountain, roundups are held approximately every two years to keep the herd size at or below twenty animals. About two to four horses are rounded up each time and transferred to BLM facilities for adoption. This management strategy appears to be working well, since the habitat on Black Mountain is not being degraded by the current level of use (K. Cooper, Santa Lucia Ranger district, pers. comm.).

Wild burro (*Equus asinus*)

Status and Distribution: A burro population of approximately fifty to sixty animals currently exists in the eastern San Bernardino Mountains (fig. 6.10). This population is organized into multiple loose herds that stay primarily in wildland habitats east of Baldwin Lake. Prior to a roundup in 1997, several large burro herds had become habituated to humans and taken up residence in housing tracts on the east side of the Big Bear Valley. In August and September of 1997, seventy-seven of these "town burros" were rounded up and taken out of the area.

Habitat: Burros are primarily found in arid desert-montane habitats. They are pportunistic herbivores that roam across large areas in search of food resources.

Management Issues: The Wild Horse and Burro Protection Act of 1971 provides direction for managing wild burro populations. This legislation directs that burros removed from the wild are to be cared for and put up for adoption at public auctions.

Wild burros roaming residential areas in the Big Bear Valley have been a management problem for many years. These burros have been adored and fed by some residents and disliked by others, primarily because of their habit of knocking over trash cans and dispersing the contents. Their presence along highly traveled roads also created a dangerous safety problem for both burros and people; on average, thirteen burros a year were hit and killed by vehicles in the Big Bear area (USDA, Forest Service 1998). Fortunately no people have been killed in these accidents, but the potential is clearly there.

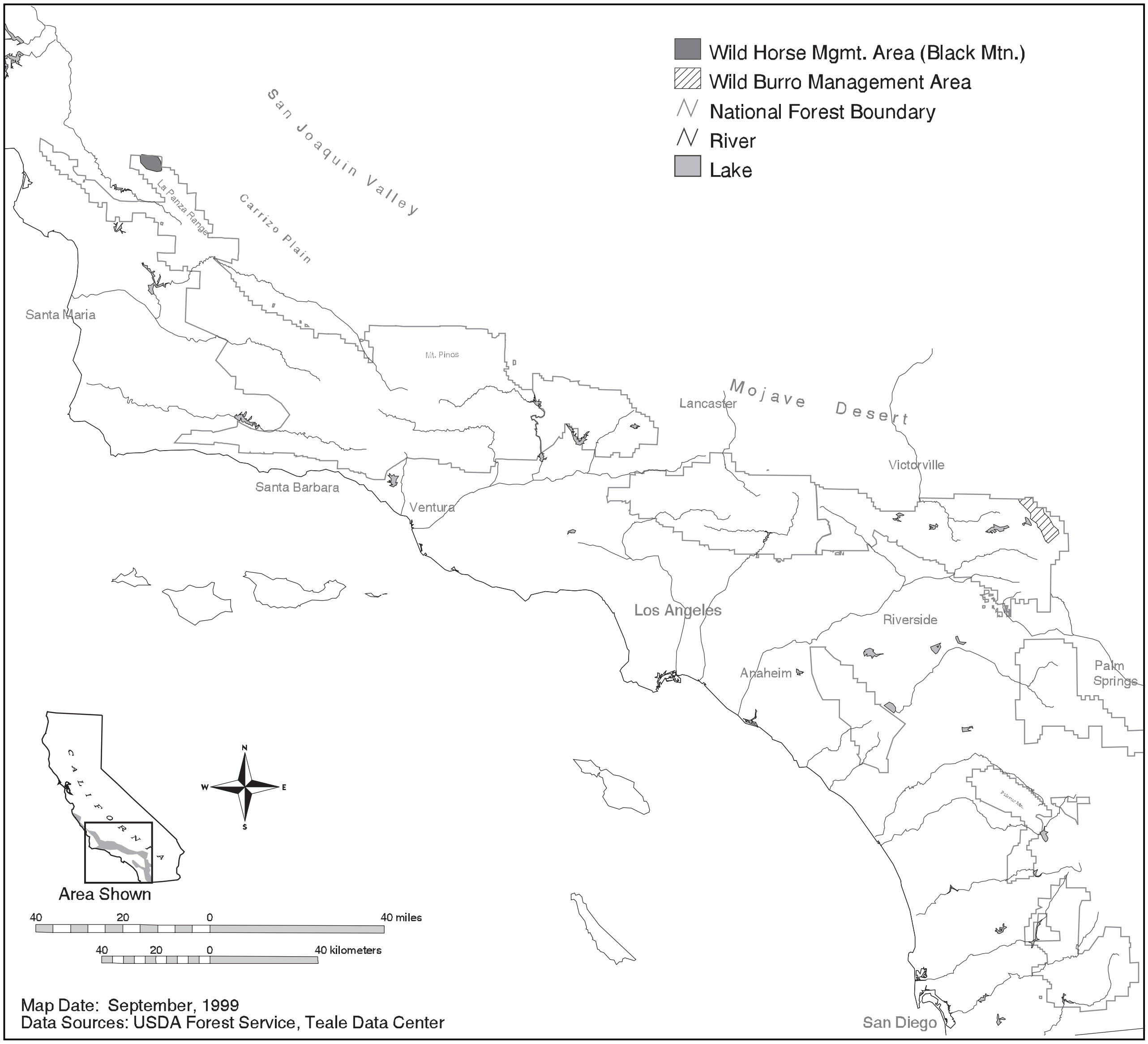


Figure 6.10. The general areas where wild horses and wild burros occur in the coastal mountains of southern California.

After a lengthy environmental review and public involvement period, the Forest Service conducted an extensive roundup of the town-habituated burros in 1997. The animals were taken to BLM holding facilities and subequently put up for adoption. This action has greatly reduced the number of burros hit by vehicles; only one has been hit since the roundup.

Chapter 5 – Potentially Vulnerable Species: Plants

The earth never tires:
The earth is rude, silent, incomprehensible at first—Nature is rude and incomprehensible at first;
Be not discouraged—keep on—there are divine things, well enveloped;
I swear to you there are divine things more beautiful than words can tell.
— Walt Whitman (1856)

Key Questions

- **Which plant species are rare or at risk in the coastal mountains and foothills of southern California?**
- **What is known about the status and distribution of each?**
- **What factors threaten their continued persistence?**

Using the fine-filter screening criteria (see description in the first section of chapter 4), we identified 256 plants occurring within or near the assessment area which warrant individual consideration. Thirty of these species are listed as threatened or endangered (table 5.1) and thus legally protected under the federal Endangered Species Act. Two additional species are proposed for federal listing (table 5.1). Most of the other identified plants are Forest Service Region 5 Sensitive Species. The Forest Service Sensitive (FSS) list is intended as an early alert system, to institute conservation measures before a species declines to levels that necessitate it becoming listed as threatened or endangered. FSS plants are protected through the implementation of Forest Plans and the biological evaluation (BE) process, which considers the potential effects of Forest Service activities on these species.

A few plant species considered in the assessment are neither federally listed nor Forest Service Sensitive species. These are plants which currently do not warrant FSS designation, but information is still gathered about them because they are either locally rare, disjunct occurrences, or information is lacking about their distribution and abundance. Some forests have developed a "watch list" to track these plants.

With few exceptions, the plants addressed in this assessment are higher vascular plants and nomenclature follows the *Jepson Manual* (Hickman 1993). Virtually no evaluation was done of the ferns, fern allies, bryophytes, lichens, basidiomycetes, and ascomycetes in the study area; however, their importance in forest ecosystems is well recognized.

Our primary objective was to use the available information on the 256 identified plants to assess their current status and vulnerability within the assessment area, and, where possible, identify their conservation needs. This information can then be used when developing management priorities.

Evaluating Status and Conservation Potential

The potential for conservation, and the actions needed to conserve, vary considerably depending on the individual characteristics of each species. To assess those characteristics, we compiled information on species-habitat relationships. As with the animals, we structured the evaluation process by grouping the plants based on primary habitat associations. The groupings are clearly generalizations and few of the species fit perfectly within the described

Table 5.1. Federally listed plant species occurring within or near the assessment area and their distribution by national forest (y = occurs, p = potential to occur).

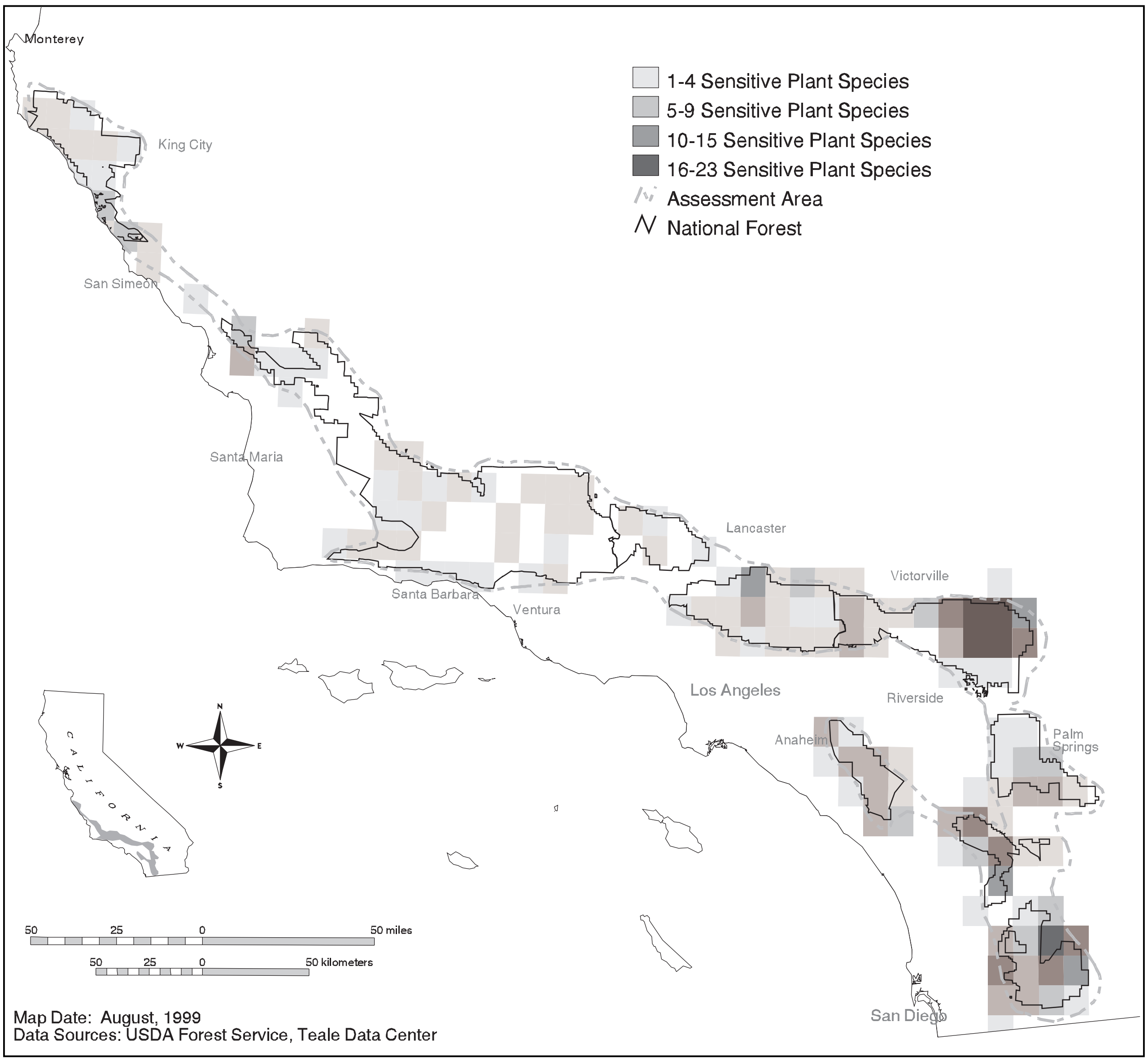
Common Name	Scientific Name	Federal Status	CNF	SBNF	ANF	LPNF
Cushenbury milk-vetch	*Astragalus albens*	Endangered		y		
Braunton's milk-vetch	*Astragalus brauntonii*	Endangered	p		y	
California jewelflower	*Caulanthus californicus*	Endangered				p
Slender-horned spineflower	*Dodecahema leptoceras*	Endangered	y	y	p	
Kern mallow	*Eremalche parryi kernensis*	Endangered				p
Santa Ana River woollystar	*Eriastrum densifolium sanctorum*	Endangered		p		
Cushenbury buckwheat	*Eriogonum ovalifolium vineum*	Endangered		y		
San Bern. Mtns. bladderpod	*Lesquerella kingii bernardina*	Endangered		y		
Cushenbury oxytheca	*Oxytheca parishii goodmaniana*	Endangered		y		
Gambel's watercress	*Rorippa gambellii*	Endangered	p	p		
Bird-footed checkerbloom	*Sidalcea pedata*	Endangered		y		
Slender-petaled thelypodium	*Thelypodium stenopetalum*	Endangered		y		
Encinitas baccharis	*Baccharis vanessae*	Threatened	y			
Santa Monica Mtns. dudleya	*Dudleya cymosa ovatifolia*	Threatened	y		p	
Hoover's eriastrum	*Eriastrum hooveri*	Threatened				y
Parish's daisy	*Erigeron parishii*	Threatened		y		
San Diego thorn-mint	*Acanthomintha ilicifolia*	Threatened	y			
Munz's onion	*Allium munzii*	Endangered	y			
Coachella Valley milk-vetch	*Astragalus lentiginosus coachellae*	Endangered		p		
Triple-ribbed milk-vetch	*Astragalus tricarinatus*	Endangered		p		
Nevin's barberry	*Berberis nevinii*	Endangered	y	p	y	
Mexican flannelbush	*Fremontodendron mexicanum*	Endangered	p			
San Bernardino blue grass	*Poa atropurpurea*	Endangered	y	y		
California dandelion	*Taraxacum californicum*	Endangered		y		
Big Bear Valley sandwort	*Arenaria ursina*	Threatened		y		
Thread-leaved brodiaea	*Brodiaea filifolia*	Threatened	y	p	p	
Ash-gray Indian paintbrush	*Castilleja cinerea*	Threatened		y		
Vail Lake ceanothus	*Ceanothus ophiochilus*	Threatened	y			
La Graciosa thistle	*Cirsium loncholepis*	Proposd. End.				y
Southern mountain buckwheat	*Eriogonum kennedyi austromontanum*	Threatened		y		
Camatta Canyon amole	*Chlorogalum purpureum reductum*	Proposed Th.				y
Marsh sandwort	*Arenaria paludicola*	Endangered		p		

habitat. Many of these species are extremely limited in their distribution and thus occupy only a small portion of the defined habitat association. Still, it is useful to organize species based on general factors that help predict their occurrence. The groups are defined primarily by associations with vegetation types, but soil, geology, moisture, and elevation were also used as habitat indicators.

Many of the focal species are endemic to (i.e., only occur in) one or several mountain ranges and, in some cases, are restricted to portions of a single watershed. Some species continue their distributions into northern Baja California, the Mojave and Sonoran deserts, and the mountains of Arizona and Nevada. The mapped distribution of all species reveals several key areas of rare plant concentration in the assessment area: the eastern San Bernardino Mountains and the mountains of southern San Diego County (fig. 5.1).

Current and historic occurrences of most of the focal plant species were compiled and stored in a GIS database. In addition, a database was developed to track life-history requirements for many of these plants. Information was captured on (1) occurrence by mountain range, national forest, and watershed; (2) associated soils and vegetation types; and (3) information on the effects of fire, grazing, ground disturbance, and exotic species. Base information was obtained from

Figure 5.1. Concentrations of rare plant species across the assessment area (by USGS 7.5-minute quad map).



CALFLORA (Dennis 1995) and PLANTS (1994). The database is an effort to track information that currently exists and to help identify areas where more data are needed. In general, there is more information on woody species and the communities they define than on herbaceous plants.

We also placed each plant species into conservation categories based on criteria that (1) consider their conservation needs, (2) assess the ability to meet those needs on public lands within the assessment area, and (3) evaluate the type of actions needed. Determinations were made for each species after analyzing available information on life-history characteristics, degree of rarity or endemism, regional context, response to land use, extant population size and trend, and other variables as necessary. A complete listing of all plant species and their assigned conservation categories is located in appendix A. The findings from our evaluations are summarized in the following species accounts.

Species Accounts

In addition to the sources cited in chapter 1, much of the baseline information reported in the following tables and species accounts was obtained from the California Native Plant Society's *Inventory of Rare and Endangered Vascular Plants of California* (Skinner and Pavlik 1994) and the *Jepson Manual* (Hickman 1993).

The acres of known habitat listed in the tables for each species are based on mapped occurrences within national forest system boundaries. For plants which we have no mapped information or where it was determined that our information was clearly inaccurate, a *y* or *p* is listed to denote if the plant occurs or potentially occurs within a particular national forest. Even when acres are listed it does not necessarily provide an accurate portrayal of the plants' distribution; rather, it reflects the state of the Forest Service's mapped information. We hope that if inaccuracies are noticed here, it will help spur individuals to supply distributional information so that our maps can be updated.

Riparian Plants

General Riparian Associates

Six rare plants are typically found in riparian habitats, but the association is general and the plants tend to occur across a wide elevational range. Summary information is shown in table 5.2.

Boykinia rotundifolia (round-leaved boykinia)

Boykinia rotundifolia is distributed throughout the San Bernardino, San Gabriel, San Jacinto, Santa Ana, Elsinore, Palomar, and Volcan mountains. There are known occurrences on the San Bernardino and Angeles national forests. Occurrences are also reported for the Cuyama Valley, north of the southern Los Padres region, and there are historic occurrences on the Los Padres National Forest (D. Wilken, Santa Barbara Botanic Garden, pers. comm.). The species is found in lower and upper montane conifer habitats—at mesic places in canyons surrounded by chaparral or yellow pine, and on stream banks in riparian woodlands. The species is predicted to be more common than previously thought due to the abundance of potential habitat yet to be surveyed.

Hemizonia mohavensis (Mojave tarplant)

Hemizonia mohavensis is state listed as endangered. It is known from three historic occurrences, including one in the San Jacinto Mountains and another along the Mojave River near Deep Creek at the foot of the San Bernardino Mountains. The species was thought to be extirpated, but several new occurrences have recently been discovered; plants were found along Twin Pines and Brown creeks on the northern slopes of the San Jacinto Mountains, including an estimated six thousand plants counted in the fall of 1994 in the Twin Pines Creek drainage (Sanders, Banks, and Boyd 1997). Additional populations were

Table 5.2. Rare plants found in riparian habitats (general). y = the taxon occurs on the forest; p = has potential to occur; h = is known historically. Trend, knowledge of distribution, and vulnerability information was determined by forest botanists/biologists and generally refers to occurrences on national forest system lands (unkn. = unknown; decl. = declining; incr. = increasing).

Scientific Name (common name) *listing status*	Acres of Known Habitat CNF	SBNF	ANF	LPNF	Trends	Vulner-ability on NFS lands	Overall Distribution (Knowledge of distribution on NFS lands)
Boykinia rotundifolia (round-leaved boykinia)	p	y	5	h	unkn.	unkn.	San Bernardino, San Gabriel, San Jacinto, Santa Ana, Elsinore, Palomar, & Volcan mtns., Cuyama Valley; (low)
Hemizonia mohavensis (Mojave tarplant) *state endangered*	72	y	p		stable[1]	low	San Bernardino, San Jacinto, & Pal-omar mtns., S Sierra Nevada; (moder ate)
Lilium humboldtii ssp. *ocellatum* (ocellated Humboldt lily)	y	y	y	y	unkn.	low	Santa Lucia Ranges, S Los Padres & Castaic regions, Peninsular Ranges in SD Co., E San Gabriel, San Bernardino, San Jacinto, Santa Ana, & Santa Monica mtns., Channel Islands; (moderate)
Muhlenbergia californica (California muhly)		y	y		unkn.	unkn.	San Bernardino, San Gabriel, & San Jacinto mtns. (low)
Scutellaria bolanderi ssp. *austromontana* (southern skullcap) *FS sensitive*	y	y			unkn.	low on CNF, unkn. on SBNF	San Bernardino & San Jacinto mtns., Peninsular Ranges in SD Co. (low)
Thelypteris puberula var. *sonorensis* (Sonoron maiden fern)		y	p	y	unkn.	unkn.	coastal to foothills in LA, Riverside, San Bernardino, & Santa Barbara cos., Baja & Sonora, Mexico, AZ; (low)

[1]Sanders, Banks and Boyd 1997

found in the Poppet Flat area one year later and, in 1997, in the Baldy Mountain area. In 1996, occurrences were discovered in Cutca Valley and adjacent areas of the Long Creek drainage on the north side of Palomar Mountain in San Diego County. Other San Diego County populations were discovered in the vicinity of Indian Flats and in Chihuahua Valley, north of Warner Springs. The species was also recently documented in the southern Sierra Nevada (CNPS 1999).

Lilium humboldtii ssp. *ocellatum* (ocellated Humboldt lily)

Lilium humboldtii ssp. *oscellatum* is an uncommon though wide-ranging subspecies, distributed in the southern Santa Lucia Ranges, the southern Los Padres and Castaic regions, the Peninsular Ranges in San Diego County, the eastern San Gabriel, San Bernardino, San Jacinto, Santa Ana, and Santa Monica mountains, and the Channel Islands (McAuley 1985). Occurrences are known on all four southern California national forests. The plant is included in a conservation strategy for coastal sage scrub (USFS/USFWS/CDFG 1997).

Plants on the Cleveland and San Bernardino national forests are found in low-elevation riparian areas and seeps of chaparral canyons. On the Angeles National Forest the taxon is found in riparian areas with big-leaf maple or in mixed evergreen forest. Occurrences are known from Lucas Creek (near the Big Tujunga narrows) and Trail and Wilson canyons (Bramlet and Boyd 1998). Occurrences on the Los Padres National Forest range from the Casitas Pass area to San Julian Creek in the Santa Ynez Mountains, and inland to mountainous areas along Sespe Creek and at Thorn Meadows (Smith 1976). The plant generally grows on gravelly soils, in drainages and canyon bottoms. These areas are subject to natural flooding and erosion, and plant occurrences are vulnerable to activities that affect natural water flows. Altered fire regimes in some areas have led to stand densification upslope of riparian areas, which in turn has caused reduced base flows. The plant is also vulnerable to horticultural collecting.

***Muhlenbergia californica* (California muhly)**

Muhlenbergia californica is a perennial grass found along streams in the San Bernardino, San Gabriel, and San Jacinto mountains. Occurrences are known mainly from coastal-flowing drainages and canyons, but some plants have been found at the southeastern end of the San Bernardino Mountains near the desert interface. Plants grow in perennially mesic areas within chaparral, coastal sage scrub, and lower montane coniferous forest. Most occurrences are found in the chaparral zone between 3,000 and 4,000 feet. Five occurrences are recorded in the CNDDB, all from 1951 or earlier. Other more recent occurrences are known on the San Bernardino and Angeles national forests, where the species is protected through management of riparian areas and wetlands. The species is vulnerable to flooding and erosion.

***Scutellaria bolanderi* ssp. *austromontana* (southern skullcap)**

Scutellaria bolanderi ssp. *austromontana* is a Forest Service Sensitive Species. It is known from extant occurrences in the Peninsular Ranges of San Diego County and the San Jacinto Mountains. One historic occurrence is known from near the San Bernardino Mountains. The CNDDB lists sixteen occurrences, some on the Cleveland National Forest. At least two more occurrences are known on the San Bernardino National Forest in the San Jacinto Mountains. The plant grows in gravelly soils (sometimes gabbro) along streams.

***Thelypteris puberula* var. *sonorensis* (Sonoran maiden fern)**

Thelypteris puberula var. *sonorensis* is an uncommon fern distributed in Los Angeles, Riverside, San Bernardino, and Santa Barbara counties. Occurrences are also known from Arizona and Baja and Sonora, Mexico. The plant grows in meadows, seeps, and along streams, in coastal and inland valley areas, and up to around 2,000 feet in the foothills. The CNDDB contains records for twelve occurrences and at least one additional location is known on the San Bernardino National Forest. The Hemlock Fire of 1997 occurred at this same location but it is still unclear what effects the fire and subsequent flooding and erosion had on this occurrence. Smith (1976) lists six canyons where this fern occurs on the Los Padres National Forest.

Low-Elevation Riparian Associates

Eleven rare plants are found or have potential to occur in low-elevation riparian habitats within the assessment area. Summary information is shown in table 5.3. Three federally endangered species and one proposed endangered species are included in this group.

***Artemisia palmeri* (San Diego sagewort)**

Artemisia palmeri occurs in moist ravines in southwestern San Diego County (McMinn 1951). The shrub is occasional along perennial coastal drainages and in mesic areas of chaparral farther inland. It grows with willow, sycamore, and cottonwood in riparian areas, and chaparral whitethorn, scrub oak, and coast live oak in areas of chaparral. Reiser (1994) lists numerous historic and extant occurrences,

Table 5.3. Rare plants found in low-elevation riparian habitats. y = the taxon occurs on the forest; p = has potential to occur; h = is known historically). Trend, knowledge of distribution, and vulnerability information was determined by forest botanists/biologists and generally refers to occurrences on national forest system lands (unkn. = unknown; decl. = declining; incr. = increasing).

Scientific Name (common name) *listing status*	Acres of Known Habitat				Trends	Vulner-ability on NFS lands	Overall Distribution (Knowledge of distribution on NFS lands)
	CNF	**SBNF**	**ANF**	**LPNF**			
Artemisia palmeri (San Diego sagewort)	y				decl.[1]	low	coastal & cismontane San Diego Co.; (high)
Astragalus deanei (Dean's milk-vetch) *FS sensitive*	27				stable/ decl.[2]	low	Peninsular Ranges in San Diego Co.; (moderate)
Cirsium loncholepis (La Graciosa thistle) *proposed endangered*				y	decl.	low	S central coast (Monterey Coast, Guadalupe Dunes); (high)
Dodecahema leptoceras (slender-horned spineflower) *federally endangered*	8	10	p		unkn./ decl.	mod.[4]/ high[5]	Peninsular Ranges of SD Co., base of San Bernardino & San Gabriel mtns., San Jacinto Mtns.; (high)
Dudleya densiflora (San Gabriel Mtns. dudleya) *FS sensitive*			9			mod.	along San Gabriel River in San Gabriel Mtns.
Eriastrum densifolium ssp. *sanctorum* (Santa Ana River woollystar) *federally endangered*		h/p			decl.[3]		base of San Bernardino Mtns.; (moderate)
Ericameria palmeri ssp. *palmeri* (Palmer's goldenbush)	p				decl.[1]		coastal and foothill San Diego Co., Baja; (low)
Hemizonia floribunda (Tecate tarplant) *FS sensitive*	p				stable[1]		San Diego Co., Baja; (low)
Hemizonia pungens ssp. *laevis* (smooth tarplant)	p				decl.[1]		SD, LA, Orange, Riverside, San Bernardino, & Kern cos., Baja; (low)
Pedicularis dudleyi (Dudley's lousewort) *FS sensitive*				224	stable to incr.	mod.	Monterey, Santa Cruz (historically), SLO, & San Mateo cos.; (moderate)
Rorippa gambellii (Gambel's water cress) *federally endangered*	p	p		p	unkn.		W Santa Barbara & SLO cos., Baja, h in San Diego and San Bernardino cos.; (low)

[1] Reiser 1994 (refers to all known occurrences)
[2] stable on national forest system lands, declining on private lands
[3] White 1990
[4] on the Cleveland National Forest
[5] on the San Bernardino National Forest

ranging from sea level to approximately 2,000 feet in elevation. A small amount is known to occur on the Cleveland National Forest.

Astragalus deanei (Dean's milk-vetch)

Astragalus deanei is a Forest Service Sensitive Species. It is distributed in the upper Otay River and Sweetwater River drainages in southwestern San Diego County (Reiser 1994). There are close to ten recorded occurrences, some located on the Cleveland National Forest. The plant is associated with coastal sage scrub and chaparral vegetation. It grows in low-elevation riparian habitat and sandy washes. A conservation strategy for coastal sage scrub includes this species (USFS/USFWS/CDFG 1997).

Cirsium loncholepis (La Graciosa thistle)

Cirsium loncholepis is proposed for federal listing as endangered. It is a short-lived plant (one to two years) found along the southern central coast. Approximately nine occurrences are known in western and northern Santa Barbara and southern San Luis Obispo counties (fig. 5.2). These occurrences are found in back dunes and coastal wetlands, which are part of the Guadalupe Dune system located at the mouth of the Santa Maria River. The habitat is described as areas where free water is available along dune lakes and swales, marshes, and the edges of willow thickets. The species grows with rush, tule, willow, poison oak, salt grass, and coyote brush. These occurrences are located on private lands and are vulnerable to groundwater pumping and development associated with oil production. The historic distribution of this species has been significantly reduced by the conversion of wetland habitat for agricultural use and other development (USFWS 1998n). In addition, coastal dune habitat where this species is found has been invaded by non-native plants such as veldt grass, European beach grass, iceplant, and crystalline ice plant.

One occurrence is known in Monterey County on the Los Padres National Forest. This occurrence in not noted in the proposed rule for federal listing (USFWS 1998n). Habitat in Monterey County consists of serpentine seeps surrounded by maritime or coastal chaparral that receives exposure to coastal fog.The one known occurrence on national forest system land is found near Willow Creek, just north of Cape San Martin.

Dodecahema leptoceras (slender-horned spineflower)

Dodecahema leptoceras is a federally endangered species found along sandy stream terraces. Occurrences are known from Arroyo Seco and Temescal creeks in the mountains of San Diego County, on the east side of the Santa Ana Mountains, along the Santa Ana River at the foot of the San Bernardino Mountains, along Lytle Creek at the foot of the San Gabriel Mountains, and in Bautista Canyon and along the San Jacinto River near the San Jacinto Mountains (fig. 5.3). There are close to a dozen recorded occurrences in all, many of them small, and an estimated one-third to one-half of them are located on federal or state lands. *D. leptoceras* occupies alluvial fan scrub habitat, which is declining in Los Angeles, San Bernardino, and Riverside counties due to urban and agricultural development, sand and gravel mining, and flood control measures (USFWS 1987). In some areas, off-road vehicle activity and trash dumping have degraded the habitat. Plants are typically found in areas with no exotic species or obvious ground disturbance. In the San Jacinto Mountains, plants occur on relatively young alluvial benches and are affected by erosion (M. Lardner, San Bernardino NF, in litt. 1999). The U.S. Fish and Wildlife Service uses the name *Centrostegia leptoceras* when referring to this species. An interim species management guide was developed for occurrences on the Cleveland National Forest (L. Croft, Cleveland NF, unpubl. doc. 1989) and the plant is included in a conservation strategy for coastal sage scrub (USFS/USFWS/CDFG 1997).

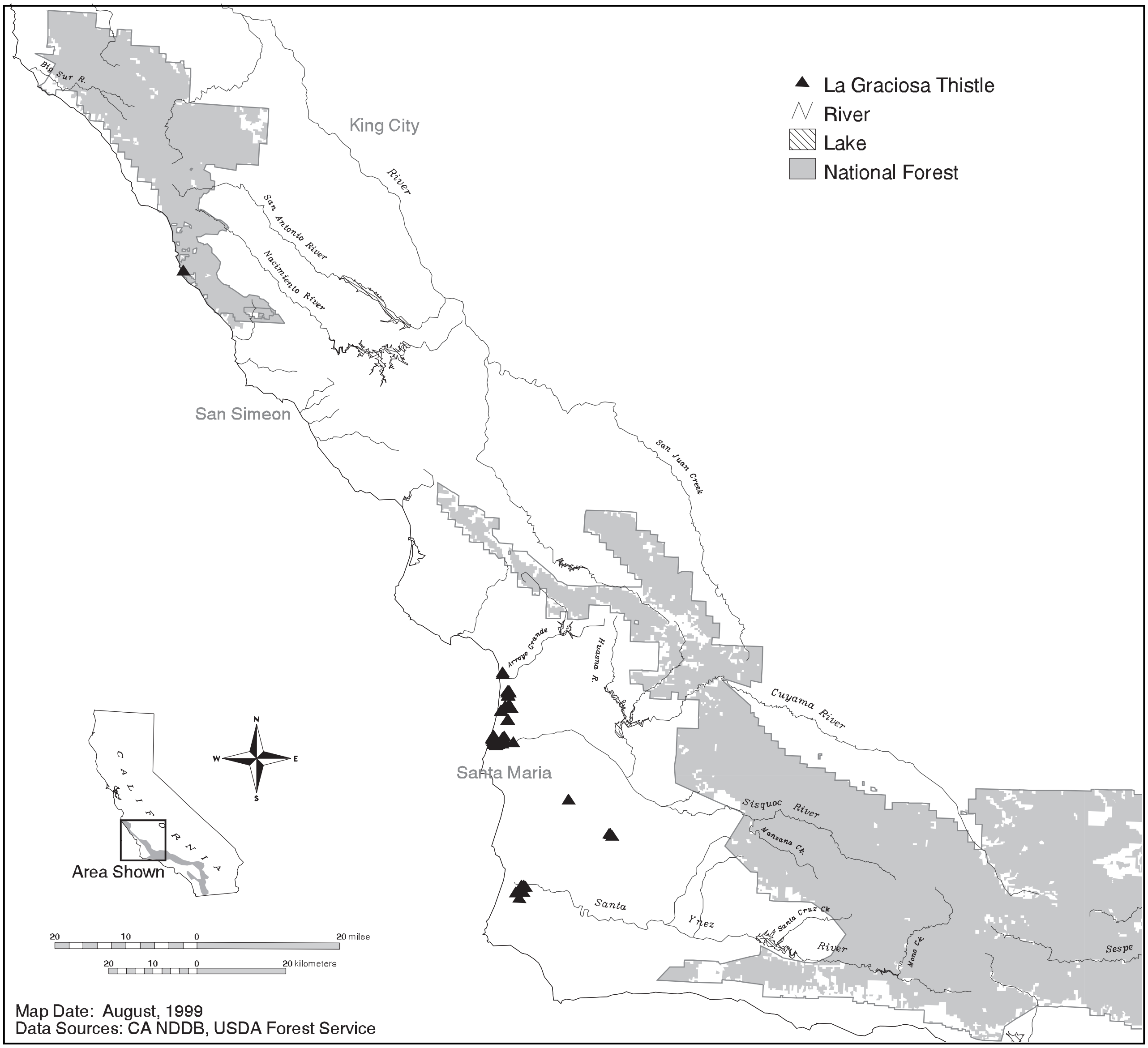


Figure 5.2. Known distribution of *Cirsium loncholepis,* the La Graciosa thistle.

Dudleya densiflora
(San Gabriel Mountains dudleya)

Dudleya densiflora is a Forest Service Sensitive Species. It is known from approximately five occurrences along the San Gabriel River: at Fish Canyon, Roberts Canyon, and the mouth of San Gabriel River Canyon. Close to 1,750 plants were counted at these three sites during surveys in 1989 (Mistretta and Brown 1989). Most of these plants occur on the Angeles National Forest. Since the 1940s there has been a decline in the number of plants at San Gabriel River Canyon and Fish Creek Canyon, especially at lower canyon sites. This decline is attributed mainly to rock quarrying operations on private lands below the forest boundary (Mistretta and Brown 1989). Like many *Dudleyas,* San Gabriel Mountains dudleya grows on granitic substrates—on cliffs, from crevices in rocks, and on steep canyon walls. The Angeles National Forest has written a management guide for this species (Mistretta and Brown 1989).

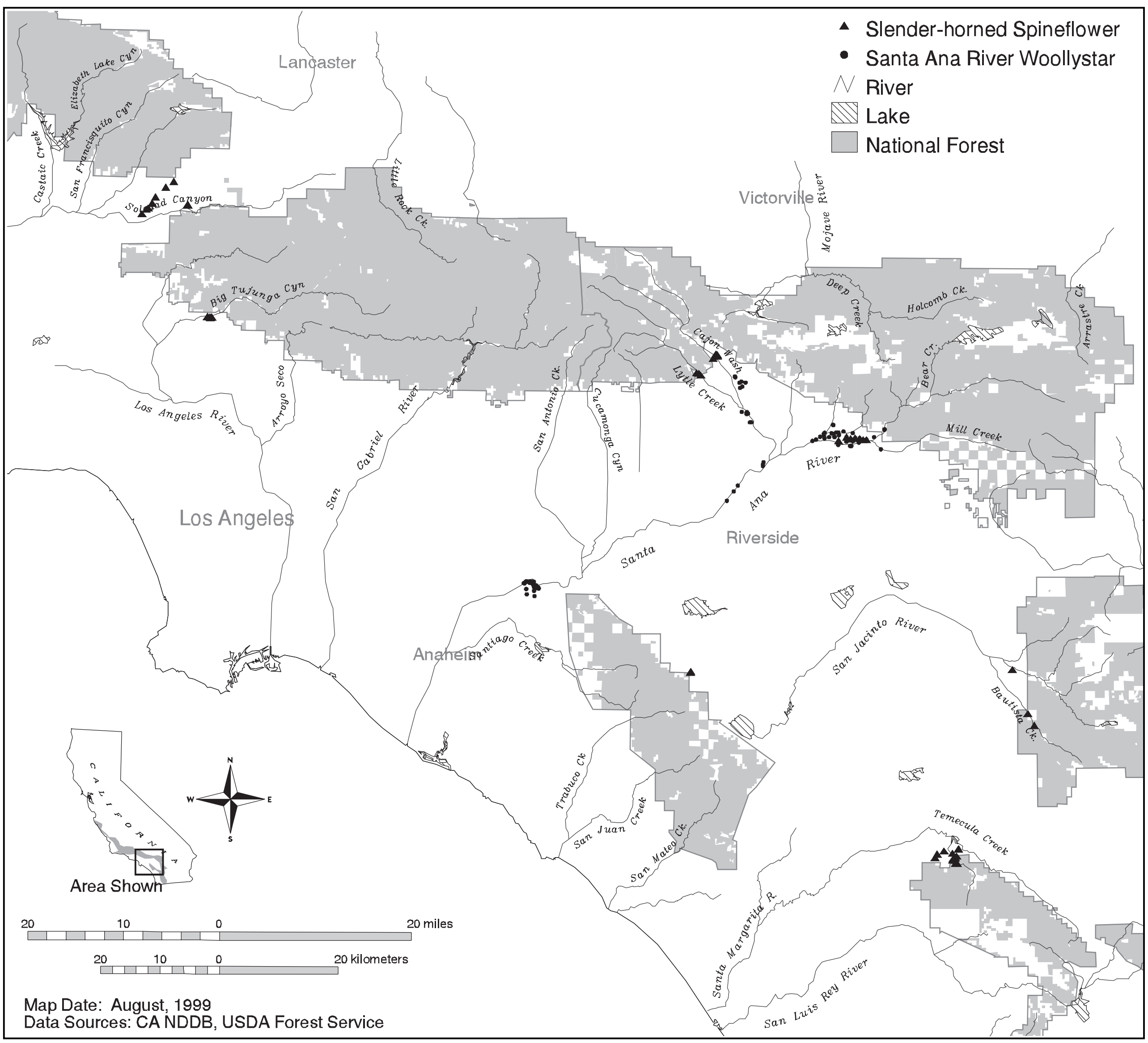
Eriastrum densifolium* ssp. *sanctorum
(Santa Ana River woollystar)

Eriastrum densifolium ssp. *sanctorum* is federally and state listed as endangered. It is found along gravelly riverbeds and floodplain terraces in alluvial fan scrub habitat at the base of the San Bernardino Mountains. An estimated 90 percent of its original habitat has been eliminated by flood control projects, sand and gravel mining, urbanization, and farming (White 1990). Historic occurrences covered about 60 miles from Rancho Santa Ana in Orange County to near Highland in San Bernardino County; however, the subspecies is now extirpated at many locations. Extant occurrences are recorded at Lytle Creek and along the floodplain of the Santa Ana River (and its tributaries), between the city of Colton and the mouth of Santa Ana Canyon (fig. 5.3). The *CNPS Inventory* notes these occurrences as one extended but fragmented population (Skinner and Pavlik 1994). The amount of occupied habitat was estimated to be 1,800 acres in 1986 (USFWS 1987). One occurrence, located on an inholding of the San Bernardino National Forest, was extirpated in 1993 during the construction of Seven Oaks Dam (M. Lardner, San Bernardino NF, pers. comm.). Periodic natural flooding appears to be a requirement for successful regeneration of this taxon.

Ericameria palmeri ssp. *palmeri* (Palmer's goldenbush)

Ericameria palmeri ssp. *palmeri* is an evergreen shrub distributed in the Peninsular Ranges of San Diego County and Baja California, Mexico. The subspecies is located mainly at lower elevations outside of the

Figure 5.3. Known distribution of *Dodecahema leptoceras* (slender-horned spineflower) and *Eriastrum densifolium* ssp. *sanctorum* (Santa Ana River woollystar).



assessment area—in coastal sage scrub, riparian scrub, and chaparral communities. In San Diego County, its known range is located adjacent to urban development and there is potential for the species to be extirpated in the United States (Reiser 1994). Reiser (1994) lists eleven occurrences, five of these either extirpated or on land proposed for development projects. The plant is found in significant numbers scattered along the Otay River drainage and appears to tolerate ground disturbance from local dredging operations. Subspecies identification needs to be confirmed at this site as well as others because the plant is difficult to identify and can be confused with other genera.

Hemizonia floribunda (Tecate tarplant)

Hemizonia floribunda is a Forest Service Sensitive Species. It is an annual species known from the Peninsular Ranges of San Diego County and Baja California, Mexico. The CNDDB contains records for seventeen occurrences, some in the assessment area. The plant inhabits sandy washes in desert habitats.

Hemizonia pungens ssp. *laevis* (smooth tarplant)

Hemizonia pungens ssp. *laevis* is known from occurrences in San Diego, Los Angeles, Orange, Riverside, San Bernardino, and Kern counties. The plant is also documented in Baja California, Mexico. Reiser (1994) cites occurrences along Temecula Creek, near Lake Perris, along the San Jacinto River, north of Tucalota Creek, and along Potrero and Lytle creeks. The annual grows on seasonally mesic alkaline substrates, in grasslands or sites with minimal shrub cover. In San Diego County, occurrences are close to being extirpated (Reiser 1994). Plants in western Riverside County are affected by flood control measures and development along drainages. Sixty-one occurrences in all are listed in the CNDDB. A conservation strategy for coastal sage scrub includes this taxon (USFS/USFWS/CDFG 1997).

Pedicularis dudleyi (Dudley's lousewort)

Pedicularis dudleyi is a Forest Service Sensitive Species. It is a riparian species of concern on the Los Padres National Forest (Los Padres NF 1994) and is listed by the state of California as rare. The plant occupies coastal habitats in Monterey, Santa Cruz (historically), San Luis Obispo, and San Mateo counties. Occurrences are found in serpentine chaparral, grasslands, and shaded areas in redwood or mixed evergreen forest. The *CNPS Inventory* cites fewer than fifteen known occurrences in all (Skinner and Pavlik 1994). Three occurrences are located on the Los Padres National Forest, another occurs within a state park, and some are located on private land owned by the Hearst Corporation. The species is vulnerable to trampling and trail maintenance activities. There is potential for occurrences to be affected by logging, road building, and development projects.

Rorippa gambellii (Gambel's water cress)

Rorippa gambellii is a federally endangered species known from occurrences outside the assessment area in the dune lakes of western Santa Barbara and San Luis Obispo counties, as well as locations in Baja California, Mexico (D. Wilken, Santa Barbara Botanic Garden, pers. comm; Reiser 1994; Mason 1957). Historically, the species was reported from about a dozen locations in southern California, including interior wetland areas of San Diego, San Bernardino, and Los Angeles counties (USFWS 1993c). Habitat for the species is described as freshwater or brackish marshes and swamps, at the margins of lakes, or along slow-flowing streams. Extant occurrences in San Luis Obispo County are known from a series of small freshwater marshes found in association with beach dune habitat. These marshes extend from Oceano south to the Oso Flaco Lakes area, and inland to Black Lake Canyon (USFWS 1993c). Other plants found in the same habitat include cattails, bulrushes, and bur-reeds.

One historic occurrence is noted for San Diego County, in freshwater habitat near the town of Julian and close to the Cleveland National Forest. Another historic occurrence is reported for Arrowhead Hot Springs near the San Bernardino National Forest (S. Eliason, San Bernardino NF, pers. comm.). Other historic occurrences are reported for Los Angeles County at "Cienega" and "Kurtz Street Marsh" (G. Wallace, USFWS, pers. comm.). These occurrences are believed to have been extirpated due to habitat alteration (USFWS 1993c), and it is unknown whether any potential habitat occurs on national forest system lands in the assessment area. Wetland habitats where this species is found have declined significantly in California due to urbanization and agricultural conversion.

Foothill Woodland, Savanna, and Grassland Plants

Nine rare plants are found or have potential to occur in foothill woodland, savanna, or grassland habitat within the assessment area. Summary information is shown in table 5.4. One federally endangered species, one federally threatened species, and one proposed threatened species are included in this group.

Calycadenia villosa (dwarf calycadenia)

Calycadenia villosa is an annual species known from occurrences in the Santa Lucia Ranges of Monterey and San Luis Obispo counties. It was known historically in Kern County but is now believed to be extirpated. The plant occurs on dry hills and ridges with rocky soils, at low elevations (below 3,600 feet) in chaparral, cismontane woodlands, dry meadows, and valley-foothill grasslands. The CNDDB contains records for twelve occurrences, most of them historic. The species appears to be declining; the *CNPS Inventory* notes that it was at one time known from twelve USGS 7.5-minute quad maps but now has been extirpated from all but two. One unrecorded occurrence is located along with *Chlorogalum purpureum* var. *reductum* at an area near La Panza on the Santa Lucia Ranger District of the Los Padres National Forest (D. Wilken, Santa Barbara Botanic Garden, in litt. 1998). Four recent occurrences are known east of the forest within Fort Hunter Liggett. These occurrences are affected by military training activities and grazing to some extent, although grazing pressures have been reduced. Overgrazing in other areas continues to be a hazard along with urban development projects, road development, off-highway vehicles, and nonnative invasive plants. Some occurrences were lost when the San Antonio Reservoir was constructed. Fire suppression is also a threat because the species appears to be a fire follower.

Chlorogalum purpureum var. *reductum* (Camatta Canyon amole)

Chlorogalum purpureum var. *reductum* is proposed for federal listing as threatened. It is narrowly distributed on the northeast side of the La Panza Range in San Luis Obispo County (fig. 5.4). Plants occur in two discrete locations separated by approximately 3 miles. The larger of the two occurrences is found on both private and national forest system lands (Santa Lucia Ranger District of the Los Padres National Forest) and occupies between 10 and 12 acres of habitat bisected by Highway 58. Several hundred thousand plants are estimated to occur at this location and, despite being partially fenced by the Forest Service, the area is still used as an informal staging area for off-highway vehicles and cattle. The second occurrence covers about one-quarter of an acre and is estimated to contain several hundred plants. This site is located entirely on private land and has been registered by the property owners with The Nature Conservancy's (TNC) private land owner protection program.

At both locations, the plants grow in various size patches and are not uniformly distributed throughout the habitat, which is described as sparsely vegetated annual grasslands surrounded by blue oak woodland and gray/foothill pines. Other native species found in the area include *Brodiaea coronaria,*

Table 5.4. Rare plants found in foothill woodland, savanna, and/or grassland habitats. y = the taxon occurs on the forest; p = has potential to occur. Trend, knowledge of distribution, and vulnerability information was determined by forest botanists/biologists and generally refers to occurrences on national forest system lands (decl. = declining; unkn. = unknown).

Scientific Name (common name) *listing status*	Acres of Known Habitat: CNF	SBNF	ANF	LPNF	Trends	Vulnerability on NFS lands	Overall Distribution (Knowledge of distribution on NFS lands)
Calycadenia villosa (dwarf calycadenia)				26	decl.	unkn.	Santa Lucia Ranges (Monterey & SLO cos.), h in Kern Co.; (low)
Chlorogalum purpureum var. *reductum* (Camatta Canyon amole) *proposed threatened*				40	stable	low	La Panza Range (SLO Co.); (high)
Eremalche parryi ssp. *kernensis* (Kern mallow) *federally endangered*				p	unkn.		San Joaquin Valley (W Kern Co.); (high)
Eriastrum hoover (Hoover's eriastrum) *federally threatened*				67	stable[1]	low	Fresno, Kern, Kings, San Benito, SLO, & Santa Barbara cos. (e.g., Carrizo Plain, Elkhorn Plain, Temblor Range, Caliente Mtns., Cuyama Valley, & Sierra Madre Mtns.); (high)
Eriophyllum lanatum var. *hallii* (Ft. Tejon woolly sunflower) *FS sensitive*				13	stable	low-mod.	Sierra Madre Mtns., S Tehachapi Mtns. (Santa Barbara & Kern cos.); (moderate)
Holocarpha virgata ssp. *elongata* (graceful tarplant)	y				decl.[2]	low	coastal areas of central and southern CA; (low)
Lupinus ludovicianus (S. Luis Obispo Co. lupine) *FS sensitive*				49	decl.	low	Santa Lucia Ranges (endemic to SLO Co.); (moderate)
Pentachaeta exilis ssp. *aeolica* (slender pentachaeta) *FS sensitive*				48	unkn.	unkn.	Santa Lucia Ranges (Santa Barbara, Monterey, & San Benito cos.); (moderate)
Sibaropsis hammittii (Hammitt's clay-cress) *FS sensitive*	y				unkn.	mod.[3]	Peninsular Ranges of S. CA (Santa Ana & Cuyamaca mtns.); (moderate)

[1] stable or increasing on nation forest system lands; declining on private lands
[2] Reiser 1994 (refers to all known occurrences)
[3] based on Boyd and Ross 1997

Clarkia purpurea, Crassula erecta, Dichellostemma capitatum, and another focal species, *Calycadenia villosa* (dwarf calycadenia). Plants grow on clay soils with substantial amounts of pebbles and gravels. The taxon appears to be restricted to areas with rocky, nutrient-poor soils that tend to prevent herbivory from pocket gophers. In areas with better soils, non-native annuals (e.g., red brome, filaree, Mediterranean grass, and slender wild oat) appear to be outcompeting *C. purpureum* var. *reductum* for space, light, nutrients, and water.

The Los Padres National Forest has been monitoring the population dynamics of this taxon by tracking the number and age-class of plants in eleven 0.5-square-meter plots. The study began in 1991 and data were collected until 1997. Analysis of the data has not yet been completed, but preliminary findings suggest the abundance of this taxon is relatively static with some variation on an annual basis due to dormancy, mortality, and recruitment, with recruitment of seedlings generally occurring in years with above-average precipitation. See the proposed rule for federal listing for more information (USFWS 1998h).

Eremalche parryi ssp. *kernensis* (Kern mallow)

Eremalche parryi ssp. *kernensis* is a federally endangered taxon known only from the San Joaquin Valley in western Kern County. There are no known occurrences on or adjacent to national forest system lands (fig. 5.4). However, plants of uncertain taxonomic affinity assumed to be *E. parryi*s ssp. *parryi* are found in and adjacent to the Los Padres National Forest (M. Foster, Los Padres NF, pers. comm.). These two subspecies together form a complex whose taxonomy is currently unresolved. The range, distribution, abundance, habitat requirements, and taxonomy of *E. parryi* ssp. *kernensis* are described in detail in a draft recovery plan (USFWS 1998l). This document also discusses the taxonomy and physical characteristics of the *E. parryi* ssp. *kernensis*/*E. parryi* ssp. *parryi* complex. If understanding of the taxonomy of this complex should change, it may be determined that some of the populations on national forest system lands are *Eremalche parryi* ssp. *kernensis.* See the final rule for federal listing for more information (USFWS 1990).

Eriastrum hooveri (Hoover's eriastrum)

Eriastrum hooveri is a federally threatened species known from six California counties: Fresno, Kern, Kings, San Benito, San Luis Obispo, and Santa Barbara. The plant was once wide ranging but many populations have been extirpated due to conversion of habitat for agriculture. The U.S. Fish and Wildlife Service has grouped all of the known occurrences into four metapopulations plus several small, scattered populations. Surveys by Lewis (1992) documented 629 occurrences covering an estimated 2,239 acres of occupied habitat. Six occurrences are found on the Mount Pinos Ranger District of the Los Padres National Forest; they are part of one metapopulation that covers the Carrizo Plain, Elkhorn Plain, Temblor Range, Caliente Mountains, Cuyama Valley, and Sierra Madre Mountains. The occurrences are located in the foothills of Sierra Madre Ridge, just south of Cuyama Valley in Castro, Goode, and Tennison canyons (fig. 5.4). In 1993, more than thirteen thousand plants were estimated to occur at these six locations. Within metapopulations, *E. hooveri* forms scattered groups of plants with each group typically occupying less than one acre. The density of plants within a group is variable between sites and years, with higher densities observed in years of higher precipitation.

Habitat for this species extends across a wider range of environmental conditions than is typical for narrow endemics. The plant has been found on ridgetops, hillsides, benches, alluvial fans, flats, washes, along roadways, and in pastures, from north-facing to south-facing slopes, and from 280 to 2,770 feet in elevation (Lewis 1992). Danielsen (1993) characterized habitat on the Los Padres National Forest as juniper woodland often in association with California buckwheat. *E. hooveri* has also been found in alkali sinks, valley saltbush scrub, interior coast range

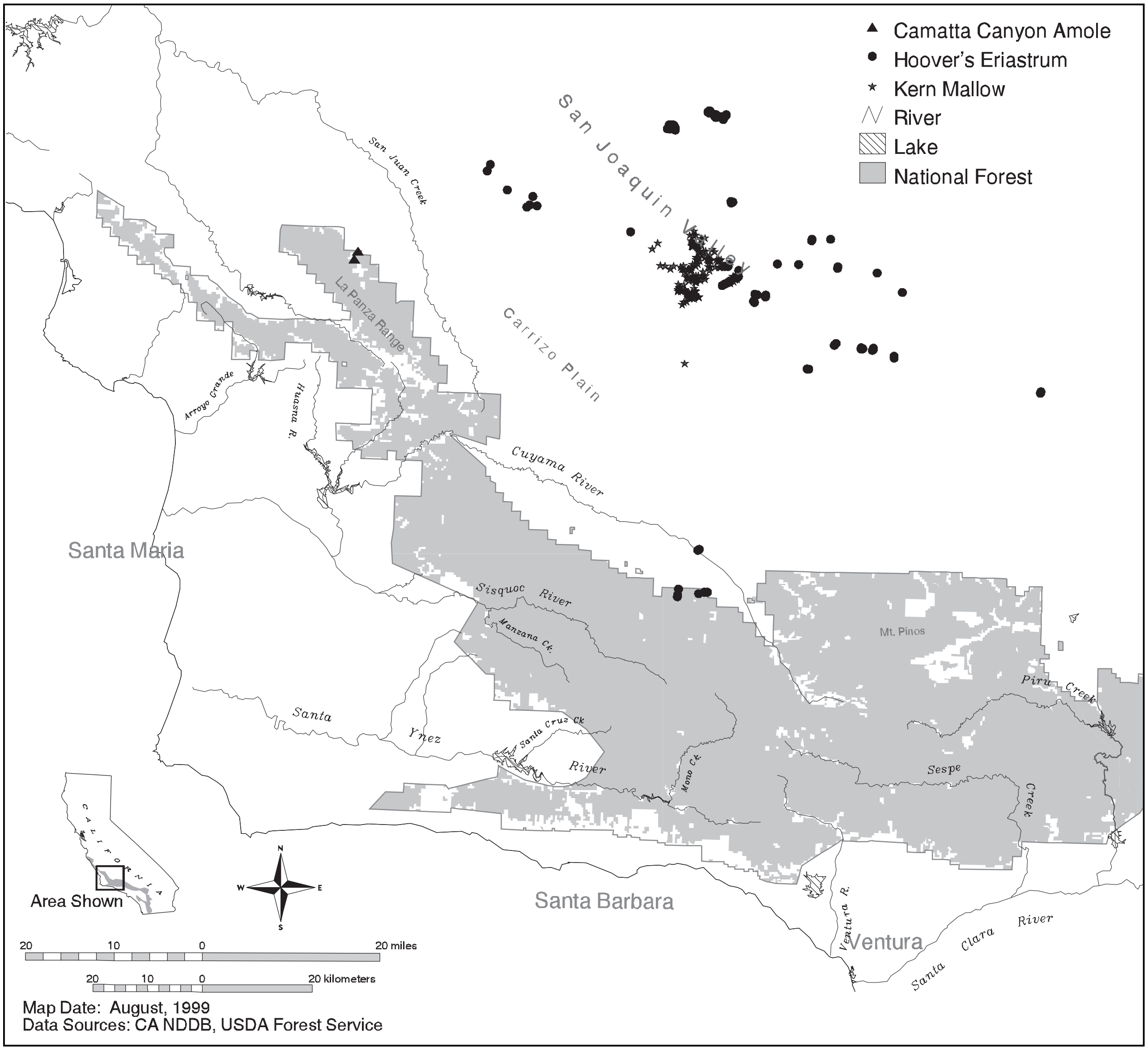


Figure 5.4. Distribution of *Chlorogalum purpureum* var. *reductum* (Camatta Canyon amole), *Eriastrum hooveri* (Hoover's eriastrum), and *Eremalche parryi* ssp. *kernensis* (Kern mallow).

saltbush scrub, and in grasslands. Lewis (1992) reports that matchweed is a good indicator of habitat for *E. hooveri* throughout its range and winged ragweed is an accurate indicator specifically in the Cuyama Valley. High-quality habitat for *E. hooveri* is thought to include stabilized silty to sandy soils, a low cover of competing vegetation, and the presence of cryptobiotic crusts. Moderate-quality habitat is provided by loamy soils that lack cryptobiotic crusts and support fairly dense stands of vegetation.

The species appears to be somewhat tolerant of disturbance. Plants have been observed invading soil surfaces within one year after disturbances cease. In areas of dense vegetation, the species may benefit from light to moderate soil disturbance if it reduces the abundance of competing non-native plants. On the Los Padres National Forest all of the six known occurrences are found near lightly used roads.

The range, distribution, abundance, and habitat requirements of this annual species are described in detail in a draft recovery plan (USFWS 1998l). This report can be referred to for more detailed information, particularly in regards to off-forest distribution, abundance, and threats. Lewis (1992) also provides extensive information on *E. hooveri*. The final rule for federal listing also has additional information (USFWS 1990).

Eriophyllum lanatum var. *hallii* (Fort Tejon woolly sunflower)

Eriophyllum lanatum var. *hallii* is a Forest Service Sensitive Species known from the southern Tehachapi and Sierra Madre mountains (Kern and Santa Barbara counties respectively). The taxon occurs at Sierra Madre Ridge on the Los Padres National Forest and is included in a conservation strategy (USFS/USFWS 1996). Generally the perennial occupies dry sites within chaparral and cismontane woodlands, at elevations of 3,900 to greater than 4,900 feet. Livestock grazing is cited as a primary threat to the plant although occurrences on national forest system lands appear stable. The occurrence at Sierra Madre Ridge is fenced and a second occurrence is located in steep terrain believed to be inaccessible to cattle. Road construction and maintenance, erosion associated with roads, and competition from non-native annuals are also thought to adversely affect this plant.

Lupinus ludovicianus (San Luis Obispo County lupine)

Lupinus ludovicianus is a Forest Service Sensitive Species. It is endemic to (and the official flower of) San Luis Obispo County. The CNDDB contains records for sixteen occurrences. The species is thought to be declining; at least four historic occurrences may now be extirpated. One extant occurrence is located on the Los Padres National Forest and others are somewhat protected by occurring in remote places. The perennial has been found in chaparral and in open grassy areas in foothill oak woodlands. Plants typically grow in sandy soils associated with the Santa Margarita formation, but one occurrence is found on limestone soil. Habitat conversion for agricultural use and urban development, livestock grazing and trampling, and off-highway vehicle activities are factors believed to be negatively affecting this species.

Pentachaeta exilis ssp. *aeolica* (slender pentachaeta)

Pentachaeta exilis ssp. *aeolica* is a Forest Service Sensitive Species. It is an annual taxon known from locations in Santa Barbara, Monterey, and San Benito counties. Two occurrences are located on the Los Padres National Forest, where they are vulnerable to fire suppression and the invasion of non-native grasses. The plant is found below 2,200 feet elevation in foothill grasslands or grassy openings within foothill pine woodlands.

Sibaropsis hammittii (Hammitt's clay-cress)

Sibaropsis hammittii is a Forest Service Sensitive Species. It is a newly described taxon discovered recently on three mountains in the Peninsular Ranges of southern California (Boyd and Ross 1997). The first known collections were made on Elsinore Peak in the Santa Ana Mountains in the spring of 1992. The following spring, collections were made 75 miles to the south on Poser and Viejas mountains. All of these occurrences are located on the Cleveland National Forest, although some spill over onto Indian reservation and private lands. The occurrences are vulnerable to urbanization close to the forest boundary, increased fire frequencies, non-native invasive species, trampling, and habitat damage by off-road vehicles (Boyd and Ross 1997). It appears that a constant supply of moisture and low levels of competition from other plants are required by *S. hammittii* for successful growth.

At all locations the annual is found on vernally saturated clay soils, in purple needlegrass grassland surrounded by chamise chaparral. Occurrences at the Elsinore Peak locale are found on clay soils derived from basalt outcrops or marine sediments. Associated species include blue-eyed-grass, *Lomatium dssycarpum, Dichelostemma pulchellum,* purple sanicle, foothill needlegrass, *Allium haematochiton,* chocolate lily, California-aster, and the federally endangered *Allium munzii.* On Poser and Viejas mountains, *S. hammittii* is found on clay soils derived from gabbro. More occurrences of *S. hammittii* are expected to be found on gabbro and metavolcanic soils in the mountains of San Diego County and northwestern Baja California, Mexico (e.g., Otay, Tecate, San Miguel, Jamul, Cerro Bola, Cuyamaca, McGinty, Guatay, Iron, and Agua Tibia). Basalt outcrops on the Santa Rosa Plateau may also harbor this species.

Scrub and Chaparral Plants

Plants of Both Scrub and Chaparral

Eleven rare plants are found or have potential to occur in both scrub and chaparral habitats within the assessment area. Summary information is shown in table 5.5. Two federally endangered species and two federally threatened species are included in this group.

Allium munzii **(Munz's onion)**

Allium munzii is a federally endangered and state threatened species distributed within the Santa Ana and Elsinore mountains, and Gavilan Hills of western Riverside County. It grows in clay soils, usually in grassy openings between shrubs on mesas and slopes. It also grows in mesic grasslands (e.g., southern needlegrass grassland), vernal pools, and other wetlands. In the Gavilan Hills the perennial grows with California juniper (R. Minnich, UC Riverside, in litt. 1998).

There are thirteen known occurrences, two located partly on the Cleveland National Forest in the Elsinore Mountains (fig. 5.5). Five populations occur in the Gavilan Hills—three on private lands, one at Harford Springs County Park, and one on land managed by the Riverside County Habitat Conservation Agency (RCHCA). Other populations occur on private lands in the Temescal Valley, north of Walker Canyon, and in or near the Paloma Valley. Some locations in the Paloma Valley are managed by the Reserve Management Committees (Domenigoni Hills and Bachelor Mountain) for the Riverside County multispecies plans. The U.S. Fish and Wildlife Service estimates a total of twenty thousand to seventy thousand plants at all known locations (USFWS 1998m).

An estimated 90 percent of the potential habitat for this plant has been extirpated by development projects and clay mining (K. Winter, Cleveland NF, unpubl. doc. 1992). The species is sensitive to ground-disturbing activities in general; discing of habitat for weed abatement or dry land farming, off-road vehicle activity, trampling/grazing from livestock, and displacement by non-native annual grasses are cited as threats by the U.S. Fish and Wildlife Service (USFWS 1998m). Some occurrences are known from the slopes of Elsinore Peak on the Trabuco Ranger District, Cleveland National Forest. They are located near a Forest Service road and an electronic site. A species management guide was written by the Cleveland National Forest in 1992 to address threats to the species on forest system lands (K. Winter, Cleveland NF, unpubl. doc. 1992). Munz's onion is also included in a conservation strategy for coastal sage scrub (USFS/USFWS/CDFG 1997).

Arctostaphylos edmundsii **(Little Sur manzanita)**

Arctostaphylos edmundsii is a Forest Service Sensitive Species. It is a shrub that occurs in Monterey County, from Garrapata Creek south to Pfeiffer Point. There are eight known occurrences, two located on the Monterey Ranger District of the Los Padres National Forest. Another occurrence is found on land managed by the U.S. Coast Guard, and the rest occur on private lands. The species occupies habitat described as coastal bluffs and terraces with sandstone soils. The taxon *A. edmundsii* var. *parvifolia* is state-listed rare, but recent taxonomic work calls into question the validity of this variety.

Astragalus brauntonii **(Braunton's milk-vetch)**

Astragalus brauntonii is a federally endangered species endemic to foothill habitats in the Santa Ana, San Gabriel, and Santa Monica mountains (White 1990). The species is found on small limestone outcrops in gaps or disturbed places within chaparral, coastal sage

Table 5.5. Rare plants which occur in both scrub and chaparral habitats. y = the taxon occurs on the forest; p = has potential to occur. Trend, knowledge of distribution, and vulnerability information was determined by forest botanists/biologists and generally refers to occurrences on national forest system lands (decl. = declining; unkn. = unknown).

Scientific Name (common name) *lisitng status*	Acres of Known Habitat				Trends	Vulner-ability on NFS lands	Overall Distribution (Knowledge of distribution on NFS lands)
	CNF	**SBNF**	**ANF**	**LPNF**			
Allium munzii (Munz's onion) *federally endangered*	23				decl.	mod.	Santa Ana & Elsinore mtns., Gavilan Hills (W Riverside Co.); (high)
Arctostaphylos edmundsii (Little Sur manzanita) *FS sensitive*				7	unkn.	mod.	Monterey Coast; (high)
Astragalus brauntonii (Braunton's milk-vetch) *federally endangered*	p		p		decl.		foothills of Santa Ana, San Gabriel, & Santa Monica mtns.; (moderate)
Baccharis vanessae (Encinitas baccharis) *federally threatened*	1				decl.	low	coastal & foothill San Diego Co., Santa Margarita Mtns.; (moderate)
Berberis nevinii (Nevin's barberry) *federally endangered*	1	h/p	y		decl.	low	foothills, San Gabriel Mtns. to Santa Ana Mtns. (Los Angeles, San Bernar dino, Riverside cos.); (moderate)
Chorizanthe parryi var. *parryi* (Parry's spineflower) *FS sensitive*		p			unkn.		valley-floor & foothills, Los Angeles, San Bernardino, & Riverside cos.
Chorizanthe rectispina (straight-awned spineflower) *FS sensitive*				40	stable	low	Santa Lucia Ranges; (low)
Dudleya cymosa ssp. *ovatifolia* (S. Monica Mtns. dudleya) *federally threatened*	y		p		decl.	mod.	Santa Ana & Santa Monica mtns.; (moderate)
Lepidium virginicum var. *robinsonii* (Robinson's pepper-grass)	y				unkn.		San Diego Co.
Nolina cismontana (chaparral beargrass) *FS sensitive*	y				decl.	low	from Ventura to San Diego cos., foothills of Santa Ynez Mtns., Santa Ana Mtns., Simi Hills, foothills W of Palomar & Cuyamaca mtns.; (high)
Quercus dumosa (Nuttall's scrub oak) *FS sensitive*				y	decl.	mod.	Orange, Santa Barbara, San Diego cos., Baja; (moderate)

scrub, and closed-cone conifer forest. Much of the potential habitat for this plant occurs on private lands with potential to be developed, and all of the protected habitat is located near expanding urban areas where alteration of natural fire regimes is likely to occur.

The total number of plants at all known locations was estimated in 1997 to be less than one hundred (USFWS 1997a). Occurrences are known from the Simi and Chino hills, Santa Ynez Canyon (Santa Monica Mountains), and Coal and Gypsum canyons (Santa Ana Mountains). Potential habitat occurs on the Trabuco Ranger District of the Cleveland National Forest. Occurrences are documented in the San Gabriel Mountains on private lands adjacent to the Angeles National Forest, and it is highly probable that the species occurs on the forest (P. Krueger, Angeles NF, pers. comm.). Potential habitat occurs near the lower Clam Shell Truck Trail, the Van Tassel Truck Trail, and near the city of Monrovia (G. Wallace, USFWS, pers. comm; P. Krueger, Angeles NF, pers. comm.). These areas are relatively inaccessible and the only management activities taking place are prescribed burns. Occurrences on private land near the Clam Shell Truck Trail are vulnerable to road maintenance and invasion of exotic species. All of the occurrences in the San Gabriel Mountains are located in an urban interface area with a history of human-caused fires. This species is a short-lived (two to three years) fire follower and, depending on fire-return intervals, may appear only once in twenty to fifty or more years (USFWS 1997a). After the Gypsum Canyon Fire in 1982, several populations (approximately four hundred plants) appeared on the divide between Gypsum and Coal canyons (White 1990). This species is included in a conservation strategy for coastal sage scrub (USFS/USFWS/CDFG 1997) and the US Fish and Wildlife Service has developed a draft recovery plan (USFWS 1998o).

***Baccharis vanessae* (Encinitas baccharis)**

Baccharis vanessae is a federally threatened species found in coastal and foothill habitats of San Diego County (fig. 5.5). The shrub is distributed from the coast (near the city of Encinitas) east to Iron Mountain and the Mount Woodson area, where it grows in dense southern mixed chaparral. The bulk of known occurrences, however, are associated with southern maritime chaparral, a habitat type which has declined between 82 and 93 percent due to urban development and conversion of land for agriculture (USFWS 1996a). There are fourteen known extant occurrences containing an estimated two thousand plants, most located on private lands fragmented by development. Four of these occurrences contain fewer than six plants each. Some occurrences are protected within the San Mateo Wilderness Area (Santa Margarita Mountains) on the Cleveland National Forest. Other occurrences are protected in the Elfin Forest Reserve, managed in part by the BLM, and within Oak Crest Park in Encinitas. The species is included in a conservation strategy for coastal sage scrub (USFS/USFWS/CDFG 1997).

***Berberis nevinii* (Nevin's barberry)**

Berberis nevinii is a federally endangered species known from Riverside, San Bernardino, and Los Angeles counties. Its current range extends from the foothills of the San Gabriel Mountains to near the foothills of the Santa Ana Mountains (fig. 5.6). Plants occur as discrete, localized occurrences in two types of habitat—sandy and gravelly places along the margins of dry washes, and on coarse soils in chaparral (USFWS 1995a). Extant native occurrences include those at Dripping Springs (near Aguanga), Scott Canyon, and the largest known occurrence in the Vail Lake/Oak Mountain area. Other occurrences appear to be introduced (e.g., at Arroyo Seco). Occurrences on national forest system lands are located near the Agua Tibia Wilderness Area of the Cleveland National Forest, and in San Francisquito and Lopez canyons on the Angeles National Forest. Surveys of potential habitat on the San Bernardino National Forest have found no new occurrences.

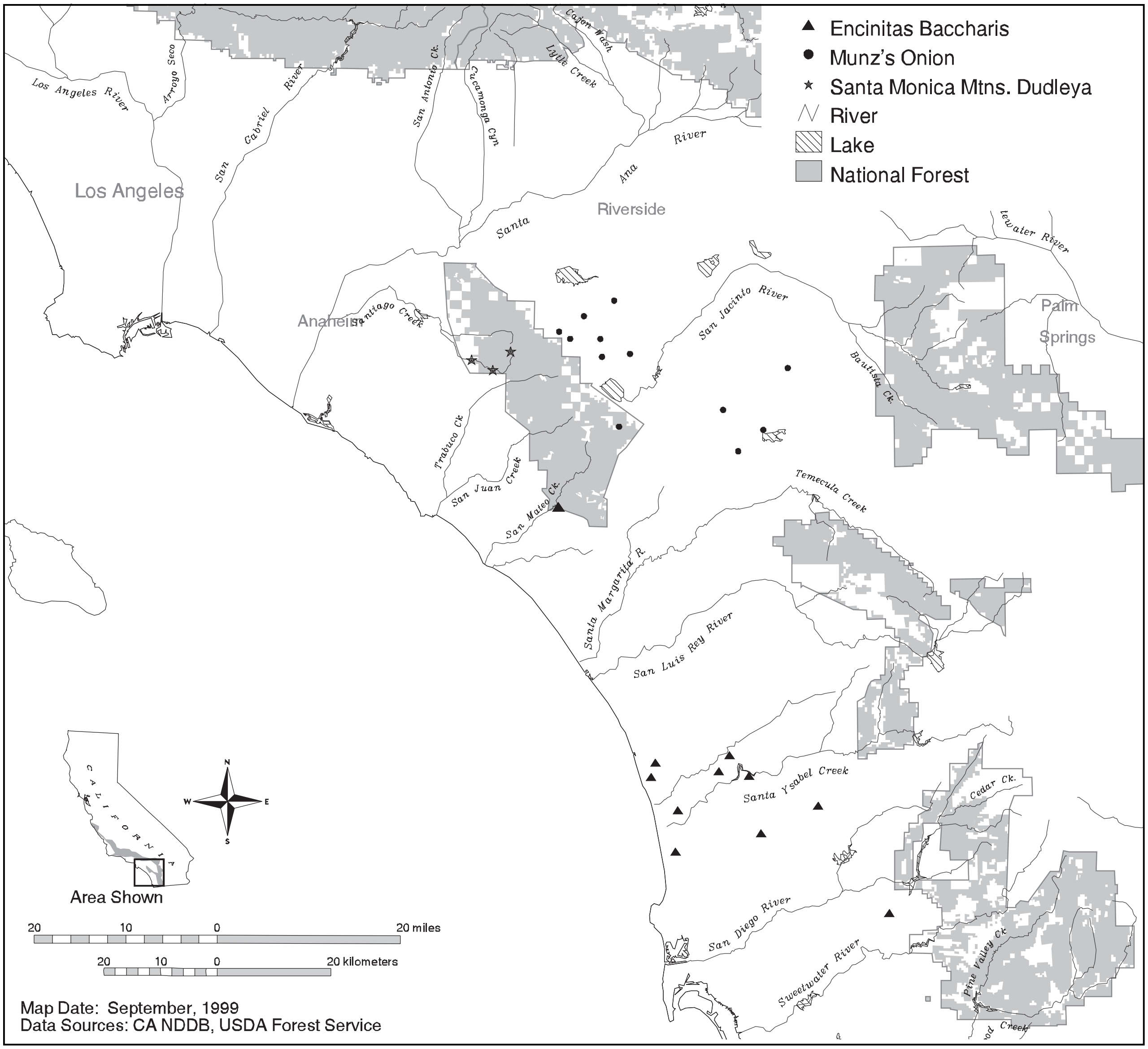


Figure 5.5. Distribution of *Allium munzii* (Munz's onion), *Baccharis vanessae* (Encinitas baccharis), and *Dudleya cymosa* ssp. *ovatifolia* (Santa Monica Mountains dudleya).

This species is known historically from fewer than thirty scattered occurrences (USFWS 1998g). At least seven occurrences are known to have been extirpated, probably due to factors associated with urban development. Currently, there are 500 to 1,000 plants estimated to occur at all known sites (Mistretta and Brown 1989b; USFWS 1998g). Most of these are found on private lands; however, a few are protected on land managed by the BLM and the Forest Service. The Vail Lake/Oak Mountain occurrence contains approximately 200 plants. The San Francisquito Canyon occurrence is estimated to contain 130 to 250 plants.

B. nevinii continues to be threatened by development projects on private lands. The species is naturally restricted to areas with alluvial or sedimentary-based substrates, in chaparral or scrub plant communities. The loss of alluvial scrub habitats is estimated to now be over 90 percent (USFWS 1998g). In addition, the species appears to have naturally low rates of regeneration due to sporadic viable seed production (Mistretta and Brown 1989b). Fire suppression and brush clearing activities are further expected to reduce abundance of this species by altering the natural fire regime necessary for its long-term survival. The species is included in a conservation strategy for coastal sage scrub (USFS/USFWS/CDFG

1997) and the Angeles National Forest has developed a species management guide for occurrences on the forest (Mistretta and Brown 1989b).

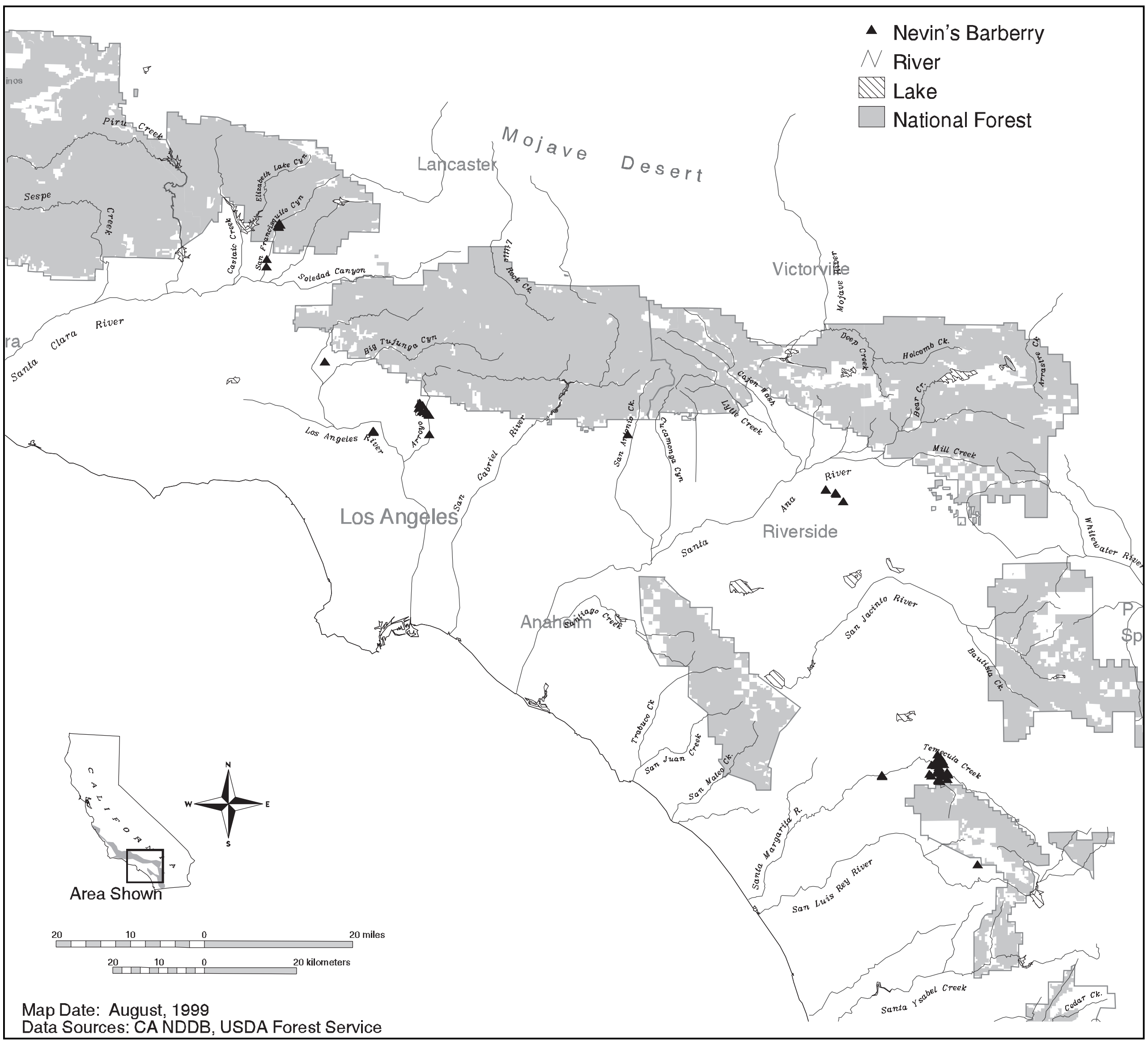
Chorizanthe parryi var. *parryi* (Parry's spineflower)

Chorizanthe parryi var. *parryi* is a Forest Service Sensitive Species. It occurs in valley-floor and foothill habitats in San Bernardino, Riverside, and Los Angeles counties. There are twenty-three recorded occurrences, all on private lands; however, some of them are located close to the San Bernardino National Forest and suitable habitat exists on the forest. The plant grows in dry, sandy soils within coastal sage scrub and chaparral. Most occurrences are vulnerable to flooding or development projects.

Chorizanthe rectispina (straight-awned spineflower)

Chorizanthe rectispina is endemic to the Santa Lucia Ranges and has been found in Monterey, San Luis Obispo, and Santa Barbara counties. The *CNPS Inventory* cites about twenty known occurrences (Skinner and Pavlik 1994). One occurrence is located on the Los Padres National Forest and three are found on BLM lands. Another occurrence on private land is proposed for development. The annual has been found in woodland habitat in addition to scrub and chaparral.

Figure 5.6. Distribution of *Berberis nevinii* (Nevin's barberry).



Dudleya cymosa ssp. *ovatifolia* (Santa Monica Mountains dudleya)

Dudleya cymosa ssp. *ovatifolia* is a federally threatened and state endangered taxon distributed within the Santa Monica and Santa Ana mountains. The perennial occupies habitat consisting of unstable talus slopes and north-facing cliffs in chaparral. The substrate is further defined as rock outcrops with forms specific to sedimentary conglomerate or volcanic breccia (USFWS 1997a). In the assessment area, plants are found in Modjeska Canyon, on the western flank of the Santa Ana Mountains (fig. 5.5). These occurrences represent a range disjunction of approximately 60 miles from populations in the Santa Monica Mountains, which are outside the assessment area.

Fewer than ten occurrences of this taxon are known. While the major portion of its distribution occurs on private lands affected by development projects, the disjunct occurrences located in the Santa Ana Mountains are not especially threatened at this time. Like many *Dudleyas* however, *D. cymosa* ssp. *ovatifolia* is vulnerable to horticultural collecting. The plant is included in a conservation strategy for coastal sage scrub (USFS/USFWS/CDFG 1997).

Lepidium virginicum var. *robinsonii* (Robinson's pepper-grass)

Lepidium virginicum var. *robinsonii* is distributed within chaparral and coastal sage scrub communities in San Diego County. Some local botanists believe this taxon to be more widespread and common than originally thought. A number of occurrences are on the Cleveland National Forest. On private lands the taxon may be unprotected and threatened by development projects that remove its habitat.

Nolina cismontana (chaparral beargrass)

Nolina cismontana is a Forest Service Sensitive Species. It is distributed in coastal drainages below 3,000 feet from Ventura to San Diego counties. Occurrences are known from the foothills of the Santa Ynez Mountains, south through the Simi Hills and Santa Ana Mountains to the foothills west of the Palomar and Cuyamaca mountains (Hess and Dice 1995). Its habitat is described as chaparral vegetation with sandstone and gabbro-derived substrates.Throughout its range, the species is threatened by residential and commercial land development. Protected occurrences of significant size exist at Viejas Mountain on the Cleveland National Forest, in the Coal Canyon Ecological Reserve in the Santa Ana Mountains, and at scattered locations on the Trabuco Ranger District of the Cleveland National Forest (Santa Ana Mountains). This species appears to be a fire follower; it has been observed in greater abundance in burned Tecate cypress stands at Coal Canyon than in unburned stands (Scott 1990). The species is included in the conservation strategy for coastal sage scrub (USFS/USFWS/CDFG 1997).

Quercus dumosa (Nuttall's scrub oak)

Quercus dumosa is a Forest Service Senstive Species. It is a rare evergreen shrub known from occurrences in southern Santa Barbara, Orange, and San Diego counties, and northwestern Baja California, Mexico (Roberts 1995). Scattered occurrences are found on the south-facing slopes of the Santa Ynez Mountains. At least one occurrence is known on Santa Cruz Island. Another occurrence is found in Torrey Pines State Reserve. One occurrence is known on the Los Padres National Forest and another is located on land managed by the Santa Barbara Botanic Garden. The species grows in low-elevation habitat close to the coast (i.e., chaparral, coastal sage scrub, maritime succulent scrub, and closed-cone conifer forest) on sandstone or clay loam. Some occurrences are vulnerable to development projects and fuels modification (mechanical thinning, spring burning, and fire suppression). The species hybridizes with *Q. berberidifolia* (Hickman 1993).

Plants of Coastal Sage Scrub

Three rare plants are found or have potential to occur in coastal sage scrub habitat within the assessment area. Summary information is shown in table 5.6.

Dudleya multicaulis (many-stemmed dudleya)

Dudleya multicaulis is a Forest Service Sensitive Species. It is distributed in coastal and foothill areas of Los Angeles, Orange, western Riverside, and San Diego counties. Occurrences are known from the Santa Ana and San Gabriel mountains, and San Onofre Mountain in San Diego County. The CNDDB contains records for ninety-four occurrences and sixteen general locations. Most are located on private lands with potential for development. The species forms vegetative parts and inflorescences above ground each year and then dies back in late spring leaving just the underground corm. If surveys are done between approximately July and the following March, the species will probably be missed (White 1990).

Occurrences are found on the Cleveland National Forest near Lucas Canyon and Oak Flat in the San Mateo Wilderness Area. Other occurrences are known from the Angeles National Forest and Camp Pendleton. In addition to openings in scrub and chaparral vegetation, the species has been found in grasslands and occupies the same habitat as *Chorizanthe staticoides* ssp. *chrysacantha* at some coastal locations (Reiser 1994). It grows on dry, stony soils, often with a high clay content. This species is included in a conservation strategy for coastal sage scrub (USFS/USFWS/CDFG 1997).

Dudleya viscida (sticky dudleya)

Dudleya viscida is a Forest Service Sensitive Species. It is a perennial species found in coastal, foothill, and mountain areas of Orange, Riverside, and San Diego counties. In coastal areas, the species occupies bluffs, while farther inland it usually grows in steep and rocky riparian canyons and is sometimes found on a gabbro substrate. An estimated thirty occurrences are known, about half located on federal or state lands. A significant occurrence containing an estimated ten thousand plants is found at Devil's Gorge, where Devil's Canyon and San Mateo Creek meet, in the northeastern corner of Camp Pendleton (Reiser 1994). Other occurrences are documented on the Cleveland National Forest,

Table 5.6. Rare plants which occur in coastal sage scrub habitats. y = the taxon occurs on the forest; p = has potential to occur. Trend, knowledge of distribution, and vulnerability information was determined by forest botanists/biologists and generally refers to occurrences on national forest system lands (decl. = declining; unkn. = unknown).

Scientific Name (common name) *listing status*	Acres of Known Habitat				Trends	Vulnerability on NFS lands	Overall Distribution (Knowledge of distribution on NFS lands)
	CNF	**SBNF**	**ANF**	**LPNF**			
Dudleya multicaulis (many-stemmed dudleya) *FS sensitive*	8		y		decl.	low–mod.	coastal & foothill areas of LA, Orange, W Riverside, & SD cos.; Santa Ana & San Gabriel mtns., San Onofre Mtn.; (high)
Dudleya viscida (sticky dudleya) *FS sensitive*	202				stable/ decl.	low	Orange, Riverside, and SD cos.; (high)
Malacothamnus davidsonii (Davidson's bush mallow)			1	p	unkn.	unkn.	LA (W San Gabriel Mtns.), SLO, & Monterey cos.; (low)

most in canyons within the San Mateo Wilderness Area and one large occurrence found along the Ortega Highway in San Juan Canyon. A conservation strategy for coastal sage scrub includes this species (USDA Forest Service et al. 1997).

Malacothamnus davidsonii (Davidson's bushmallow)

Malacothamnus davidsonii is a shrub species known to occur at low elevations in Los Angeles, San Luis Obispo, and Monterey counties. However, occurrences reported for the mountains of northwestern San Luis Obispo County and adjacent Monterey County may prove to be misidentifications (Bramlet and Boyd 1998). The *CNPS Inventory* reports that this species intergrades with *M. fasciculatus* (Skinner and Pavlik 1994). In Los Angeles County, occurrences of *M. davidsonii* are known from the San Fernando Valley and western end of the San Gabriel Mountains. In the mountains, plants are recorded for the Bear Divide area, Little Tujunga Canyon, near the Tujunga District headquarters, at Lopez Canyon, upper Haines Canyon, Loop Canyon, Big Tujunga Wash, and Pacoima Canyon (Bramlet and Boyd 1998). The species is typically found in sandy washes and in openings of coastal sage scrub or chaparral. A fire follower, it usually appears in the first three to four years after a fire and then may not be found until the next fire event.

Plants Specific to Chaparral Habitats

Thirty-six rare plants are found or have potential to occur in chaparral habitat within the assessment area. Summary information is shown in table 5.7. One federally threatened species is included in this group.

Arabis johnstonii (Johnston's rock cress)

Arabis johnstonii is a Forest Service Sensitive Species known mainly from the Garner Valley area of the San Jacinto Mountains in Riverside County. It was proposed for federal listing as threatened in 1985 but the proposal was subsequently withdrawn. Eight occurrences are distributed in two distinct population centers at Garner Valley (where the species is affected by livestock grazing) and about 4 miles east on the desert divide. Most of the occurrences are located on the San Bernardino National Forest within two grazing allotments. The species grows between 4,400 and 5,000 feet, in dry areas on clay and gravelly soils. Plants are found in openings within chaparral and at the edges of meadows. In one of the grazing allotments it grows on stock driveways. In the second allotment, the plant grows in openings within chaparral uphill from the meadow, an area cattle naturally avoid, so the plant may not be heavily disturbed at this location. Adverse effects to the species began in the late 1800s with increasing settlement and cattle grazing in the Garner Valley and construction of the Desert Divide Trail (Pacific Crest Trail) (USFWS 1995b). Portions of some occurrences are protected within enclosures.

Arctostaphylos luciana (Santa Lucia manzanita)

Arctostaphylos luciana is a Forest Service Sensitive Species. It is distributed within the southern Santa Lucia Range, southeast of Cuesta Pass. There are eight recorded occurrences in all, five located on the Los Padres National Forest and the rest on private lands. The distribution of this species may be linked to disturbance as some of the occurrences are found near roads. The shrub grows on shale substrates within chaparral vegetation. It has also been found among Coulter pines. Nine acres of occupied habitat mapped on the Angeles National Forest need to be re-examined because the species is known as a San Luis Obispo County endemic.

Arctostaphylos peninsularis ssp. *peninsularis* (Peninsular manzanita)

Arctostaphylos peninsularis ssp. *peninsularis* is a Forest Service Sensitive Species. This shrub is known from occurrences on the north side of the Santa Rosa Mountains (Riverside

County) and in the In-Ko-Pah Mountains (San Diego County), east of the Cleveland National Forest (CNDDB 1997). Plants on the Cleveland National Forest, once thought to be this species, have now been identified as *Arctostaphylos rainbowensis.* Occurrences in the Santa Rosa Mountains are located on land which the San Bernardino National Forest may acquire and there is other potential habitat on the forest. Appropriate habitat is described as chaparral between 4,000 and 5,000 feet elevation. Fire suppression and trail construction could affect this species.

Arctostaphylos pilosula (Santa Margarita manzanita)

Arctostaphylos pilosula is a Forest Service Sensitive Species. This shrub is endemic to the Santa Lucia Ranges. It occurs in Monterey County and San Luis Obispo County near Santa Margarita. Twelve occurrences are recorded in the CNDDB (1997). One occurrence is located on the Los Padres National Forest, one is on county land, and others are on private land or the ownership is unknown. The taxon grows on shale substrates in chaparral and with Sargent cypress.

Arctostaphylos rainbowensis (Rainbow manzanita)

Arctostaphylos rainbowensis is a Forest Service Sensitive Species. It is a newly described shrub found in Riverside and San Diego counties. It is found in relative abundance at three locations: on the Pala/Temecula Road, near Pala Creek (an estimated five thousand individuals were identified during a 1990 survey), and on Magee Road (Reiser 1994). Smaller populations are distributed from Pala west to the eastern slopes of the Santa Margarita Mountains. The species appears to be declining; populations that occur within the western Agua Tibia Mountains are protected in a wilderness area on the Cleveland National Forest; however, other populations occur on private lands proposed for development. The expansion of agriculture in the Pala and De Luz regions is also expected to remove habitat for this species (Reiser 1994).

Arctostaphylos refugioensis (Refugio manzanita)

Arctostaphylos refugioensis is a Forest Service Sensitive Species. It is an evergreen shrub found within the Santa Ynez Mountains of Santa Barbara County. Known habitat occurs on south-facing slopes and ridgelines in areas of sandstone soil and chaparral. Eight known occurrences are documented, some protected within the Los Padres National Forest. They range from above Canada del Cojo near Lompoc to San Pedro Canyon near San Marcos Pass. Numerous plants occur along Camino Cielo Road. Most occurrences on the Santa Ynez quadrangle were burned in 1916 and again in the 1955 Refugio Fire; however, other populations are experiencing reduced habitat capability due to fire suppression.

Arenaria macradenia var. *kuschei* (Forest Camp sandwort)

Arenaria macradenia var. *kuschei* is a Forest Service Sensitive Species. It was originally known from one historic collection at "Forest Camp, Mohave Desert," a locality subject to interpretation. The next recognized recollection was in 1995 when the plant was found near the western summit of Liebre Mountain (Ross et al. 1995). "Sunny, rocky openings in mosaic of chaparral and oak woodland vegetation on granitic substrate" are the habitat parameters described at this location. A subsequent study in 1997 surveyed potential habitat on Liebre Mountain and adjacent areas and located six new populations (Boyd 1997). All of the recently discovered populations are small, both in number of individual plants and area covered. All occur on decomposed granite and are found in areas of gentle relief along the summit of Liebre Mountain within the Angeles National Forest.

The largest populations were found at the eastern end of the mountain on the ridge dividing the Bear Canyon and Fish Canyon watersheds. Two smaller populations were found along the crest of the eastern end of Liebre Mountain: one to the east, due north of Atmore Meadow; the other to the west, near

Table 5.7. Rare plants which occur in chaparral habitats. y = the taxon occurs on the forest; p = has potential to occur. Trend, knowledge of distribution, and vulnerability information was determined by forest botanists/biologists and generally refers to occurrences on national forest system lands (decl. = declining; unkn. = unknown).

Scientific Name (common name) *listing status*	Acres of Known Habitat CNF	 SBNF	 ANF	 LPNF	Trends	Vulner-ability on NFS lands	Overall Distribution (Knowledge of distribution on NFS lands)
Arabis johnstonii (Johnston's rock cress)				83	unkn.	mod.	Garner Valley, San Jacinto Mtns.; (high)
Arctostaphylos luciana (Santa Lucia manzanita)			9	3,179	unkn.	low	S Santa Lucia Mtns.; (high)
Arctostaphylos peninsularis ssp. *peninsularis* (Peninsular manzanita)		p			unkn.		Santa Rosa & In-ko-pah mtns., Baja; (low)
Arctostaphylos pilosula (Santa Margarita manzanita)				10	unkn.	low	Santa Lucia Ranges; (moderate)
Arctostaphylos rainbowensis (Rainbow manzanita)	1				decl.	low	Riverside & SD cos., Santa Margarita Mtns., W Agua Tibia Mtns. (low)
Arctostaphylos refugioensis (Refugio manzanita)				367	stable	low	Santa Ynez Mtns.; (moderate)
Arenaria macradenia var. *kuschei* (Forest Camp sandwort)			34[1]		stable[1]		Liebre Mtn.; (moderate)
Aster greatae (Greata's aster)		p	1				San Gabriel Mtns.; (low)
Calochortus clavatus var. *gracilis* (slender mariposa lily)			y		unkn.		San Gabriel Mtns.
Calochortus plummerae (Plummer's mariposa lily)		y	y	p	unkn.	mod/ high	San Gabriel, San Bernardino, San Jacinto, Santa Ana, & Santa Monica mtns.; (moderate)
Calochortus weedii var. *vestus* (late-flowered mariposa lily)				753	stable	low	Monterey Coast, Santa Lucia Ranges, S Los Padres, Santa Ynez Mtns. (Mont., SLO, SB, & Vent. cos.); (mod.)
Ceanothus cyaneus (Lakeside ceanothus)	82				decl./ stable[2]	low	SD Co. (El Cajon Mtn.), Baja; (high)
Ceanothus ophiochilus (Vail Lake ceanothus) *federally threatened*	63				decl./ stable	low	Vail Lake area of S Riverside Co.; (high)
Chaenactis parishii (Parish's chaenactis)	41	1+			stable	low	Riverside (Santa Rosa & San Jacinto mtns.), & San Diego (Laguna & Cuyamaca mtns.) cos., Baja; (mod. – high)
Chorizanthe blakleyi (Blakely's spineflower)				15	unkn.	low	Sierra Madre Mtns. (Santa Barbara & SLO cos.); (moderate)
Chorizanthe polygonoides var. *longispina* (long-spined spineflower)	y	y			decl.	low	Riverside, SD (Black Mtn.), & Santa Barbara cos., Baja; (moderate)
Dudleya cymosa ssp. *crebrifolia* (San Gabriel River dudleya)	y						San Gabriel Mtns.

Scientific Name (common name) *listing status*	Acres of Known Habitat CNF	SBNF	ANF	LPNF	Trends	Vulner-ability on NFS lands	Overall Distribution (Knowledge of distribution on NFS lands)
Erigeron breweri var. *bisanctus* (pious daisy)			y	y		unkn.	San Gabriel & San Bernardino mtns.; (low)
Eriogonum butterworthianum (Butterworth's buckwheat)				65	stable	low	n Santa Lucia Mtns. (Monterey Co.); (low)
Heuchera rubescens var. *versicolor* (San Diego County alumroot)	y				stable	low	Peninsular Ranges of SD Co., N Baja, TX
Lepechinia cardiophylla (heart-leaved pitcher sage)	y				stable	low	Santa Ana Mtns., San Diego Co. (Iron Mtn.), Baja; (high)
Lepechinia fragrans (fragrant pitcher sage)		p	4		unkn.	unkn.	San Gabriel & Santa Monica mtns., Santa Cruz, Santa Rosa, & Santa Catalina islands; ((low)
Lepechinia ganderi (Gander's pitcher sage)	371					low	Santa Ana to Otay Mtns. (SD Co.), to Baja; (low)
Malacothamnus aboriginum (Indian Valley bush mallow)	13			p	unkn.	mod.	SD, Fresno, Monterey, & San Benito cos.; (high)
Malacothamnus palmeri var. *lucianus* (Arroyo Seco bush mallow)				y	stable	low	Monterey & SLO cos. (Santa Lucia Mtns.); (moderate)
Malacothrix saxatilis var. *arachnoidea* (Carmel Valley cliff-aster)				y	unkn.	low	(moderate)
Monardella viridis ssp. *saxicola* (rock monardella)		y	y		unkn.	low	San Gabriel Mtns.; (low)
Orobanche valida ssp. *valida* (Rock Creek broomrape)			1+	2	unkn.	low	San Gabriel & Topatopa mtns.; (low)
Oxytheca emarginata (white-margined oxytheca)		y					San Jacinto & Santa Rosa mtns., Garner Valley
Oxytheca parishii var. *abramsii* (Abram's oxytheca)				28	unkn.	low	San Rafael Mtns., W Transverse Ranges (Mt. Pinos & Topatopa Mtns.); (moderate)
Penstemon californicus (California beardtongue)	p	126			unkn.	mod.	San Jacinto & Santa Rosa mtns., Garner Valley, Sierra Juarez & Sierra San Pedro Martir (Baja); (low)
Phacelia suaveolens ssp. *keckii* (Santiago Peak phacelia)	51				unkn.	mod.	Santa Ana Mtns., Peninsular Ranges of San Diego Co.; (low)
Plagiobothrys uncinatus (hooked popcorn-flower)				8	unkn.	low	Santa Lucia & Gabilan ranges (Monterey, San Benito, Santa Clara, & SLO cos.); (low)
Ribes canthariforme (Moreno currant)	y				stable	low	San Diego Co.; (moderate to high)
Sidalcea hickmanii ssp. *hickmanii* (Hickman's checkerbloom)				429	unkn.	low	N Santa Lucia Mtns.; (moderate)
Thermopsis macrophylla (Santa Ynez false lupine)				565	unkn.	low	Santa Ynez Mtns (Santa Barbara Co.); (moderate)

[1] Boyd 1997

[2] occurrences on private land appear to be declining, those on federal land appear stable

Bear Gulch Camp. Three other populations were found near the head of Tent Rock Canyon (Boyd 1997). Based on these new occurrences, the taxon is probably stable within forest boundaries. Activities such as light grading may benefit the perennial by creating openings or gaps within the habitat for seedling establishment.

Aster greatae (Greata's aster)

Aster greatae is a perennial species known from the southern slopes of the San Gabriel Mountains. One of the two known occurrences is located in Gold Canyon on the Angeles National Forest. The species is found in damp places within foothill and lower montane conifer habitats. Potential habitat for the species also exists on the San Bernardino National Forest.

Calochortus clavatus var. *gracilis* (slender mariposa lily)

Calochortus clavatus var. *gracilis* is a perennial species found in the San Gabriel Mountains. Plants occupy shaded foothill canyons with chaparral. RAREFIND contains records for nine occurrences: either historic, located on private lands, or on the Angeles National Forest (CNDDB 1997). Occurrences are vulnerable to landfill expansion, development projects, sand and gravel mining, and off-road vehicle activity.

Calochortus plummerae (Plummer's mariposa lily)

Calochortus plummerae is found in the San Gabriel, San Bernardino, San Jacinto, Santa Ana, and Santa Monica mountains. The CNDDB lists fifty-eight occurrences, some of them located on the Angeles and San Bernardino national forests. Many, however, are located on private lands slated for development. In addition to chaparral, the species has been found in alluvial fan sage scrub habitat, grasslands, and lower montane conifer forests below 5,500 feet (S. Eliason, San Bernardino NF, in litt.). The species is vulnerable to development projects, trail construction and maintenance, fire suppression, habitat conversion, grazing, trampling, and sand and gravel mining.

Calochortus weedii var. *vestus* (late-flowered mariposa lily)

Calochortus weedi var. *vestus* is a Forest Service Sensitive Species. It is distributed in the Santa Lucia Ranges and southern Los Padres region. Occurrences are scattered across four counties: Monterey, San Luis Obispo, Santa Barbara, and Ventura. The plant is abundant at some locations and uncommon at others. Like many species of mariposa lily, its abundance varies from year to year due to climatic conditions. In addition, some *Calochortus* species appear to be disturbance oriented, showing up in openings in the vegetation created by low-level ground disturbances. This plant has been noted on road banks and fuel breaks. In relatively undisturbed areas it occurs on rocky substrates, which effectively reduce competition from other plants. The taxon has been found on sandstone, siltstone, shale, and serpentine. Surrounding vegetation is described as chaparral and open woodlands. Occurrences are protected on the Los Padres National Forest in the Lion Den Botanical Area (Matthews 1998), in the Santa Ynez Mountains, and at Wheeler Springs near Ojai. Occurrences on private lands are known from the Hollister Ranch area south to Hearst Ranch.

Ceanothus cyaneus (Lakeside ceanothus)

Ceanothus cyaneus is a Forest Service Sensitive Species. It occurs in San Diego County and Baja California, Mexico. The shrub is found in San Diego County from Crest to the foothills of Lakeside, including significant populations on El Cajon Mountain (Reiser 1994). The species can be common within this narrow range. A good portion of its known habitat is protected on Cleveland National Forest and BLM lands. It appears to cross with other *Ceanothus* species *(C. leucodermis* and *C. tomentosus)*, and plants outside of the Crest or El Cajon Mountain areas may be hybrids (Reiser 1994). Fire-return intervals that are too frequent may type convert its habitat to grassland. The species is included in a conservation strategy for coastal sage scrub (USDA Forest Service et al. 1997).

Ceanothus ophiochilus (Vail Lake ceanothus)

Ceanothus ophiochilus is a federally threatened and state endangered shrub species first discovered at Oak/Vail Mountain in 1989. Occurrences are known from near Vail Lake in southern Riverside County and just south of Vail Lake in the Agua Tibia Wilderness Area of the Cleveland National Forest (fig. 5.7). These occurrences are estimated to contain between ten thousand and twenty thousand plants in all. The species can hybridize with *C. crassifolius* and at least two occurrences may be hybrid swarms (USFWS 1995a). Occurrences are reported in drier areas on ridgetops and north- to northeast-facing slopes within chamise chaparral, and also along the edges of creeks and in dry canyons. Plants are restricted to nutrient-poor (phosphorus deficient) soils such as gabbro or metavolcanics, which may allow them to maintain reproductive isolation (USFWS 1998g).

Alteration of the natural fire regime is a threat to this species; it requires fire for seed germination and does not resprout vegetatively after fire. Short fire-return intervals can prevent plants from reaching maturity and producing seed, leading to a gradual depletion of the seed pool (USFWS 1995a). While some occurrences are protected by their location in rugged, relatively inaccessible terrain, others are threatened by habitat destruction, alteration, fragmentation, and degradation from urban development. One occurrence located near Vail Lake is threatened by the development of a planned community and was partly graded to create fuel breaks. A portion of the Agua Tibia Wilderness occurrences have also been graded for fuel breaks. A conservation strategy for coastal sage scrub includes this species (USFS/USFWS/CDFG 1997).

Chaenactis parishii (Parish's chaenactis)

Chaenactis parishii is a perennial species found in Riverside and San Diego counties, and Baja California, Mexico. Occurrences are known on the Cleveland and San Bernardino national forests. Some of the best-protected sites occur within the Santa Rosa Wilderness Area in the Santa Rosa Mountains. Other occurrences are known in the San Jacinto Mountains and in the Garnet Peak area of the Laguna Mountains. There are historic occurrences in the Cuyamaca Mountains at Stonewall and Cuyamaca peaks (Reiser 1994). The plant is known to respond positively to disturbance and has appeared along the sides of roads.

Chorizanthe blakleyi (Blakley's spineflower)

Chorizanthe blakleyi is a Forest Service Sensitive Species. It is an annual species endemic to the Sierra Madre Mountains of Santa Barbara and San Luis Obispo counties. Occurrences are found between Bates Canyon and Lion Canyon in openings within chaparral or pinyon-juniper woodland (USFS/USFWS 1996). The U.S. Fish and Wildlife Service reports six to ten known populations of this plant. The Santa Barbara Botanic Garden has specimens that document at least nine different sites for the species, with more than half located on the Los Padres National Forest (D. Wilken, Santa Barbara Botanic Garden, in litt. 1998).

Chorizanthe polygonoides var. *longispina* (long-spined spineflower)

Chorizanthe polygonoides var. *longispina* is a Forest Service Sensitive Species. It is an annual plant found within Riverside, San Diego, and Santa Barbara counties, and Baja California, Mexico (Reiser 1994). The CNDDB contains records for twenty-nine occurrences, most at Lake Matthews in Riverside County. Reiser (1994) describes eleven locations in San Diego and Riverside counties. One known occurrence on the San Bernardino National

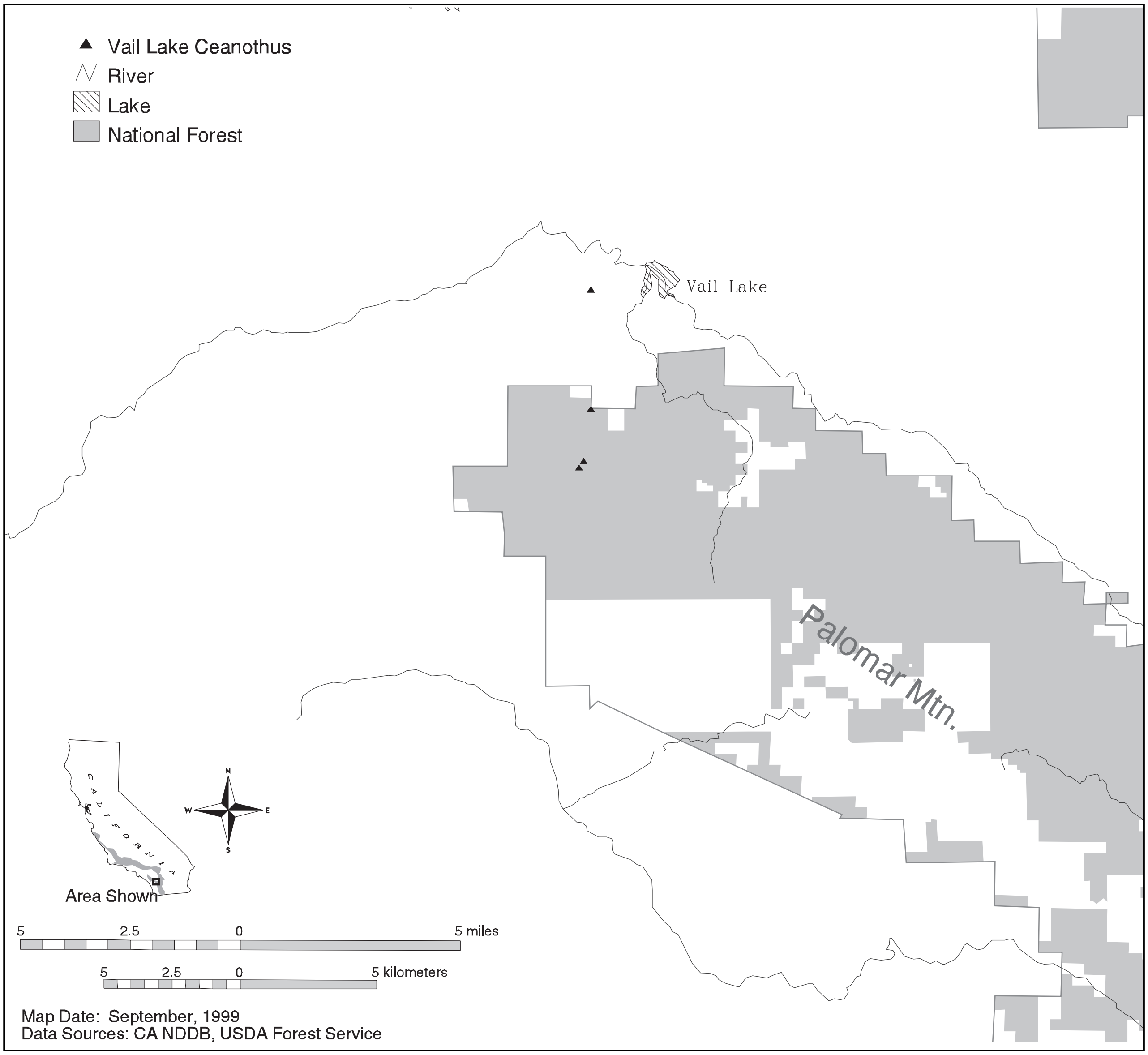


Figure 5.7. Distribution of *Ceanothus ophiochilus* (Vail Lake ceanothus).

Forest is located within an active grazing allotment and was estimated to contain over two thousand plants in 1995. The Cleveland National Forest contains some occurrences, primarily at Black Mountain. Other occurrences are protected in reserves in Riverside County: the Mott Reserve at UC Riverside, Harford Springs County Park, and Lake Matthews Biological Preserve. Occurrences in Santa Barbara County need to be confirmed. The species grows on gabbro-derived clay soil or "clay lenses" and, in addition to scrub and chaparral habitats, has been found at the edges of vernal pools in grasslands and meadows (Reiser 1994). Non-native grasses may be a threat to this species.

Dudleya cymosa ssp. *crebrifolia* (San Gabriel River dudleya)

Dudleya cymosa ssp.*crebrifolia* is endemic to the San Gabriel Mountains where it is known from one location in Fish Canyon along the San Gabriel River. It occurs on a granitic substrate.

Erigeron breweri var. *bisanctus* (pious daisy)

Erigeron breweri var. *bisanctus* is a watch-list plant on the San Bernardino and Angeles national forests. It occurs in the San Bernardino and San Gabriel mountains, and four occurrences are recorded in the CNDDB. Plants grow in chaparral and lower montane coniferous forest, on dry open slopes, and in washes. One occurrence is protected within the Glendora Wilderness Park. Habitat for this plant on national forest system lands may be affected by trampling, fuel wood harvesting, and prospecting. This variety is difficult to identify and may be confused with other more common taxa; therefore, we may not have an accurate picture of its rarity.

Eriogonum butterworthianum (Butterworth's buckwheat)

Eriogonum butterworthianum is a Forest Service Sensitive Species. It is a shrub known from four occurrences near Arroyo Seco in the northern Santa Lucia Range of Monterey County. These occurrences are located on the Los Padres National Forest. Abundance estimates for each occurrence range from fifty to fewer than one thousand individual plants. The species grows on sandstone soils within chaparral vegetation. *Castilleja foliosa* and *Mimulus aurantiacus* are common associates.

Heuchera rubescens var. *versicolor* (San Diego County alumroot)

Heuchera rubescens var. *versicolor* is a rare perennial plant known from a small number of occurrences in the foothills and mountains of San Diego County (i.e., Cuyamaca Peak, Hot Springs Mountain, along San Luis Rey River east of Barker Valley, and the east end of Harper Valley) (Reiser 1994). The taxon is also reported from northern Baja and Texas. San Diego County occurrences appear to be stable, although Reiser (1994) reports plants at the Hot Springs Mountain locale are declining and need protection from foot traffic. Other occurrences are found on state and Indian reservation lands. Plants occupy rocky cliffs in montane chaparral vegetation above 4,900 feet. These areas receive relatively low levels of disturbance.

Lepechinia cardiophylla (heart-leaved pitcher sage)

Lepechinia cardiophylla is a Forest Service Sensitive Species. This shrub is found in the Santa Ana Mountains, the Peninsular Ranges of San Diego County (disjunct Iron Mountain population), and southward into Baja California, Mexico (White 1990; Reiser 1994). It has potential to occur in the Laguna Mountains. Some populations occur in the Santa Ana Mountains on the upper slopes of Coal and Gypsum canyons among groves of Tecate cypress. The species is reportedly a fire follower; burned areas on the slopes of Sierra Peak contained a significantly higher number of *L. cardiophylla* plants than unburned areas (White 1990). There are about twenty-five recorded occurrences, mostly on the Cleveland National Forest. The species is included in a conservation strategy for coastal sage scrub (USFS/USFWS/CDFG 1997).

Lepechinia fragrans (fragrant pitcher sage)

Lepechinia fragrans is an uncommon shrub species distributed within the San Gabriel and Santa Monica (near Triunfo Pass) mountains and on the islands of Santa Cruz, Santa Rosa, and Santa Catalina. Scattered occurrences in the San Gabriel Mountains are found on both the Angeles and San Bernardino national forests. They are vulnerable to fire and habitat alteration (type conversion).

Lepechinia ganderi (Gander's pitcher sage)

Lepechinia ganderi is a shrub species known from fewer than ten occurrences in the Otay Mountains of San Diego County, in the Santa Ana Mountains, and in Baja California, Mexico. The plant grows in various foothill habitats—closed-cone conifer forest, chaparral, coastal sage scrub, and valley-foothill grasslands.

Malacothamnus aboriginum (Indian Valley bush mallow)

Malacothamnus aboriginum occurs in San Diego, Fresno, Monterey, and San Benito counties. Reiser (1994) lists about five extant occurrences in San Diego County, where the species is thought to be declining and close to extinction. The Garnet Peak population has experienced significant site disturbance and is being shaded out by planted pines (Reiser 1994). It needs to be determined if populations in the San Diego ranges are disjuncts or a separate species or subspecies. The *CNPS Inventory* (which only reports the northern populations) notes that this shrub appears in abundance after fires (Skinner and Pavlik 1994).

***Malacothamnus palmeri* var. *lucianus* (Arroyo Seco bush mallow)**

Malacothamnus palmeri var. *lucianus* is endemic to Monterey and San Luis Obispo counties. Three occurrences are documented from Monterey County—two occurrences near Big Sur and a third on the Los Padres National Forest near Hanging Valley in the upper Arroyo Seco watershed (D. Wilken, Santa Barbara Botanic Garden, in litt. 1998). Plants grow in chaparral and low-elevation meadow habitat. Occurrences on national forest system lands appear to be stable and in areas of low impact.

***Monardella viridis* ssp. *saxicola* (rock monardella)**

Monardella viridis ssp. *saxicola* is a Forest Service Sensitive Species distributed on the southern slopes of the San Gabriel Mountains between 1,700 and 6,000 feet. The perennial grows on dry rocky soils, in sunny exposed places, on partially shaded gravelly benches within chaparral, and in open areas of yellow pine forest. Plants also occupy burned areas in chaparral (Bennett 1979a). Two or three occurrences are known on the San Bernardino National Forest (eastern San Gabriel Mountains), all near one road. Occurrences are also documented in the San Dimas Experimental Forest on the Angeles National Forest. The plant is vulnerable to road-maintenance activities and disturbances that lead to type conversion of its habitat. At least one occurrence is located on private lands and may be vulnerable to development projects.

***Orobanche valida* ssp. *valida* (Rock Creek broomrape)**

Orobanche valida ssp. *valida* is a Forest Service Sensitive Species. It is known from at least one locality in the Topatopa Mountains and eight localities in the central and eastern San Gabriel Mountains. An estimated sixteen hundred plants occur at these localities, with the majority (94 percent) occurring in the San Gabriel Mountains on both coastal and desert-side slopes (Mistretta and Boyd 1997b). Plants occur in the San Gabriels at Lookout Mountain and along the South Fork of Big Rock Creek. Abundance data collected in the past two decades indicate that these occurrences are stable. Estimated population size along the South Fork of Big Rock Creek has increased from fifty plants in 1979, to one hundred plants in 1982, and three hundred plants in 1995. Estimated population size at Lookout Mountain for the same three years was thirty-five, greater than forty, and two hundred plants, respectively (Mistretta 1996). In addition, surveys in 1994 and 1995 found six new localities in the eastern San Gabriel Mountains. The taxon is known from a historic collection in the Topatopa Mountains and a more recent collection from the head of Santa Paula Canyon in the same mountains. Only a portion of the potential habitat for this taxon has been surveyed and it seems likely that additional occurrences will be found in the western San Gabriel Mountains and at other locations in the Castaic and southern Los Padres regions (Mistretta 1996).

The perennial is found on granitic soils in fairly open chaparral and pinyon-juniper woodlands between 4,100 and 6,600 feet elevation. It parasitizes various chaparral species such as silk tassel, yerba santa, California buckwheat, desert needlegrass, scrub oak, canyon live oak, and mountain mahogany; however, it is most frequent on silk tassel and has never been observed without this shrub nearby (Mistretta 1996). For the most part, *O. valida* ssp. *valida* inhabits remote terrain that receives few impacts; however, management activities that affect the persistence or stability of the chaparral vegetation could adversely affect the taxon. One occurrence near the Horse Canyon Shooting Area is vulnerable to habitat degradation. Another occurrence along the lower South Fork of Big Rock Creek is affected by erosion, and the population at Glendora Ridge (in the San Dimas Experimental Forest) could be adversely affected by desert crested wheatgrass, an introduced perennial grass.

Oxytheca emarginata
(white-margined oxytheca)

Oxytheca emarginata is a Forest Service Sensitive Species endemic to the San Jacinto and Santa Rosa mountains of Riverside County. Occurrences are located between 3,900 and 8,200 feet elevation on gravelly soils in openings within chaparral, lower montane coniferous forest, and pinyon-juniper woodlands. In at least one occurrence, *O. emarginata* is found with *Penstemon californicus,* another focal species. Most occurrences are found within chaparral in and around the Garner Valley, an area with two active grazing allotments. The species is vulnerable to overgrazing, trampling, development projects, and recreational activities.

Oxytheca parishii var. *abramsii*
(Abram's oxytheca)

Oxytheca parishii var. *abramsii* is an annual taxon found within the San Rafael Mountains and southern Los Padres region (Topatopa Mountains and Mount Pinos). Some occurrences are located on the Los Padres National Forest. The CNDDB contains records for five occurrences, mostly historic .

Penstemon californicus
(California beardtongue)

Penstemon californicus is a Forest Service Sensitive Species distributed in the San Jacinto and Santa Rosa mountains of Riverside County and in the Sierra Juarez and Sierra San Pedro Martir of Baja California, Mexico. Plants generally grow on sandy soils in chaparral, lower montane conifer forest, yellow pine forest, and pinyon-juniper woodlands. The CNDDB contains records on twelve occurrences, many on the San Bernardino National Forest. One historic occurrence is recorded in the Aguanga area near the border of Riverside and San Diego counties. Another historic record describes an occurrence within the Santa Rosa Wilderness Area. Other occurrences are located on private lands.

Occurrences on the forest grow in rocky or clay soils (specifically granitic soil with pleistocene nonmarine deposits of eroded clay), in openings within chaparral adjacent to meadow habitat in Garner Valley. Plants also grow in openings within chaparral on ridgetops and in the ecotone between chaparral and lower montane conifer forest. At some locales the perennial occurs with *Arabis johnstonii,* another focal species. Some of the occurrences on the forest are located in an active grazing allotment, including portions of two occurrences protected within exclosures. However, the main distribution of this species is in areas above those used by cattle (M. Lardner, San Bernardino NF, in litt. 1999).

Phacelia suaveolens ssp. *keckii*
(Santiago Peak phacelia)

Phacelia suaveolens ssp. *keckii* is a Forest Service Sensitive Species. An annual, it is endemic to the Santa Ana Mountains and San Diego region (Dennis 1995). The *CNPS Inventory* cites occurrences near Santiago Peak and Pleasants Peak in the Santa Ana Mountains (Skinner and Pavlik 1994). The plant is also reported from a drainage near Wild Horse Peak in the Agua Tibia Wilderness Area of the Cleveland National Forest (Reiser 1994). All of these occurrences are located on federal lands where they are somewhat protected. The taxon grows on volcanic soils in chaparral and with knobcone pine and is seen in greatest abundance following fires (White 1990).

Plagiobothrys uncinatus
(hooked popcorn-flower)

Plagiobothrys uncinatus is a Forest Service Sensitive Species. It is known from the Santa Lucia and Gabilan ranges in Monterey, San Benito, Santa Clara, and San Luis Obispo counties. Most of the documented occurrences are historic, including those at Pinnacles National Park and the Hastings Reserve. At least one occurrence is protected within the Cuesta

Ridge Botanical Area of the Los Padres National Forest. Two occurrences are located on Fort Hunter Liggett. This annual plant has been found in chaparral, woodlands, and grasslands.

Ribes canthariforme (Moreno currant)

Ribes canthariforme is a Forest Service Sensitive Species. This shrub is endemic to the foothills of San Diego County near Moreno Dam. There are about twelve recorded occurrences, many consisting of only a few plants and protected on state or federal lands. The species is included in a conservation strategy for coastal sage scrub (USFS/USFWS/CDFG 1997). In chaparral, it occurs in mesic areas with gabbro soils and large granite boulders.

Sidalcea hickmanii ssp. *hickmanii* (Hickman's checkerbloom)

Sidalcea hickmanii ssp.*hickmanii* is a Forest Service Sensitive Species. It is known from the northern Santa Lucia Range. The CNDDB contains records for ten occurrences (some of them historic). Six of the known occurrences are found on the Los Padres National Forest.

Thermopsis macrophylla (Santa Ynez false lupine)

Thermopsis macrophylla is a Forest Service Sensitive Species. It is known from fewer than fifteen occurrences in Santa Barbara County. All of the occurrences are located on the Santa Barbara Ranger District of the Los Padres National Forest, where they range from Santa Ynez Peak east to Camino Cielo Road and La Cumbre Peak. The species grows on sandstone, granitic, and adobe soils within chaparral. Some occurrences are found in disturbed areas such as fuel breaks. The plant is locally abundant after wildfires, gradually decreasing in abundance until the next fire, and is therefore sensitive to fire suppression. The *Jepson Manual* refers to this taxon as *T. macrophylla* var. *agnina* (Hickman 1993).

Plants Associated with Gabbro Soils

Gabbro is a localized soil type that supports a number of rare plant species in the chaparral belt. Thirteen rare plants are found or have potential to occur on gabbro-derived substrates within the assessment area. Summary information is shown in table 5.8. Two federally threatened species and one federally endangered species are included in this group.

Acanthomintha ilicifolia (San Diego thorn-mint)

Acanthomintha ilicifolia is state endangered and federally threatened. An annual plant, it is endemic to mesa and foothill areas of San Diego County and northern Baja California, Mexico. At least a third of the known historic occurrences have been extirpated by urban and rural development. About thirty small occurrences are presently known. The two largest are found on the Cleveland National Forest near Viejas and Poser mountains (fig. 5.8). These occurrences are located adjacent to an Indian reservation and could be affected by unauthorized cattle grazing and off-highway vehicle activity. Other smaller occurrences are protected in open space reserves throughout San Diego County, including a California Department of Fish and Game reserve at McGinty Mountain. Because much of its original habitat has been removed in San Diego County, *A. ilicifolia* is expected to remain rare. The Cleveland National Forest has developed a species management guide for occurrences on the forest (Winter, 1991c). See the final listing rule (USFWS 1998j) for more information on this species.

Arctostaphylos otayensis (Otay manzanita)

Arctostaphylos otayensis is an evergreen shrub endemic to San Diego County. Populations are recorded on six 7.5-minute quad maps centered in the Otay Mountain area. The habitat is described as chaparral and woodlands with gabbro or volcanic substrates in the foothill, lower montane, and montane conifer zones. Potential habitat exists on the Cleveland National Forest; however, most of

Table 5.8. Plants found in association with gabbro soils. y = the taxon is known to occur on the forest; p = has potential to occur). Trend, knowledge of distribution, and vulnerability information was determined by forest botanists/biologists and generally refers to occurrences on national forest system lands (decl. = declining; incr. = increasing; unkn. = unknown).

Scientific Name (common name) *listing status*	Acres of Known Habitat				Trends	Vulner-ability on NFS lands	Overall Distribution (Knowledge of distribution on NFS lands)
	CNF	**SBNF**	**ANF**	**LPNF**			
Acanthomintha ilicifolia (San Diego thorn-mint) *federally threatened*	157				decl.	mod.	San Diego Co. & adjacent areas of Baja; (high)
Arctostaphylos otayensis (Otay manzanita)	p				unkn.		San Diego Co. (Otay Mtn.); (high)
Brodiaea filifolia (thread-leaved brodiaea) *federally threatened*	y	p	p		unkn.	low	LA, Orange, SW Riverside (Santa Rosa Plateau), San Bernardino, & NW San Diego cos.; (moderate)
Brodiaea orcuttii (Orcutt's brodiaea) *FS sensitive*	719				decl.	low	Orange, San Bernardino, S Riverside, & SD cos., Baja (Santa Ana Mtns., Santa Rosa Plateau, Santa Margarita Mtns., S to Peninsular Ranges of SD Co.; (moderate)
Calochortus dunni (Dunn's mariposa lily) *FS sensitive*	163				decl.	low	Peninsular Ranges of SD Co. & Baja; (moderate)
Chorizanthe procumbens (prostrate spineflower)	y	p	p		stable[1]	low	SD, Riverside, Orange, LA, San Bernardino, & Ventura cos., Baja; (low)
Clarkia delicata (delicate clarkia) *FS sensitive*	y				decl.	low	Peninsular Ranges of SD Co. & N Baja; (low)
Fremontodendron mexicanum (Mexican flannelbush) *federally endangered*	p				decl[1].		Peninsular Ranges of SD Co. (San Ysidro Mtns., Otay Mtn.) and Baja; (low)
Horkelia truncata (Ramona horkelia) *FS sensitive*	338				stable	low–mod.	Peninsular Ranges of SD Co. & Baja; (high)
Monardella hypoleuca ssp. *Lanata* (felt-leaved monardella) *FS sensitive*	159				stable	low–mod.	Peninsular Ranges of SD Co. (Palomar & Laguna mtns.) & N Baja; (moderate)
Nolina interrata (Dehesa nolina) *state endangered*	p				stable[1]		Peninsular Ranges of SD Co. & Baja; (low)
Senecio ganderi (Gander's ragwort) *FS sensitive*	67				stable	mod.	Peninsular Ranges of SD Co. (Black, Laguna, & Palomar mtns.); (high)
Tetracoccus dioicus (Parry's tetracoccus) *FS sensitive*	97				decl.	low	foothills of Orange, Riverside, & SD cos., Baja; (moderate)

[1] Reiser 1994 (refers to all known occurrences)

Figure 5.8. Distribution of *Acanthomintha ilicifolia* (San Diego thorn-mint).

the known populations are located on BLM lands being considered for inclusion in a national wildlife refuge. In recent years populations at Otay Mountain have been impacted by repeated fires linked to illegal immigration through the area. Frequent fires may lead to conversion of the habitat to non-native grassland and eliminate native woody species. Despite this threat, the species was removed from the Forest Service Sensitive list because no occurrences are known on national forest system lands.

Brodiaea filifolia (thread-leaved brodiaea)

Brodiaea filifolia is a federally threatened and state endangered species distributed in Los Angeles, Orange, Riverside, San Bernardino, and San Diego counties. The CNDDB (1997) lists forty-five extant occurrences in all. Most are located on the Santa Rosa Plateau in southwestern Riverside County and in the Vista-San Marcos-Carlsbad region of northwestern San Diego County (fig. 5.9). Other occurrences are found along the San Jacinto River and a tributary of Old Salt Creek, west of the city of Hemet. Some occurrences are protected in the San Jacinto Wildlife Area managed by the California Department of Fish and Game, and one occurrence is known from Camp Pendleton. In all, this species occupies less than 600 acres of habitat (USFWS 1994b). The largest known occurrence, on the Santa Rosa

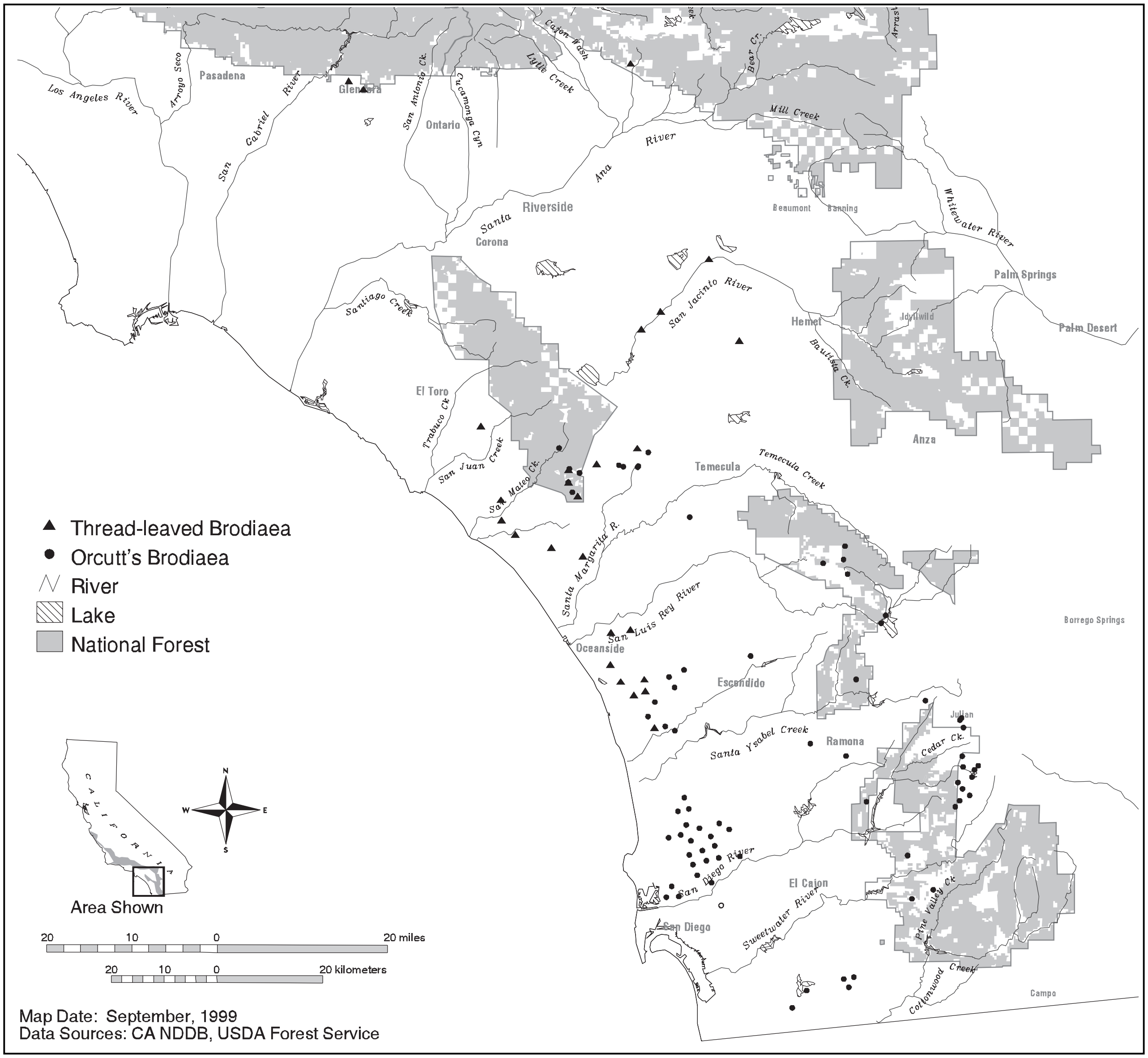


Figure 5.9. Distribution of *Brodiaea filifolia* (thread-leaved brodiaea).

Plateau, is estimated to contain over thirty thousand plants and occupy about 50 acres. The majority of occurrences are located on private lands in San Diego County; however, three populations occur near Miller Mountain on the Cleveland National Forest. These populations contain an estimated twenty thousand plants thought to be the hybrid *B. filifolia* x *B. orcuttii* (K. Winter, Cleveland NF, pers. comm.). One occurrence is reported for the San Bernardino Mountains (adjacent to the San Bernardino National Forest). The species was thought to have been extirpated from Los Angeles County; however, a small occurrence was discovered in 1991 in the city of Glendora at Wildwood and Morgon canyons.

B. filifolia is found in low-elevation inland valley and foothill habitats such as coastal sage scrub, chaparral, cismontane woodlands, and grasslands (e.g., southern needlegrass grassland and alkali grassland). Plants are found on clay soils in mesic places, including vernal pools (USFWS 1998m). In western Riverside County (i.e., Perris, San Jacinto, and Menifee valleys), the plant grows in vernal wetland plains and alkali lake playas (e.g., the Mystic Lake area).

This species is declining throughout its range in southern California (Reiser 1994). Its habitat has been significantly reduced by urban and agricultural development. An estimated 25 percent of *B. filifolia* populations have been eliminated and over 25 percent of the remaining populations in San Diego and Riverside counties occur in areas of proposed or approved development projects (USFWS 1998m). The species is also vulnerable to trampling, grazing, and invasion of exotic species such as perennial ryegrass in San Diego County and prickle grass in Riverside County. Unless flowering, the species can easily be missed during surveys.

Brodiaea orcuttii **(Orcutt's brodiaea)**

Brodiaea orcuttii is a Forest Service Sensitive Species. It occurs in Orange, San Bernardino, southern Riverside, and San Diego counties, and Baja California, Mexico. Occurrences are known from the Santa Ana Mountains, Santa Rosa Plateau, Santa Margarita Mountains, and south to Santa Ysabel and Pine Hills in San Diego County (Reiser 1994). The plant grows from sea level to about 5,300 feet, in vernally moist grasslands (including those with mima mound topography), at the periphery of vernal pools, on streamside embankments, within closed-cone conifer forest, chaparral, cismontane woodland, and meadows. It typically is associated with clay soils (sometimes serpentine) on mesas, and can grow with *Deschampsia danthonioides.* There are an estimated one hundred known populations, most of them west of national forest system lands; however, some plants are found on the Cleveland National Forest. Populations are declining because much of the appropriate habitat has been eliminated by development in coastal areas. The species is included in a conservation strategy for coastal sage scrub (USDA Forest Service et al. 1997). It can form hybrids with *B. filifolia,* another rare species. Plants grow in flat terrain near spring ponds.

Calochortus dunnii **(Dunn's mariposa lily)**

Calochortus dunnii is a Forest Service Sensitive Species. A perennial plant, it is found only in San Diego County and Baja California, Mexico. About twelve populations are known, a small number of them protected on the Cleveland National Forest. Unconfirmed reports in Baja are from near Guadalupe Mountain and Laguna Hansen (Reiser 1994). Occurrences on private lands in San Diego County are declining mainly due to urban and rural development. Other factors impacting the species are horticultural collecting and too frequent fire-return intervals that degrade its habitat.

Chorizanthe procumbens **(prostrate spineflower)**

Chorizanthe procumbens is distributed in San Diego, Riverside, Orange, Los Angeles, San Bernardino and Ventura counties, as well as Baja California, Mexico. Reiser (1994) cites about twenty-two known current locations and several more historic ones within California. Populations are known to occur on the Cleveland National Forest but are not yet recorded in our GIS database. Habitat conversion due to urban and rural development and competition from non-native grasses are factors negatively impacting the species. It does appear to tolerate some types of ground disturbance—it often grows alongside dirt roads and in lightly disturbed areas of chaparral and coastal sage scrub.

Clarkia delicata **(delicate clarkia)**

Clarkia delicata is a Forest Service Sensitive Species. An annual plant, it is found within the foothill and lower montane conifer zones of San Diego County and northern Baja California, Mexico. It appears to be associated with gabbro soils where they occur in oak woodlands and chaparral. Some occurrences are protected on federal and state lands; however, those on private lands lack protection and are declining from increased urban and rural development.

Fremontodendron mexicanum **(Mexican flannelbush)**

Fremontodendron mexicanum is a federally endangered species. It is an evergreen shrub known from the San Ysidro Mountains (specifically Otay Mountain) in the San Diego region and Baja California, Mexico. Most of the confirmed populations occur in the Otay Mountain area. Potential habitat occurs on the Cleveland National Forest. At Otay Mountain the species is associated with closed-cone conifer forest and southern mixed chaparral habitats (Reiser 1994). Much of it grows in the Cedar Canyon drainage along with scattered Tecate cypress. Ten confirmed occurrences are recorded in CNDDB, though some reported on the southern central coast appear to be misidentifications (D. Wilken, Santa Barbara Botanic Garden, pers. comm.) See the proposed and final rules for more information (USFWS 1995a; USFWS 1998g).

Horkelia truncata (Ramona horkelia)

Horkelia truncata is a Forest Service Sensitive Species. A perennial plant, it is known from foothill and lower montane conifer habitats in the San Diego ranges and Baja California, Mexico. It grows exclusively on gabbro soils in open areas of chaparral and cismontane woodland. The species is sometimes observed growing in disturbed areas and is apparently tolerant of fire and some soil disturbances. Approximately forty occurrences are known, most on public lands. These occurrences could potentially be affected by mining activities, heavy road maintenance, chaparral management, and livestock grazing.

Monardella hypoleuca ssp. *lanata* (felt-leaved monardella)

Monardella hypoleuca ssp. *lanata* is a Forest Service Sensitive Species. A perennial plant, it is endemic to the Palomar and Laguna mountains of San Diego County and northern Baja California, Mexico. Locations recorded for the Santa Ana Mountains are now believed to be erroneous. The taxon grows within foothill and lower montane conifer habitats, mainly on gabbro soils in chaparral and cismontane woodlands. About fifty occurrences are located on federal, state, and private lands. Occurrences on the Cleveland National Forest appear stable and are relatively well protected.

Nolina interrata (Dehesa beargrass)

Nolina interrata is a state-listed endangered species found in San Diego County and Baja California, Mexico. It was proposed for federal listing as threatened but the proposal was subsequently withdrawn (USFWS 1995a; USFWS 1998i). The species is usually found in chaparral below 2,100 feet elevation. Nine sites are known in California (Reiser 1994). There is potential for the species to occur on the Cleveland National Forest but all recorded populations are located west of the forest. The *CNPS Inventory* lists residential development and horticultural collecting as threats to the species (Skinner and Pavlik 1994).

Senecio ganderi (Gander's ragwort)

Senecio ganderi is a Forest Service Sensitive Species. A perennial plant, it is found on Black, Laguna, and Palomar mountains in San Diego County. The plant grows on gabbro soil within chaparral vegetation (including recently burned areas). The *CNPS Inventory* cites fewer than fifteen known occurrences on both public and private lands. Most of the known occurrences are located on federal or state lands. Those occurrences on private lands have potential to be affected by residential or commercial development projects. The species is state-listed rare and included in a conservation strategy for coastal sage scrub (USFS/USFWS/CDFG 1997).

Tetracoccus dioicus (Parry's tetracoccus)

Tetracoccus dioicus is a Forest Service Sensitive Species. It is a deciduous shrub known from the foothills of Orange, Riverside and San Diego counties, and Baja California, Mexico. It grows specifically on gabbro soils within chaparral and coastal sage scrub communities. Habitat conversion for agriculture and development projects is adversely affecting the species on private lands.

Montane Conifer Forest Plants

Thirty rare plants are primarily associated with montane conifer forest habitat within the assessment area. Summary information is shown in table 5.9.

Antennaria marginata (white-margined everlasting)

Disjunct occurrences of *Antennaria marginata* are located in the upper Santa Ana River watershed of the San Bernardino Mountains. The species also occurs in Colorado and New Mexico. Two occurrences are recorded in the CNDDB (1997). In the San Bernardino Mountains, the plant grows in dry areas within lower and upper montane conifer forest habitats. One occurrence is located in the San Gorgonio Wilderness Area. This species can be affected by recreation activities such as camping, hiking, horseback riding and off-road vehicle use.

Astragalus bicristatus (crested milk-vetch)

Astragalus bicristatus is a Forest Service Sensitive Species. It is a perennial species found in sandy or rocky places within lower and upper montane conifer forests, between 5,800 and 9,000 feet elevation. Occurrences are known in the eastern San Gabriel, San Bernardino, and Santa Rosa mountains. In the San Bernardino Mountains, plants occur on carbonate soils and rocky/pebbly slopes. At least seven occurrences are found in Big Bear and Holcomb valleys and in the upper Santa Ana River watershed. At least one occurrence is documented in the Santa Rosa Mountains. This species is vulnerable to mining activities, high recreation use, and construction/development projects.

Astragalus lentiginosus var. *antonius* (San Antonio milk-vetch)

Astragalus lentiginosus var. *antonius* is a Forest Service Sensitive taxon endemic to the San Gabriel Mountains (fig. 5.10). The CNDDB contains records for four historic occurrences. Plants are found on dry, open slopes within montane conifer/yellow pine forests (Angeles NF 1995; Hickman 1993).

Castilleja gleasonii (Mount Gleason Indian paintbrush)

Castilleja gleasonii is a Forest Service Sensitive Species. Endemic to the western San Gabriel Mountains of Los Angeles County, the perennial grows on granitic soils in conifer forest habitat above 5,000 feet. Fewer than ten occurrences are known, all located on the Angeles National Forest—at Messenger Peak/Flat, Mount Gleason, Lightning Ridge, and east to Chilao, Horse Flats, and the Little Rock Creek area (fig. 5.10) (Mistretta and Brown 1987a).

Like all *Castilleja* species, *C. gleasonii* is hemiparasitic on other plants. Associations are formed with *Artemisia tridentata,* wild buckwheats, and other native species. The plant is usually found in areas of open yellow pine woodland (e.g., ponderosa pine and Coulter pine), with a well-developed shrub or sub-shrub understory. It can also be found growing with bigcone Douglas-fir, white fir, *Arctostaphylos parryana,* and chaparral whitethorn. Occurrences at Mount Gleason grow with one of the narrow-leaved bedstraws *(Galium angustifolium* ssp. *angustifolium)* and prickly phlox. The Messenger Flat occurrence is found primarily in a mixed live oak/yellow pine habitat that grades into chaparral. Plants at Lightning Ridge grow at the interface of conifers and chaparral.

The primary threat to this species is its preference for habitat that is also popular for human recreation activities (i.e., gentle slopes and an open understory). Occurrences are reportedly threatened by their proximity to campgrounds (Horse Flats, Bandido, Chilao Flats, Messenger Flats, and Lightning Ridge). Designated trails (e.g., the Pacific Crest Trail) also occur in the vicinity of occurrences. Fuel wood gathering at Mount Gleason is cited as a threat and off-highway vehicle activity is a potential threat at Mount Gleason and Messenger Flat.

It is unclear how this species responds to disturbance; discing adjacent to occurrences at Messenger Flat in 1983 did not appear to increase recruitment into the disturbed area (Mistretta and Brown 1987a). A prescribed burn at Horse Flats in October of the same year did not appear to negatively affect the species. Transect data gathered from 1982 to 1987 showed a steady decline in species abundance (attributed to deer browsing) at the Horse Flats area.

The Angeles National Forest has developed a species management guide for occurrences on the forest (Mistretta and Brown 1987a). The *Jepson Manual* lists this species as *C. pruinosa* and considers related species part of a highly variable complex that needs further study (including *C. affinis* and *C. foliolosa).*

Castilleja montigena **(Heckard's Indian paintbrush)**

Castilleja montigena is a watch-list species on the San Bernardino National Forest. The perennial is locally common and endemic to the eastern San Bernardino Mountains, where it grows in pinyon-juniper woodlands and montane coniferous forests. The species is presumed to be a stable hybrid of *C. applegatei* ssp. *martinii* and *C. angustifolia.* Habitat where it occurs may be vulnerable to ski area development and high-level recreation use.

Eriophyllum lanatum **var.** ***obovatum*** **(southern Sierra woolly sunflower)**

Eriophyllum lanatum var. *obovatum* is a perennial taxon distributed in the San Bernardino Mountains and southern Sierra Nevada. Numerous occurrences were documented in the 1980s by herbarium specimens from the San Bernardino National Forest. These occurrences have not been mapped and we were unable to include them in our GIS species coverage. In more recent years, sightings have been less frequent and there is concern that the plant is declining in abundance (A. Sanders, UC Riverside, pers. comm.). It typically occupies open habitat in montane conifer forests. Occurrences are vulnerable to high levels of recreation and development projects.

Galium angustifolium **ssp.** ***jacinticum*** **(San Jacinto Mountains bedstraw)**

Galium anustifolium ssp. *jacinticum* is a Forest Service Sensitive Species. It occurs in the Black Mountain area of the San Jacinto Mountains. It grows in the understory of coniferous forests. Three occurrences are recorded in the CNDDB. Some are found near campgrounds on the San Bernardino National Forest and possibly in the Hall Canyon RNA (Keeler-Wolf 1986a). This plant is vulnerable to trampling, tree harvesting, road maintenance, and high levels of recreation use, particularly from off-road vehicles.

Galium californicum **ssp.** ***primum*** **(California bedstraw)**

Galium californicum ssp. *primum* is a Forest Service Sensitive Species. It is a perennial species known from one occurrence and nine general locations (CNDDB 1997). One reported occurrence, located on private lands northwest of the San Jacinto Mountains, appears to be declining from "genetic swamping" by the more common *G. nuttallii.* Most occurrences, however, are known from a small area of the San Jacinto Mountains. Several of these occurrences burned in the 1996 Bee Fire and were observed resprouting fifteen months later. New plants from seed have not yet been detected (D. Volgarino, San Bernardino NF, pers. comm.). Plants typically grow on granitic and sandy soil in chaparral and in the understory of conifer forests between 4,400 and 5,600 feet.

Galium jepsonii **(Jepson's bedstraw)**

Galium jepsonii is an uncommon perennial species found in the upper montane conifer zones of the San Gabriel Mountains and potentially in the San Bernardino Mountains. It occupies dry, granitic, rocky, and gravelly places in open woodlands. A small amount of occupied habitat is recorded on the Angeles National Forest.

Table 5.9. Rare plants found in montane conifer forests. Numerical values indicate acres of occupied habitat within congressional forest boundaries (y = the taxon occurs on the forest; p = has potential to occur). Assessments of trend, knowledge of distribution, and vulnerability were made by forest botanists/ biologists and generally refer to occurrences on national forest system lands (unkn. = unknown; decl. = declining; incr. = increasing).

Scientific Name (common name) *listing status*	Acres of Known Habitat				Trends	Vulner-ability on NFS lands	Overall Distribution (Knowledge of distribution on NFS lands)
	CNF	SBNF	ANF	LPNF			
Antennaria marginata (white-margined everlasting)		y			unkn.	unkn.	San Bernardino Mtns., CO, NM; (low)
Astragalus bicristatus (crested milk-vetch) *FS sensitive*		y	p		unkn.	unkn.	San Gabriel, San Bernardino, & Santa Rosa mtns.; (low)
Astragalus lentiginosus var. *antonius* (San Antonio milk-vetch) *FS sensitive*		p	y		unkn.	unkn.	San Gabriel Mtns.; (low)
Castilleja gleasonii (Mt. Gleason Ind. paintbrush) *FS sensitive*			13			mod.–high	W San Gabriel Mtns.
Castilleja montigena (Heckard's Indian paintbrush)		y				unkn.	E San Bernardino Mtns.
Eriophyllum lanatum var. *obovatum* (S. Sierra woolly sunflower)		y			unkn.	unkn.	San Bernardino Mtns. & S Sierra Nevada; (low)
Galium angustifolium ssp. *jacinticum* (San Jacinto Mtns. bedstraw) *FS sensitive*		y				mod.–high	San Jacinto Mtns.
Galium californicum ssp. *primum* (California bedstraw) *FS sensitive*		29			decl.	mod.	San Jacinto Mtns.; (moderate)
Galium jepsonii (Jepson's bedstraw)		p	1		unkn.	unkn.	San Gabriel Mtns.; (low)
Galium johnstonii (Johnston's bedstraw)	p	y	8		unkn.	unkn.	San Gabriel, San Bernardino, & Santa Rosa mtns.; (low)
Heuchera elegans (urn-flowered alumroot)		p	7			unkn.	San Gabriel Mtns.; (high)
Heuchera parishii (Parish's alumroot) *FS sensitive*		y			unkn.	mod.	San Bernardino & San Jacinto mtns.; (low)
Horkelia wilderae (Barton Flats horkelia) *FS sensitive*		174			unkn.	mod.	San Bernardino Mtns.; (high)
Hulsea californica (San Diego sunflower)	100				stable	low	Laguna & Cuyamaca mtns. (San Diego Co.); (high)
Hulsea vestita ssp. *callicarpha* (beautiful hulsea)	y	y					San Jacinto & Santa Rosa mtns. (Riverside Co.) & Palomar Mtns. (SD Co.) .

Scientific Name (common name) *listing status*	Acres of Known Habitat CNF	SBNF	ANF	LPNF	Trends	Vulner-ability on NFS lands	Overall Distribution (Knowledge of distribution on NFS lands)
Ivesia callida (Tahquitz ivesia) *FS sensitive*		12			unkn.	low	San Jacinto Mtns.; (moderate)
Linanthus concinnus (San Gabriel linanthus) *FS sensitive*		p	y		unkn.	mod.–high	San Gabriel Mtns.; (high)
Lupinus excubitus var. *johnstonii* (interior bush lupine)			1				San Gabriel Mtns.; (low)
Machaeranthera canescens var. *ziegleri* (Ziegler's aster) *FS sensitive*		y			unkn.	low	Santa Rosa Mtns.; (high)
Mimulus clevelandii (Cleveland's bush monkeyflower)	3					low	(low)
Monardella linoides ssp. *oblonga* (flax-like monardella) *FS sensitive*				473	stable to incr.	low	Ventura, Kern, & Tulare cos., Sierra Nevada, Tehachapi Mtns.; (low)
Monardella nana ssp. *leptosiphon* (San Felipe monardella) *FS sensitive*	117	26			stable/ decl.	low[1]/ mod.[2]	San Jacinto Mtns., Peninsular Ranges of SD Co.; (high)
Oxytheca caryophylloides (chickweed oxytheca)		y	p	p?	unkn.	unkn.	LA, Riverside, San Bernardino, Tulare, & Ventura cos.; (unknown)
Oxytheca parishii var. *cienegensis* (Cienega Seca oxytheca) *FS sensitive*		y			unkn.	mod.	E San Bernardino Mtns.; (moderate)
Phlox dolichantha (Big Bear Valley phlox) *FS sensitive*		12,774			unkn.	low-mod.	NE San Bernardino Mtns.; (high)
Piperia leptopetala		y			unkn.	low	Transverse & Peninsular ranges, Sierra Nevada, North Coast, Cascade Ranges; (low)
Sedum niveum (Davidson's stonecrop) *FS sensitive*		24			unkn.	low	San Bernardino, Santa Rosa, & New York mtns., Baja; (moderate)
Senecio ionophyllus (Tehachapi ragwort)		y	2		unkn.	low	LA, San Bernardino, & Kern cos. (San Gabriel & San Bernardino mtns., Piute & Tehachapi mtns.); (low)
Sidalcea hickmanii var. *parishii* (Parish's checkerbloom) *FS sensitive*		y	p	397	unkn.	high[2]/ mod.[3]	Santa Lucia, San Rafael, & Sierra Madre mtns., southern Los Padres region, San Bernardino Mtns.; (moderate)
Streptanthus bernardinus (Laguna Mtns. jewel-flower)	1	y	p		incr.	low	S. Gabriel, S. Bernardino, S. Jacinto, Laguna & Cuyamaca mtns.; (high)

[1] on the Cleveland National Forest
[2] on the San Bernardino National Forest
[3] on the Los Padres National Forest

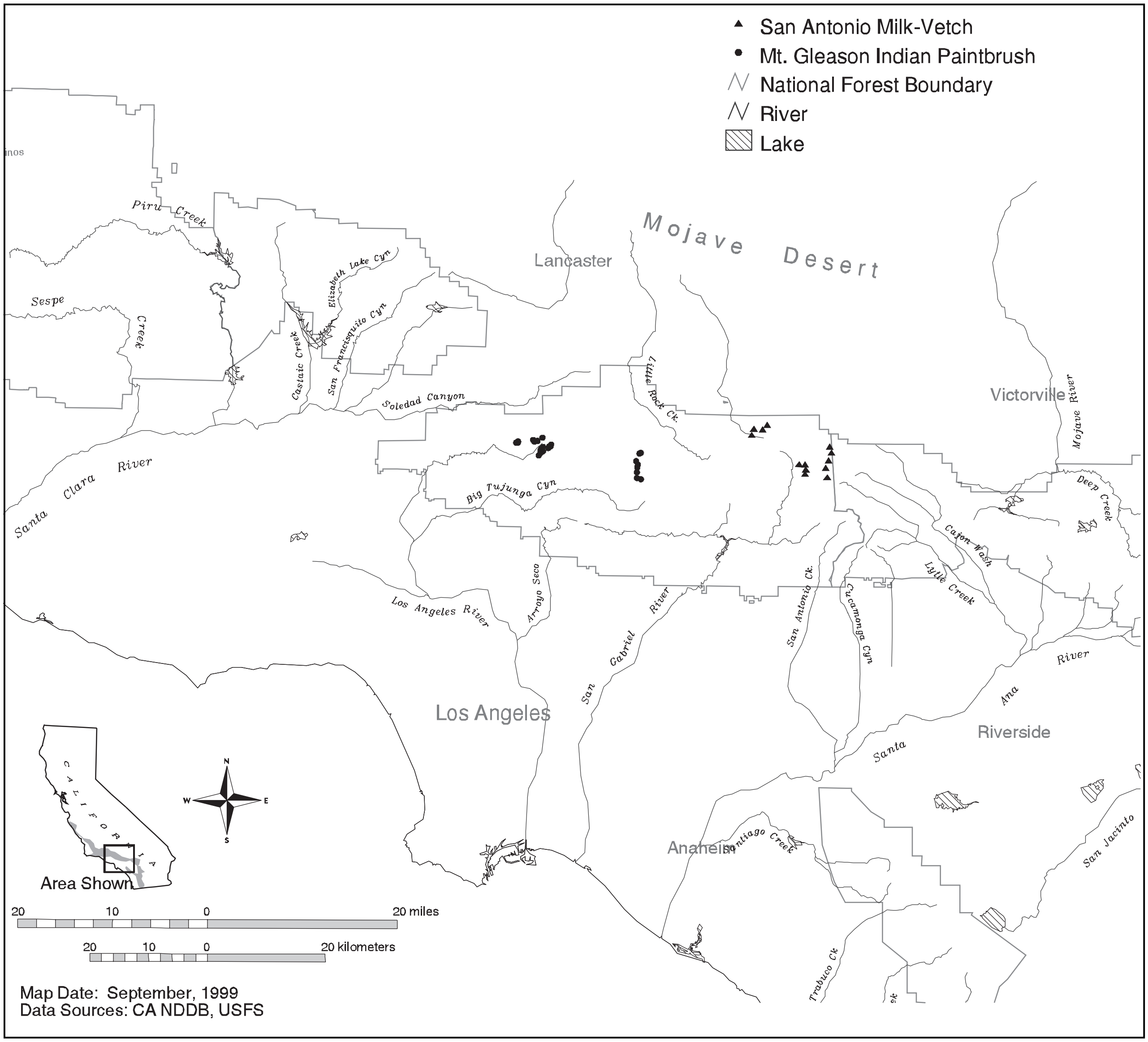


Figure 5.10. Documented locations of *Astragalus lentiginosus* var. *antonius* (San Antonio milk-vetch) and *Castilleja gleasonii* (Mount Gleason Indian paintbrush).

Galium johnstonii (Johnston's bedstraw)

Galium johnstonii is another perennial bedstraw found in the montane conifer zones of the San Gabriel, San Bernardino, and Santa Rosa mountains. The species is locally common at Santa Rosa Peak (Reiser 1994). It has been found on dry slopes in open mixed hardwood and conifer forest, and in yellow pine forest. Potential habitat exists in the San Diego ranges but the taxon has not been documented on the Cleveland National Forest. Occurrences are known on the San Bernardino and Angeles national forests.

Heuchera elegans (urn-flowered alumroot)

Heuchera elegans is a watch-list species found in Los Angeles and San Bernardino counties. Occurrences are not uncommon in the central San Gabriel Mountains (S. Boyd, Rancho Santa Ana Botanic Garden, pers. comm.). Occupied habitat is recorded on the Angeles National Forest and potential habitat exists on the San Bernardino National Forest. The perennial grows at rocky sites in lower and upper montane conifer forests, between 4,000 and 8,500 feet (Angeles NF 1995).

Heuchera parishii (Parish's alumroot)

Heuchera parishii is a Forest Service Sensitive Species. It is a perennial species known from occurrences in the San Bernardino and San Jacinto mountains. RAREFIND contains records for five occurrences (CNDDB 1997), but additional occurrences have been observed by resource personnel on the San Bernardino National Forest. The plant occupies rocky places within montane and subalpine conifer forests, as well as alpine boulder and rock fields. Some occurrences are protected in the San Gorgonio and San Jacinto wilderness areas. One occurrence is threatened by ski area development.

Horkelia wilderae (Barton Flats horkelia)

Horkelia wilderae is a Forest Service Sensitive Species. It is endemic to the Barton Flats area of the San Bernardino Mountains, where it is locally abundant in a 12- square-mile area. The CNDDB contains records for five occurrences. Plants are found in montane and subalpine habitats. They grow in yellow pine/oak forest in the understory and in openings and are not found where the canopy and other vegetation become dense. A few occurrences identified almost ten years ago have not been relocated and the vegetation in these areas has become noticeably denser (M. Lardner, San Bernardino NF, in litt. 1998). Habitat in the Barton Flats area is vulnerable to high levels of recreation use; however, the occurrences appear stable. The perennial appears to tolerate some disturbance and light trampling.

Hulsea californica (San Diego sunflower)

Hulsea californica is a rare, annual or biennial sunflower known from the Peninsular Ranges of San Diego County. Occurrences are documented at Hot Springs Mountain and in the Laguna and Cuyamaca mountains (Wilken 1975). Appearing in open areas after fires and mild ground disturbances, the species grows in chaparral and pine-oak woodlands between 3,200 and 6,600 feet. Many of the known occurrences are located on the Cleveland National Forest. Other occurrences are located on state and private lands. Increased recreation use in the Laguna Mountains may affect habitat for this species. Fire suppression may also have adverse affects, as the species appears to rely on natural fire cycles for regeneration (Reiser 1994). Occurrences at Hot Springs Mountain appear to intergrade with *H. vestita* ssp. *callicarpha.*

Hulsea vestita ssp. *callicarpha* (beautiful hulsea)

Hulsea vestita ssp. *callicarpha* is known from at least fifteen different occurrences in the San Jacinto, Santa Rosa, and Palomar mountains (Wilken 1975). Plants are known to occur on the San Bernardino and Cleveland national forests. The perennial grows on granitic soils, in chaparral and in open areas of montane conifer forest between 4,200 and 8,200 feet. Some occurrences are found on roadcuts. Hybrids of this taxon and *H. heterochroma* have been collected in the San Jacinto Mountains.

Ivesia callida (Tahquitz ivesia)

Ivesia callida is a Forest Service Sensitive Species. It is a perennial species endemic to the San Jacinto Mountains. The CNDDB contains records for two occurrences, both located in the San Jacinto Wilderness Area of the San Bernardino National Forest. A botanical investigation was completed for this species in 1982 (Berg 1982). The investigation found that one occurrence occupied five acres and contained between 1,001 and 10,000 plants. The second occurrence covered twenty acres and was estimated to contain greater than 10,000 plants. This second occurrence was revisited in 1994 and just over 150 plants were found, although the entire site was not surveyed due to the ruggedness of the terrain. Both occurrences are located in relatively inaccessible rocky habitat within upper montane conifer forest. Plants grow from crevices in granitic rocks and are vulnerable to the activities of rock climbers who use the crevices for hand and toe holds.

Linanthus concinnus **(San Gabriel linanthus)**

Linanthus concinnus is a Forest Service Sensitive Species. It is an annual species distributed in Los Angeles and San Bernardino counties. Occurrences are found in the San Gabriel Mountains on dry, rocky soils in montane conifer forests (Skinner and Pavlik 1994; Munz 1974). The CNDDB lists fifteen occurrences, most on the Angeles National Forest growing with Jeffrey and ponderosa pine. Potential habitat exists on the San Bernardino National Forest. The species is vulnerable to high levels of recreation use (i.e., trampling and ski area development). Surveys to locate this species in 1991 were unsuccessful.

Machaeranthera canescens **var.** ***ziegleri*** **(Ziegler's aster)**

Machaeranthera canescens var. *ziegleri* is a Forest Service Sensitive Species. It is found only in the Santa Rosa Mountains of Riverside County. The CNDDB contains records for two occurrences, both within the congressional boundaries of the San Bernardino National Forest. These occurrences may be located partly on private lands and partly in the Santa Rosa Wilderness Area. Very little potential habitat exists outside of this area as the Santa Rosa Mountains are surrounded by desert and desert-influenced vegetation. The Forest Service is actively trying to acquire more land with potential habitat for this taxon. Plants are widely scattered in the understory of small conifer stands between 4,500 and 8,200 feet elevation. Some plants are located along roads and adjacent to campsites, possibly indicating a positive response to ground disturbance. However, high levels of trampling, road grading, and livestock grazing may put occurrences at risk. The perennial may also be vulnerable to repeated wildfire events due to its very limited distribution.

Monardella linoides **ssp.** ***oblonga*** **(flax-like monardella)**

Monardella linoides ssp. *oblonga* is a Forest Service Sensitive Species. It is a perennial taxon distributed in Ventura, Kern, and Tulare counties. Occurrences are known from the southern Sierra Nevada and Tehachapi mountains and the southern Los Padres region. Plants grow among rock outcrops and on decomposed granite in mixed conifer forests, yellow pine forests, pinyon-juniper woodlands, and desert scrub habitat. The CNDDB contains records for ten occurrences, all on national forest system lands. Nine of the occurrences are found on the Los Padres National Forest and more potential habitat exists that has yet to be surveyed. The known occurrences appear to be stable or increasing in size. This taxon is known to respond positively to wildfire events; however, some occurrences are vulnerable to road/trail maintenance and off-road vehicle activity.

Monardella nana **ssp.** ***leptosiphon*** **(San Felipe monardella).**

Monardella nana ssp. *leptosiphon* is a Forest Service Sensitive Species. It is found in chaparral, mixed conifer forest, and yellow pine forest in the San Jacinto Mountains and Peninsular Ranges of San Diego County (Skinner and Pavlik 1994; Munz 1974). The CNDDB contains records on eleven occurrences in the mountains of San Diego County and additional occurrences are known from the San Jacinto Mountains. Altogether, an estimated twenty-five occurrences are reported by forest botanists/biologists.

Studies on plants in the San Jacinto Mountains indicate they are intermediate to *M. nana* ssp. *tenuiflora* to the north and *M. nana* ssp. *leptosiphon* to the south. Occurrences are located in an area of high recreation use (i.e., adjacent to campsites and campgrounds) but do not appear heavily affected. The plant has shown some resilience to woodcutting, fire, and low-level ground disturbance. About ten populations are recorded for the Palomar Ranger District of the Cleveland National Forest. Occurrences reported from Palomar Mountain may be another taxon or intermediate. Plants from Hot Springs Mountain, Volcan Mountain, and Banner Grade seem to better represent *M. nana* ssp. *leptosiphon,* rather than those from Palomar Mountain (Allen 1994).

Oxytheca caryophylloides (chickweed oxytheca)

Oxytheca caryophylloides is an annual species distributed in Los Angeles, Riverside, San Bernardino, Tulare, and Ventura counties (Skinner and Pavlik 1994). Plants grow on sandy soils in montane conifer forests between elevations of 3,900 and 8,500 feet. Occurrences are known on the San Bernardino National Forest and potential habitat occurs on the Angeles and Los Padres national forests.

Oxytheca parishii var. *cienegensis* (Cienega Seca oxytheca)

Oxytheca parishii var. *cienegensis* is a Forest Service Sensitive plant that occurs in the eastern San Bernardino Mountains. Nineteen occurrences have been inventoried on the San Bernardino National Forest. One occurrence near Coon Creek contained more than one thousand plants in 1990. Another located on the south side of Cienega Seca Creek contained approximately twenty plants in the same year. A third occurrence found along Highway 38 near Cienega Seca Creek had no plants visible in 1990; however, basal rosettes were observed at the site ten years earlier (Ertter 1990). One occurrence is known from the Tip Top Mountain area. The annual grows in sandy soils (carbonate or granitic) and on dry gravelly banks in upper montane coniferous forest and pinyon-juniper woodlands. Some occurrences are found in relatively open or disturbed places, either from past human disturbance or seasonal natural disturbances. Plants have been found along roadsides, along trails, and adjacent to campsites. Plants found in association with carbonate soils are vulnerable to mining activities. The taxon blooms relatively late in the year and is probably not well inventoried (M. Lardner, San Bernardino NF, pers. comm.).

Phlox dolichantha (Big Bear Valley phlox)

Phlox dolichantha is a Forest Service Sensitive Species. It is a perennial species endemic to Big Bear and Holcomb valleys in the northeastern San Bernardino Mountains. It grows on clay soils in open areas of montane conifer forest (particularly on north-facing slopes and in shaded canyons). The CNDDB documents at least eighteen occurrences, some located on private lands but the majority found on the San Bernardino National Forest. One occurrence near Aspen Glen picnic area showed a 278 percent increase in abundance from 1979 to 1995. Another occurrence at Sugarloaf is protected by fencing but vandalism is a regular threat. The species is adversely affected by fuelwood harvesting, unauthorized off-road vehicle activity, and high levels of recreation use. The large number of acres reported for this species is due to areas between discrete occurrences being included in the GIS coverage.

Piperia leptopetala

Piperia leptopetala is a watch-list plant on the San Bernardino National Forest, where two occurrences are known. Occurrences are also known on the Eldorado National Forest. The species is widespread in California, with populations found in the Transverse and Peninsular ranges, the Sierra Nevada, and the North Coast and Cascade ranges. Its distribution may continue northward to Washington. Most occurrences are small, usually fewer than ten plants, with the largest containing thirty plants (Coleman 1995). The species grows at dry sites in open mixed conifer and montane conifer forests. One occurrence on the San Bernardino National Forest is threatened by construction of a water tank. Occurrences in other areas are potentially threatened by timber harvesting.

Sedum niveum (Davidson's stonecrop)

In the assessment area, *Sedum niveum* is known from occurrences in the San Bernardino and Santa Rosa mountains. Other occurrences are reported in the New York

Mountains within the Mojave Desert. Plants reported to be this species are documented at Observatory Peak, in the Sierra San Pedro Martir (Baja California, Mexico); however, they differ in morphology, petal spot color, and chromosome number (Bennett 1979b). In the Santa Rosa Mountains, plants are found on Toro Peak and Santa Rosa Mountain. In the San Bernardino Mountains, occurrences are found at Sugarloaf and Charleston peaks, on the south side of Van Dusen Canyon, above Dry Canyon, at Snow Canyon, and above Dollar Lake (Krantz, Thorne, and Sanders 1995). Some occurrences on the San Bernardino National Forest are located in wilderness areas or are otherwise protected from vehicles and trampling by their habitat preferences; plants grow on rocky ledges and in crevices composed of granitic or carbonate substrates, on steep, north-facing slopes between 7,200 and 9,900 feet elevation. Some occurrences are reported from northeast- or northwest-facing slopes, but in these cases are shaded by rocks. Surrounding habitat consists of upper montane conifer forest with lodgepole pine, pinyon pine, or white fir. *S. niveum* appears to thrive on the leaf mold provided by fallen pine needles (Bennett 1979b). Some occurrences on the forest have potential to be affected by mining claims and ski area expansion. Further surveys are needed to determine a more complete distribution for this species and any potential threats on national forest system lands (D. Volgarino, San Bernardino NF, in litt. 1999).

Senecio ionophyllus (Tehachapi ragwort)

Senecio ionophyllus is a watch-list species on the San Bernardino National Forest. Occurrences are known from Los Angeles, San Bernardino, and Kern counties. In the assessment area, the species occurs in the San Gabriel and San Bernardino mountains, including populations on the Angeles and San Bernardino national forests. Other occurrences are known in the Piute and Tehachapi mountains. Plants are found growing on dry, granitic soils within montane conifer and subalpine forests between 4,900 and 8,900 feet elevation. Occurrences in the San Bernardino Mountains can be confused with *Senecio bernardinus,* another focal species. Potential threats to this plant are developed recreation sites and ski area expansions.

Sidalcea hickmanii var. *parishii* (Parish's checkerbloom)

Sidalcea hickmanii var. *parishii* is a Forest Service Sensitive Species. It occurs on the Los Padres and San Bernardino national forests. Occurrences are known from the Santa Lucia, San Rafael, and Sierra Madre mountains, the southern Los Padres ranges region, and the San Bernardino Mountains (Santa Ana River watershed). The CNDDB contains records for thirteen occurrences, and at least two other occurrences are known. A range extension for this taxon was discovered during post-burn surveys in San Luis Obispo in 1997. A perennial plant, it grows in chaparral and montane conifer habitat between 4,000 and 7,500 feet (Munz 1974; Skinner and Pavlik 1994). It appears to be disturbance oriented; plants are found after fire and reportedly on grazed and maintained fuel breaks on the Los Padres National Forest. An occurrence on the San Bernardino National Forest is located in an area of recent trail construction. In general, the plant is rarely found and seldom in the same locations. On private lands the taxon is vulnerable to development projects which destroy its habitat. On the San Bernardino National Forest there is potential for erosion and encroachment of brush to affect occurrences. Management of this plant on the Los Padres National Forest is guided by an existing species-specific conservation strategy (USFS/USFWS 1996).

Streptanthus bernardinus (Laguna Mountains jewel-flower)

Streptanthus bernardinus is a perennial species distributed mainly within the San Gabriel, San Bernardino, San Jacinto, and Santa Rosa mountains, and to a lesser extent on Laguna Mountain. The CNDDB contains records for nine occurrences and twenty-seven general locations. Additional occurrences are known on the San Bernardino National Forest but not yet recorded in the GIS database. Occurrences on the San Bernardino National Forest are relatively large and appear to be increasing in size (e.g., at Running Springs and Green Valley). A few occurrences are protected within research natural areas on the San Bernardino National Forest and at the UC James Reserve. Two small occurrences and several larger ones are found in Cuyamaca Rancho State Park (at Cuyamaca Peak) adjacent to the Cleveland National Forest. The species is rare on the Cleveland National Forest; it grows with cedar and Jeffrey pine on the Descanso Ranger District (about one acre of occupied habitat). A botanical investigation was unable to locate any plants on the Angeles National Forest. Potential habitat exists for the species in areas of Baja California, Mexico.

The species is found on granitic substrates in openings of chaparral, closed-cone conifer forests, mixed conifer forests, yellow pine forests, and at previously disturbed sites. It can also occupy mesic and shady streamsides (CNDDB 1996). The species is often associated with white fir, sugar pine, incense-cedar, and black oak. At the Cuyamaca Peak locale, the plant occurs in areas of partial shade near seeps or springs (Reiser 1994). Prolonged ground disturbance can adversely affect the species; however, it appears to be disturbance oriented in general, having been found in picnic areas, campgrounds, abandoned organizational camps, and along roadsides and trails. The species is relatively abundant and tolerant of disturbance.

Pebble Plains Plants

Six rare plants are associated with highly localized pebble plain habitats which occur within montane conifer forests in the northeastern San Bernardino Mountains. Some of these taxa also occur in the surrounding conifer forests. Summary information is shown in table 5.10. Three federally threatened species are included in this group. All of these species are managed by provisions in the *Pebble Plain Habitat Management Guide and Action Plan* (Neel and Barrows 1990).

Arabis parishii (Parish's rock cress)

Arabis parishii is a Forest Service Sensitive Species known from the San Bernardino Mountains. Occurrences are found on the San Bernardino National Forest at Onyx Peak, Sugarloaf Ridge, Big Bear Valley, Holcomb Valley, and Coxey Meadows. The CNDDB contains records for at least forty-five occurrences. The species is a predictable occupant of pebble plains but also grows in other habitats that are dry, sunny, and have rocky soils (carbonate, pinyon-juniper woodlands) (Munz 1974; CNDDB 1996; S. Boyd, Rancho Santa Ana Botanic Garden, pers. comm.). The species is found with other rare plants such as *Linanthus killipii* and *Echinocereus engelmannii munzii.* Some of the pebble plain occurrences are protected by fencing. The species is not protected where it occurs in the forest understory or on carbonate and, at some locations, is adversely affected by habitat conversion, trampling, non-native species, mining operations, off-road vehicles, woodcutting, dumping, and shooting activities.

Arenaria ursina (Big Bear Valley sandwort)

Arenaria ursina is a federally threatened species known from occurrences in Big Bear and Holcomb valleys (fig. 5.11). The CNDDB contains records for at least twenty-five occurrences; however, the reported range (from Onyx Peak to Cactus Flat) was recently reduced after surveys identified some of those occurrences as *Arenaria macradenia* var. *macradenia.* Some occurrences on the San Bernardino National Forest are fenced, although vandalism is a recurring problem. Other occurrences continue to be affected by off-road driving—mainly to access unauthorized woodcutting areas—and by legal forest system roads that bisect known sites. Several additional locations will be fenced in 1999, and all occurrences are being surveyed and monitored

Table 5.10. Rare plants found in association with pebble plains. Assessments of trend, knowledge of distribution, and vulnerability were made by forest botanists/biologists and generally refer to occurrences on national forest system lands (decl. = declining; unkn. = unknown).

Scientific Name (common name) *listing status*	Acres of Known Habitat				Trends	Vulner-ability on NFS lands	Overall Distribution (Knowledge of distribution on NFS lands)
	CNF	SBNF	ANF	LPNF			
Arabis parishii (Parish's rock cress) *FS sensitive*		y			unkn.	mod.	NE San Bernardino Mtns.; (high)
Arenaria ursina (Big Bear Valley sandwort) *federally threatened*		780			decl.	high	NE San Bernardino Mtns.; (high)
Castilleja cinerea (Ash-gray Indian paintbrush) *federally threatened*		1,122			decl.	high	NE San Bernardino Mtns.; (high)
Eriogonum kennedyi var. *austromontanum* (S. mountain buckwheat) *federally threatened*		910			decl.	high	NE San Bernardino Mtns.; (moderate)
Ivesia argyrocoma (silver-haired ivesia) *FS sensitive*		1,158			decl.	mod.–high	NE San Bernardino Mtns. & Baja; (high)
Linanthus killipii (Baldwin Lake linanthus) *FS sensitive*		316+			decl./stable	mod.	NE San Bernardino Mtns.; (moderate)

to determine whether further recovery actions are needed. Finally, some occurrences are located on private lands where they may be unprotected.

Castilleja cinerea (ash-gray Indian paintbrush)

Castilleja cinerea is a federally listed threatened species known to occur on clay soils, pebble plains, in dry meadows, and in openings within conifer forest, pinyon-juniper woodlands, and Mojavean desert scrub. The plant is a green-root parasite on *Eriogonum kennedyi* var. *austromontanum, Artemisia tridentata,* and other *Artemisias.* Occurrences range between Snow Valley and Fish Camp, east to Onyx Peak, and from South Fork Meadows in the south to Holcomb Valley in the north (fig. 5.11). Locally common within this area, occurrences are located on both public and private lands. At least thirty-three occurrences are recorded in the CNDDB (1997). Some are protected on the San Bernardino National Forest by fencing and by their presence within the San Gorgonio Wilderness Area. Other occurrences on the forest may be adversely affected by erosion control practices, a ski and mountain bike area, a hiking trailhead, and recreational residences. These effects are being reviewed and actions to enhance the habitat will be initiated in 1999 (D. Volgarino, San Bernardino NF, pers. comm.).

Eriogonum kennedyi var. *austromontanum* (southern mountain buckwheat)

Eriogonum kennedyi var. *austromontanum* is a federally threatened taxon known from Big Bear and Holcomb valleys in the San Bernardino Mountains (fig. 5.11). The CNDDB contains records for at least twenty-two occurrences in this area. On the San Bernardino

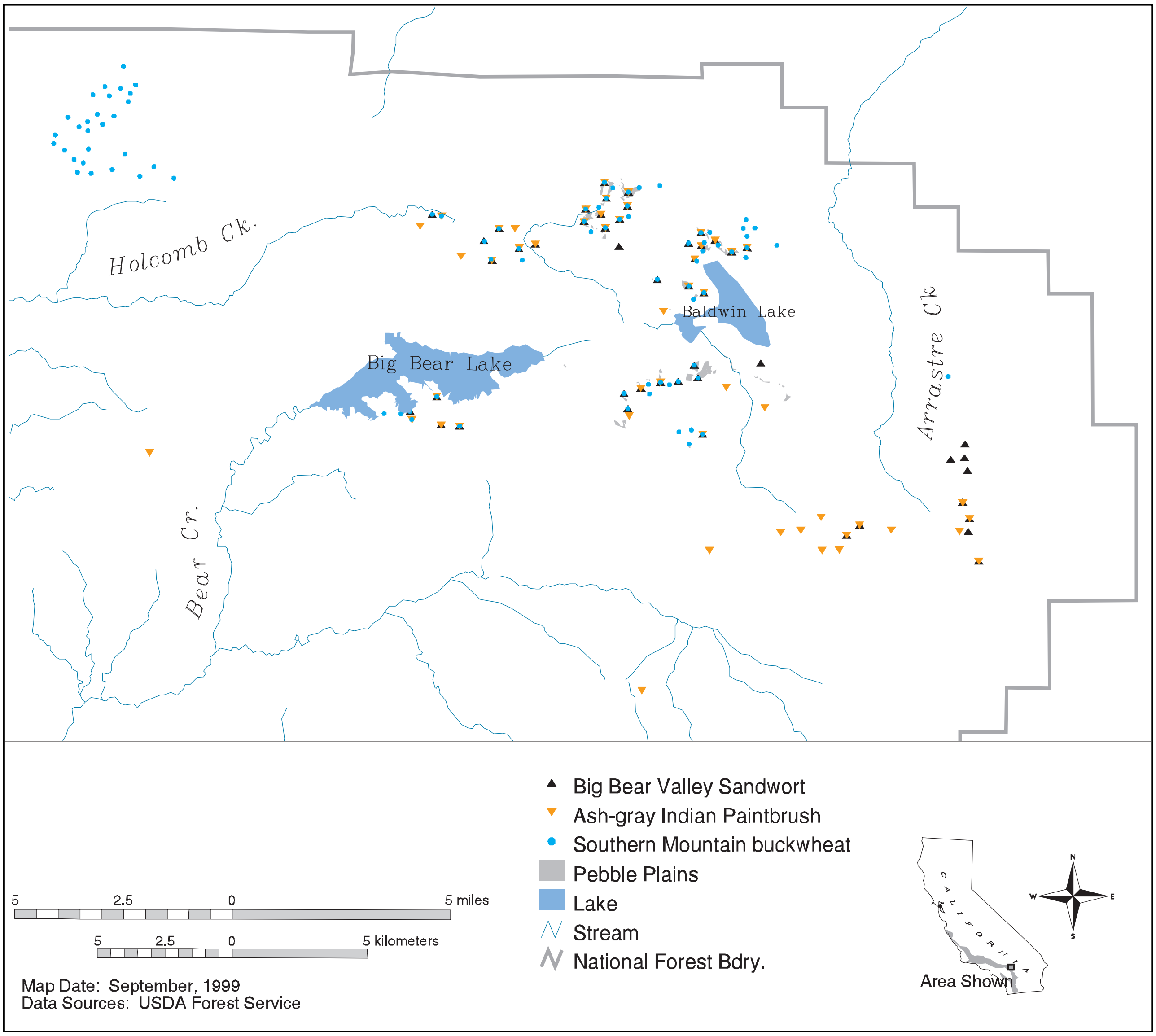


Figure 5.11. Documented locations of *Arenaria ursina* (Big Bear Valley sandwort), *Castilleja cinerea* (ash-gray Indian paintbrush), and *Eriogonum kennedyi* var. *austromontanum* (southern mountain buckwheat).

National Forest, the variety is one of the two most restricted pebble plain taxa and one that is strongly affected by activities on the forest. A few occurrences are protected by fencing, but roads bisect most of them and unauthorized off-road driving is degrading the habitat and adversely affecting individual plants. Patrols have been initiated to protect habitat, additional fencing is planned for 1999, and occurrences are being surveyed to determine additional requirements for recovery. This taxon serves as the host plant for the hemiparasitic *Castilleja cinerea* and one of the newly described San Bernardino blue butterflies (two of our focal species).

Ivesia argyrocoma (silver-haired ivesia)

Ivesia argyrocoma is a Forest Service Sensitive Species known from Big Bear and Holcomb valleys in the San Bernardino Mountains, where it appears to be declining from habitat loss. A disjunct occurrence, which may be taxonomically distinct, is located near Laguna Hansen, Sierra Jaurez, in Baja California, Mexico. The species occurs in pebble plains and alkaline meadows. The CNDDB contains records for at least twenty-four occurrences on both public and private lands. One occurrence is protected within a CDFG reserve north of Baldwin Lake. On the San Bernardino National Forest some occurrences on pebble plains are protected by fencing and several more will be fenced in 1999. One historic occurrence on the forest is recorded for the Rouse Meadows area. The species is noted as an early pioneer in disturbed pebble plain habitat; plants have recently been observed recolonizing water bars and old road beds within pebble plain habitat.

Linanthus killipii (Baldwin Lake linanthus)

Linanthus killipii is a Forest Service Sensitive Species found in pebble plains, alkaline meadows, and on dry slopes within pinyon-juniper woodlands, Joshua tree woodlands, and upper montane conifer forests. The CNDDB documents at least fifteen occurrences, the highest density of plants being found around Baldwin Lake. An additional 100 acres of occupied habitat were mapped in 1998, an El Nino wet year. These occurrences are located on granitic and clay soils east of Baldwin Lake on the San Bernardino National Forest. At several locations, large areas were completely covered with this species. Previously it appeared to be declining from habitat degradation, mainly from dispersed camping and unauthorized vehicle activity, and several occurrences are fenced for protection.

Montane Meadow Plants

Plants Associated with Wet and Dry Meadows

Twelve rare plants are associated with both wet and dry meadow habitats within the assessment area. Summary information is shown in table 5.11. One federally endangered species is included in this group.

Calochortus palmeri var. *munzii* (Munz's mariposa lily)

Calochortus palmeri var. *munzii* is a Forest Service Sensitive taxon known from seven occurrences in the San Jacinto Mountains of Riverside County. At least four of those occurrences are located on the San Bernardino National Forest. The perennial grows in meadows, seeps, and vernally moist places within chaparral and conifer forest. Occurrences are vulnerable to overgrazing, trampling, fire suppression activities, road maintenance, development projects, and invasion of exotic species.

Calochortus palmeri var. *palmeri* (Palmer's mariposa lily)

Calochortus palmeri var. *palmeri* is a Forest Service Sensitive Species. It is sparsely distributed across four national forests (Angeles, San Bernardino, Los Padres, and Sequoia) and on BLM and private lands. At least twenty-two occurrences are known. Within the assessment area, the taxon occurs in the San Bernardino, Santa Rosa, San Jacinto, San Gabriel, and San Rafael mountains, the Sespe Creek area, and the La Panza Range. Plants in the San Jacinto and Santa Rosa mountains, however, may prove to be *C. palmeri* var. *munzii* (another focal species). Occurrences are also known in the Piute Mountains and at Breckenridge Mountain in Kern County. Historic occurrences are known from the Tehachapi Mountains. The plant appears to be declining in abundance due to overgrazing, trampling, flooding, erosion, off-highway vehicles, and development projects. Most of the impact from grazing occurs between April and August when the plant is flowering and setting seed. Two occurrences are located in protected areas—one on the San Bernardino National Forest near Big Bear Lake, where it occurs within a fenced meadow area, and the other in an area free of human disturbance on the Los Padres National Forest. In addition to meadows, the plant occurs in seeps and vernally moist areas within chaparral, mixed conifer forest, and yellow pine forest.

Calochortus striatus (alkali mariposa lily)

Calochortus striatus is a Forest Service Sensitive Species. It grows in alkaline soils in meadows, seeps, springs, and other mesic places within chaparral, creosote-bush scrub, chenopod scrub (saltbush/carex scrub), and riparian forest habitats between 2,600 and

Table 5.11. Rare plants found in wet and dry montane meadows. y = the taxon occurs on the forest; p = has potential to occur. Assessments of trend, knowledge of distribution, and vulnerability were made by forest botanists/biologists and generally refer to occurrences on national forest system lands (decl. = declining; unkn. = unknown; incr. = increasing).

Scientific Name (common name) *listing status*	Acres of Known Habitat				Trends	Vulner-ability on NFS lands	Overall Distribution (Knowledge of distribution on NFS lands)
	CNF	**SBNF**	**ANF**	**LPNF**			
Calochortus palmeri var. *munzii* (Munz's mariposa lily) *FS sensitive*		y			unkn.	mod.–high	San Jacinto Mtns.; (low)
Calochortus palmeri var. *palmeri* (Palmer's mariposa lily) *FS sensitive*		y	y	1	unkn./ decl.[1]	mod.–high	San Bernardino, Santa Rosa, San Jacinto, San Gabriel, & San Rafael mtns., La Panza Range, Piute Mtns. & Breckenridge Mtn (Kern Co.), h in Tehachapi Mtns.; (low)
Calochortus striatus (alkali mariposa lily) *FS sensitive*		p	p		unkn.		desert-side of San Bernardino Mtns., W Mojave Desert, NV; (low)
Castilleja lasiorhyncha (San Bernardino Mtns. owl's-clover) *FS sensitive*	h/p	103			stable	mod.–high	San Bernardino Mtns., h in San Cuyamaca mtns.; (low)
Downingia concolor var. *brevior* (Cuyamaca Lk. downingia) *state endangered*	p				incr.[2]		Peninsular Ranges of SD Co. (Cuyamaca Mtns.); (low)
Horkelia yadonii (Santa Lucia horkelia)				y			Santa Lucia Ranges & southern Los Padres region (Big Pine & Mission Pine mtns.)
Layia ziegleri (Ziegler's tidy-tips)		175			unkn.	low	San Jacinto (Garner Valley) & Santa Rosa mtns.; (high)
Machaeranthera asteroides var. *lagunensis* (Laguna Mtns. aster) *FS sensitive*	261				stable	mod.	Peninsular Ranges of San Diego Co. (Laguna Mtns.), Baja (Rancho Las Filipinas & Sierra San Pedro Martir); (moderate)
Mimulus exiguus (San Bernardino Mtns. Monkeyflower) *FS sensitive*		y			decl.	mod.	San Bernardino Mtns., N Baja (Sierra Juarez); (moderate)
Mimulus purpureus (purple monkeyflower) *FS sensitive*		y			decl.	mod.	San Bernardino Mtns., Baja (Sierra San Pedro Martir); (high)
Thelypodium stenopetalum (slndr.-petaled thelypodium) *federally endangered*		42			stable	high	San Bernardino Mtns.; (high)
Thermopsis californica var. *semota* (velvety false lupine) *FS sensitive*	216				stable	low	Palomar, Laguna, & Cuyamaca mtns., Baja; (moderate)

[1] Skinner and Pavlik 1994 (refers to all known occurrences)
[2] Reiser 1994 (refers to all known occurrences)

4,600 feet. Occurrences are known from the northern slopes of the San Bernardino Mountains (Krantz, Thorne, and Sanders 1995). These occurrences are vulnerable to overgrazing, invasion of exotic species, altered hydrology (water extraction and pond development), road construction, and urbanization. Development of a mining plant in these mountains reduced habitat on private lands, and construction of Highway 18 reduced habitat on the San Bernardino National Forest. One new occurrence was found in 1998 on national forest system land along the proposed Cleghorn off-highway vehicle route. Occurrences are also reported for the desert side of the San Gabriel Mountains (Hickman 1993), although none are documented in the CNDDB. The CNDDB lists thirty-eight occurrences and nine general locations in all for this species, including the Kern River Preserve in Kern County and Edward's Air Force Base in Los Angeles County.

Castilleja lasiorhyncha **(San Bernardino Mountains owl's-clover)**

Castilleja lasiorhyncha is a Forest Service Sensitive Species. It is a hemiparasitic plant known from at least thirty-six occurrences, primarily in the San Bernardino Mountains. The host of this plant is unknown. Two historic locations are recorded—in the San Jacinto Mountains and in Cuyamaca Rancho State Park in San Diego County. This annual plant typically grows at the edges of meadows and along vernal streams in chaparral and montane conifer forests, sometimes only in the drying edges of the wet areas. Occurrences appear stable, but the species is dependent on annual rainfall so fluctuations are normal. Habitat for this plant is affected by ground disturbance that affects the hydrologic regime. The habitat is especially fragile when soils are wet in spring and early summer but less so when soils are dry in late summer and early fall. Some occurrences are located in a cattle grazing allotment on the San Bernardino National Forest. Other occurrences on the forest are protected by fences. The species is vulnerable to trampling, unauthorized off-road vehicles, development projects, road maintenance, erosion, and flooding.

Downingia concolor* var. *brevior **(Cuyamaca Lake downingia)**

Downingia concolor var. *brevior* is state listed as endangered. It is known from seven occurrences in the Cuyamaca Lake area of San Diego County. The annual is found in meadow habitat now on the periphery of Cuyamaca Lake, a man-made reservoir. Described as a montane variation of coastal vernal pools, the habitat has very moist soils in spring that dry out by late summer (Reiser 1994). The plant was in decline mainly due to overgrazing; however, after cattle were removed from meadows north of the lake, an estimated several thousand plants flowered in 1988 (a drought year). In 1991 the same area was submerged under water that collected from spring rainfall. Subsequent populations could be impacted if lake waters are allowed to remain high for consecutive years (Reiser 1994).

The plant is included in a conservation agreement between the U.S. Fish and Wildlife Service, California Department of Fish and Game, state parks, the U.S. Forest Service, the Lake Cuyamaca Recreation and Park District, and the Helix Water District (Helix Water District et al. 1996). An estimated 80 percent of the known remaining populations are found on land owned or managed by the Helix Water District and the Lake Cuyamaca Recreation and Park District. All known populations combined occupy less than two hundred acres; however, populations fluctuate based on annual rainfall, winter flooding, and temperatures.

Horkelia yadonii **(Santa Lucia horkelia)**

Horkelia yadonii is known from several locations in the northern and southern Santa Lucia Ranges, and in the vicinity of Big Pine and Mission Pine mountains in the southern Los Padres region (D. Wilken, Santa Barbara Botanic Garden, in litt. 1998). Its presence on the Los Padres National Forest is documented from herbarium specimens at Santa Barbara Botanic Garden.

Layia ziegleri (Ziegler's tidy-tips)

Layia ziegleri is an annual plant known from approximately fourteen occurrences in the Garner Valley area of the San Jacinto Mountains. The *CNPS Inventory* and the *Jepson Manual* treat it as a synonym of *L. platyglossa,* a common and highly variable species, and a study comparing the two taxa was inconclusive (Baldwin 1993). *L. ziegleri* may prove to be a subspecies but further research is needed. The plant is managed under the provisions of the National Forest Management Act. It occurs within active grazing allotments and also on private lands, some of which the Forest Service is attempting to purchase. Potential threats at these sites include overgrazing and unauthorized off-road vehicle use, particularly during wet months.

Machaeranthera asteroides var. *lagunensis* (Laguna Mountains aster)

Machaeranthera asteroides var. *lagunensis* is a Forest Service Sensitive Species. A perennial plant, it is known primarily from the Laguna Mountains of San Diego County, where it occurs adjacent to meadows with black oak and Jeffrey pine. Its distribution extends southward into Baja California where the plant grows in "chaparral and associated desert regions" and on "sandy or gravelly soils" (Turner 1987). The plant has been collected at Rancho Las Filipinas and in the Sierra San Pedro Martir. Five occurrences consisting of an estimated nine thousand to ten thousand plants are documented on national forest system and private lands in the Wooded Hill/Laguna Meadow area of Laguna Mountain. These occurrences occupy approximately 5 1/2 square miles, centered near the junction of Sunrise Highway and Morris Ranch Road.

A species management guide including management actions and guidelines was adopted by the Cleveland National Forest in 1992 because of the plant's limited population size and threats occurring at that time to portions of its habitat (Winter and Volgarino 1992). Management activities on national forest system lands within the range of this species include both dispersed and developed recreation, timber stand improvement and regeneration, grazing, and road maintenance. Based on field observations between 1980 and 1996, the taxon appears stable throughout its range (K. Winter, Cleveland NF, pers. comm.). Livestock grazing is continuing in at least a portion of its known habitat and the long-term effects are unclear. Monitoring to determine the effects of grazing was proposed for the Wooded Hill area and a grazing exclosure was placed at the site but so far results have been inconclusive. Grazing during fall months appears to be the most detrimental to regeneration of this taxon. Observations in other areas indicate the plant is somewhat disturbance oriented; it appears in the openings created by road and utility line maintenance and the clearing of pines and diseased trees. It also appears to respond favorably to broadcast burning, although changes in plant density after fire have not been fully determined. The use of salt on the Sunrise Highway puts this taxon and other native plants at risk from salt accumulation in the soil. Unauthorized vehicle use has occurred in habitat known to harbor this taxon and one small area along Morris Ranch Road was fenced in 1986 to prevent disturbance from recreation activities. A botanical report was completed for *M. lagunensis* populations on the Descanso Ranger District, Cleveland National Forest (Sproul and Beachamp 1979).

Mimulus exiguus (San Bernardino Mountains monkeyflower)

Mimulus exiguus is a Forest Service Sensitive Species. A tiny annual plant, it is known from approximately thirteen occurrences in Big Bear and Holcomb valleys in the San Bernardino Mountains. Eight of the occurrences are located on the San Bernardino National Forest. One occurrence is reported from northern Baja California (Sierra de Juarez) but needs confirmation. The plant grows primarily in mesic places within yellow pine forests (i.e., meadows, vernal seeps, and springs) but sometimes occurs on pebble plains (Neel and Barrows 1990). Some occurrences on the San Bernardino National Forest are protected by fencing, but occurrences in unprotected areas appear to be declining. Little is known about the ecological requirements of this species; however, observations indicate that it may tolerate limited disturbance (Neel and Barrows 1990). Natural disturbances brought on by streamflows and frost heave may be an important component of the habitat for this species. Occurrences are vulnerable to trampling, unauthorized off-road vehicle activity, development projects, and mining.

***Mimulus purpureus* (purple monkeyflower)**

Mimulus purpureus is a Forest Service Sensitive Species. It is known from eleven occurrences in the Big Bear and Holcomb valleys of the San Bernardino Mountains. There is also one known location in the Sierra San Pedro Martir of Baja California, Mexico. In addition to meadows, the species occurs in moist, sandy openings in yellow pine forest and pinyon-juniper woodland, and on the edges of pebble plains. The ecological requirements of this species are poorly understood but it appears to tolerate some disturbance and consistently occupies open areas of forest habitat that have low accumulations of leaf litter (Neel and Barrows 1990). One occurrence in Belleville Meadow of Holcomb Valley is protected by fencing. In some areas, this species appears to be declining due to habitat degradation from development projects, unauthorized off-road vehicles, overgrazing, trampling, mining activities, and parking that occurs along roadways and turnouts.

***Thelypodium stenopetalum* (slender-petaled thelypodium)**

Thelypodium stenopetalum is a federally and state-listed endangered species endemic to the San Bernardino Mountains. Occurrences are found in wet meadows and swales in Big Bear and Holcomb valleys, and near the shore of Baldwin Lake (fig. 5.12). Habitat for the species has been reduced by an estimated 85 percent following construction of the Big Bear Lake reservoir and subsequent lakeshore development (USFWS 1984). Six extant occurrences are known, one on the San Bernardino National Forest at Belleville Meadow in Holcomb Valley. This occurrence has been monitored for the last nine years and appears to be increasing in size, covering an estimated twelve acres in 1998. Prospecting, digging, dry washing, and an unauthorized trail through the meadow are factors affecting plants at this site; however, additional signing has been installed and patrols have been increased to protect the area. A recovery plan was completed for this species by the U.S. Fish and Wildlife Service (USFWS 1998b). A population on the north side of Baldwin Lake is protected by the California Department of Fish and Game. This species is a larval food plant for another focal species, the Andrew's marble butterfly *(Euchloe hyantis andrewsi)*, and monitoring of their relationship has occurred at Baldwin Lake (Krantz 1990).

***Thermopsis californica* var. *semota* (velvety false lupine)**

Thermopsis californica var. *semota* is a Forest Service Sensitive Species. It is known from the Palomar and Laguna mountains and Baja California, Mexico. About fifty occurrences are known, some relatively well protected on state and federal lands. Occurrences are recorded primarily in meadows within montane conifer forests and other areas with vernally moist soils (e.g., at Cuyamaca Lake and Laguna Meadow). The taxon has been found in lesser abundance in grasslands and sandy scrub habitats. Livestock reportedly find the perennial unpalatable and it appears tolerant of mild disturbances.

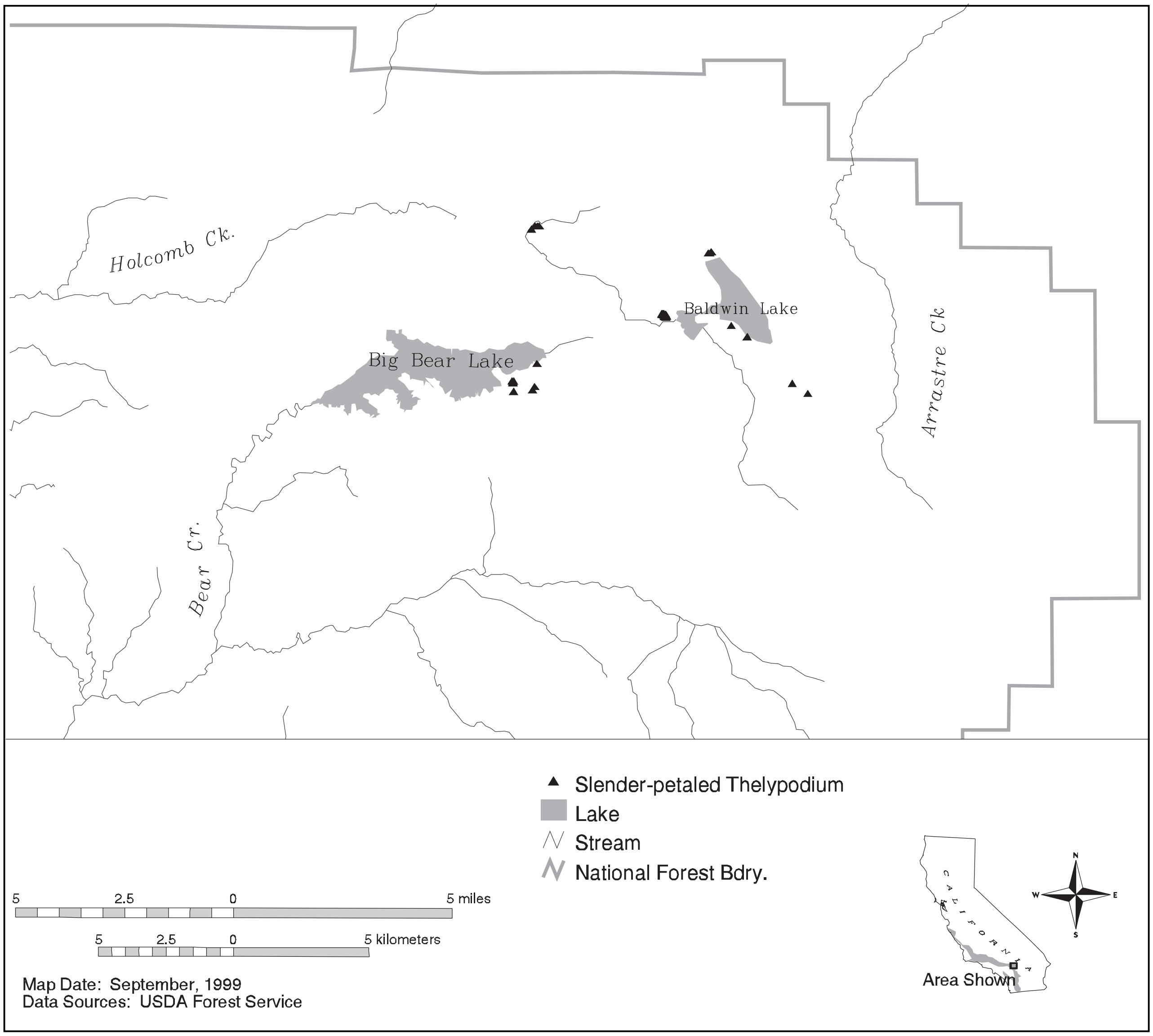


Figure 5.12. Documented locations of *Thelypodium stenopetalum* (slender-petaled thelypodium).

Plants of Wet Meadows

Fifteen rare plants are associated with wet meadows and other vernally moist habitats within the assessment area. Summary information is shown in table 5.12. Four federally endangered species are included in this group.

Arenaria paludicola (marsh sandwort)

Arenaria paludicola is a federally and state-listed endangered species. The perennial is thought to be nearly extinct, known from just one extant occurrence on private land in the Nipomo Mesa area of San Luis Obispo County. This occurrence consisted of ten plants in 1988, three plants in 1992 (USFWS 1993c), and fewer than twenty plants in 1993. Appropriate habitat occurs in marshes, swamps, and possibly wet meadows, where the species grows up through dense cover of other mesic plants such as cattails, rushes, and sedges. Historically it was known from scattered collections in low-elevation habitat from San Bernardino County north to Washington. One historic occurrence is reported from private land adjacent to the San Bernardino National Forest; however, there are no confirmed occurrences on any of the four southern California forests. The species is threatened by loss of its wetland habitat, alteration of the hydrology, urban development, competition with alien plant species, and stochastic (random)

Table 5.12. Rare plants found in wet montane meadows. y = the taxon occurs on the forest; p = has potential to occur. Assessments of trend, knowledge of distribution, and vulnerability were made by forest botanists/biologists and generally refer to occurrences on national forest system lands (decl. = declining; unkn. = unknown; incr. = increasing).

Scientific Name (common name) *listing status*	Acres of Known Habitat: CNF	SBNF	ANF	LPNF	Trends	Vulner-ability on NFS lands	Overall Distribution (Knowledge of distribution on NFS lands)
Arenaria paludicola (marsh sandwort) *federally endangered*		p			decl.		h in San Bernardino Mtns. & north to WA, extant in SLO Co.
Botrychium crenulatum (scalloped moonwort) *FS sensitive*		y	p		unkn.	unkn.	CA (San Bernardino & LA cos.), OR, ID, Montana, and UT; (low)
Delphinium hesperium ssp. *cuyamacae* (Cuyamaca larkspur) *FS sensitive*	43	y			stable	mod.	Peninsular Ranges of SD Co. (Laguna & Cuyamaca mtns.) & San Jacinto Mtns.; (low)
Grindelia hirsutula var. *hallii* (San Diego gumplant) *FS sensitive*	61				stable	low	Peninsular Ranges of SD Co. (Laguna & Cuyamaca mtns.); (moderate)
Helianthus nuttallii ssp. *parishii* (Los Angeles sunflower)		h/p			extinct?		possibly extinct, h in San Bernardino, LA, & Orange cos.; (low)
Juncus duranii (Duran's rush)		y			unkn.		San Gabriel, San Bernardino, & San Jacinto mtns.; (unkn.)
Lewisia brachycalyx (short-sepaled lewisia)	p	y					San Bernardino Mtns., Peninsular Ranges of SD Co., Baja, UT, AZ, NM; (moderate)
Lilium parryi (lemon lily) *FS sensitive*	11	429	12		unkn./ decl.[2]	mod.[4]/ high[5]	San Gabriel, San Bernardino, San Jacinto, Volcan, & Palomar mtns., AZ (Santa Rita & Huachaca mtns.), Sonora, Mexico; (high)
Limnanthes gracilis ssp. *parishii* (Parish's meadowfoam) *state endang./FS sensitive*	159				decl./ stable	mod.	Palomar & Laguna mtns. (Peninsular Ranges of SD Co.), Santa Rosa Plateau (sw Riverside Co.); (high)
Malaxis monophyllos ssp. *brachypoda* (adder's-mouth) *FS sensitive*		1	p		unkn.	mod.	San Bernardino Mtns. & CO (Rocky Mtns.), h in San Jacinto Mtns.; (low)
Navarretia peninsularis (Baja navarretia) *FS sensitive*	p	y	y?	p	stable[1]	high	from Tehachapi Mtns. S to Baja (SD, San Bern., Sta. Barbara, & Kern cos.) San Bern. Mtns., Peninsular Ranges of SD Co (Cuyamaca Mtns.); (low)
Perideridia parishii ssp. *parishii* (Parish's yampah)		29			decl.	low	San Bernardino Mtns., AZ, NM, & NV; (moderate)
Poa atropurpurea (San Bernardino blue grass) *federally endangered*	y	63			stable/ decl.[3]	mod.[5]/ high[4]	San Bernardino Mtns., Palomar & Laguna mtns. (Peninsular Ranges of SD Co.; (high)
Sidalcea pedata (bird-footed checkerbloom) *federally endangered*		1			incr./ decl.[6]	mod.	San Bernardino Mtns.; (high)
Taraxacum californicum (California dandelion) *federally endangered*		51			decl.	high	NE San Bernardino Mtns.; (moderate)

[1] Reiser 1994 (refers to all known occurrences)
[2] unknown in general, however declining significantly at Big Cienega Springs in the San Gabriel Mountains
[3] stable in southern part of range, possibly declining in northern part of range
[4] on the San Bernardino National Forest
[5] on the Cleveland National Forest
[6] increasing on the San Bernardino National Forest, declining on private lands

extinction by virtue of the limited number of individuals that remain (USFWS 1993c).

Botrychium crenulatum (scalloped moonwort)

Botrychium crenulatum is a Forest Service Sensitive Species found at a number of scattered locations throughout California and also in Oregon, Montana, Idaho, and Utah. The CNDDB lists eight occurrences in California. In the assessment area, occurrences are known from San Bernardino and Los Angeles counties. Plants are documented on the San Bernardino National Forest and suitable habitat exists on the Angeles National Forest. The species is uncommon despite occupying a wide range of habitats including in grassy fields, meadows and other mesic places, along streams or in shaded areas of montane coniferous forest, and on slopes among shrubs. The factors which limit its abundance and distribution are largely unknown; however, all species of *Botrychium* are known to have mycorrhizal requirements. In addition, plants are highly variable and difficult to identify because species of *Botrychium* may occur in mixed populations. *B. crenulatum* is vulnerable to trampling, overgrazing, timber harvesting, and changes in hydrologic regimes.

Delphinium hesperium ssp. *cuyamacae* (Cuyamaca larkspur)

Delphinium hesperium ssp. *cuyamacae* is a Forest Service Sensitive Species. Approximately fifty large populations occur within the Laguna and Cuyamaca mountains of San Diego County. Historic occurrences, as well as one more recent occurrence, are known from the San Jacinto Mountains of Riverside County. The recent occurrence was noted during an ecological survey for the Cahuilla Mountain RNA (Keeler-Wolf 1986b). This occurrence is located near an area that burned in the 1996 Diego Fire and its current status is unknown. Most of the occurrences in San Diego County are managed under a conservation agreement between the U.S. Fish and Wildlife Service, California Department of Fish and Game, state parks, the U.S. Forest Service, the Lake Cuyamaca Recreation and Park District, and the Helix Water District (Helix Water District et al. 1996). However, this agreement formally expired in August 1999. In addition to meadow habitat, the perennial grows in open shrub lands and appears to be associated with gabbro-derived soils.

Grindelia hirsutula var. *hallii* (San Diego gumplant)

Grindelia hirsutula var. *hallii* is a Forest Service Sensitive Species. It is known from occurrences in wet meadow and vernal spring habitat in the Laguna and Cuyamaca mountains of San Diego County. Plants grow on sandy or clay soils in mesic places within chaparral, valley-foothill grassland, and open pine/oak woodland (Skinner and Pavlik 1994). Occurrences are known on the Cleveland National Forest, at Cuyamaca Rancho State Park, and on private lands. They are found with coast live oak on Guatay Mountain, and with Jeffrey pine and black oak in the Lagunas (CNDDB 1996). Changes to the surface hydrology of meadow habitat is a potential threat due to road projects and off-highway vehicles. The species appears to be tolerant of some ground disturbance (e.g., fire and low levels of grazing and grading).

Helianthus nuttallii ssp. *parishii* (Los Angeles sunflower)

Helianthus nuttallii ssp. *parishii* is a perennial taxon presumed to be extinct. The CNDDB contains historical records for seven occurrences in Los Angeles, Orange, and San Bernardino counties. Plants were known to occupy freshwater and coastal salt marshes, wet meadows, and other continuously wet places, from sea level to 5,500 feet (Niehaus 1977). One historic occurrence is known from marshy, riparian habitat near Seven Oaks along the Santa Ana River on the San Bernardino National Forest. Despite the lack of recently known occurrences, the San Bernardino and Angeles national forests maintain this plant on their watch lists.

Juncus duranii (Duran's rush)

Juncus duranii is an uncommon perennial rush known from the Big Bear Valley and San Gorgonio Wilderness Area in the San Bernardino Mountains. Other occurrences are found in the San Gabriel and San Jacinto mountains. There are no records for this species in the CNDDB and little is known about its distribution. Occurrences on the San Bernardino National Forest are found in wet meadows within the montane conifer and subalpine zones.

Lewisia brachycalyx (short-sepaled lewisia)

Lewisia brachycalyx occurs in the San Bernardino Mountains, the San Diego ranges, Baja California, Utah, Arizona, and New Mexico. Occurrences are found in wet meadows within montane coniferous forests. On the San Bernardino National Forest, the species occurs in Big Bear and Holcomb valleys and the Snow Valley area and may be affected by high levels of recreation use. Potential habitat exists on the Cleveland National Forest.

Lilium parryi (lemon lily)

Lilium parryi is a Forest Service Sensitive Species. It is distributed in the San Gabriel, San Bernardino, San Jacinto, Volcan, and Palomar mountains. It occurs in lesser abundance within the Santa Rita and Huachaca mountains of Arizona and in adjacent ranges in Sonora, Mexico. Occurrences are recorded on the Cleveland, San Bernardino, and Angeles national forests and at Palomar Mountain State Park. The CNDDB lists fifty-five occurrences in all, and generally those at higher elevations are larger (some greater than one thousand plants) than those at lower elevations.

Some occurrences are located within the San Gorgonio Wilderness Area. One location at Big Cienega Springs in the San Gabriel Mountains has shown substantial decline since 1990 when 350 individual plants were counted. In 1995 only 11 individuals were seen. The plant has very showy and fragrant flowers that make it vulnerable to collection. The Angeles National Forest has developed a species management guide for this plant (Mistretta and Parra-Szijj 1991a) and the Cleveland National Forest includes it in their habitat management guide for riparian montane meadows (Winter 1991b).

Limnanthes gracilis ssp. *parishii*

Limnanthes gracilis ssp. *parishii* is a Forest Service Sensitive Species and is state listed as endangered. An annual plant, it is endemic to the Palomar and Laguna mountains of San Diego County. About fifteen populations are recorded, the largest occurring in Cuyamaca Valley near Cuyamaca Lake and Little Stonewall Creek. At least five smaller populations are mapped on adjacent land within the Cleveland National Forest. Another population, covering about five acres, is located in vernal pools on the Santa Rosa Plateau in southwestern Riverside County.

An estimated 70 percent of the known occurrences are found on land owned or managed by the Helix Water District, Lake Cuyamaca Recreation and Park District, California Department of Fish and Game, and the U.S. Forest Service. These parties entered into a habitat conservation agreement to protect the species (Helix Water District et al. 1996); however, the agreement formally expired in August 1999. The Cleveland National Forest has written a habitat management guide for riparian montane meadows that includes this taxon (Winter 1991b).

Malaxis monophyllos ssp. *brachypoda* (adder's-mouth)

Malaxis monophyllos ssp. *brachypoda* is a Forest Service Sensitive Species. It is extremely rare in California but more common in the Rocky Mountains. Two small occurrences are located in meadow habitat within the San Gorgonio Wilderness Area of the San Bernardino Mountains. The taxon was presumed to be extinct in California until twenty-six plants were discovered at this location in 1989. One historic occurrence was noted in the San Jacinto Wilderness Area (Tahquitz Valley) in

1922. The plant is generally thought to be declining in California; however, it can be difficult to find in the lush meadows where it would be expected to occur. The taxon is vulnerable to trampling.

Navarretia peninsularis (Baja navarretia)

Navarretia peninsularis is a Forest Service Sensitive Species. It is distributed from the Tehachapi Mountains south to Baja California, Mexico. The CNDDB documents six occurrences: in San Diego, San Bernardino, Santa Barbara and Kern counties. However, they are all from 1965 or earlier. Two of the historic locations, one on the north slope of Mount Pinos and one on Big Pine Mountain, occur within designated wilderness areas on the Los Padres National Forest. A more recent discovery was made at Holcomb Valley in the San Bernardino Mountains, though gold prospecting activities and vehicle traffic may be negatively affecting the site. Two other occurrences are located within Cuyamaca Rancho State Park in San Diego County. Plants at this location grow in mesic openings within chaparral (Reiser 1994). In other areas plants are found along vernal creeks, in meadows, and in snowmelt seeps within pinyon-juniper woodland and yellow pine forest.

Perideridia parishii ssp. *parishii* (Parish's yampah)

Occurrences of *Perideridia parishii* ssp. *parishii* are distributed in the San Bernardino Mountains of California, and also in Arizona, New Mexico, and Nevada. In the San Gabriel, San Jacinto, and Cuyamaca mountains the taxon is replaced by *P.p.* ssp. *latifolia* (Constance 1980). On the San Bernardino National Forest, occurrences are found on the Mountaintop Ranger District. This taxon grows in moist or wet meadows, usually around lakes or streams within upper montane conifer forests (Krantz 1990).

Poa atropurpurea (San Bernardino blue grass)

Poa atropurpurea is a federally endangered species found in the San Bernardino Mountains and in the Palomar and Laguna mountains of San Diego County (fig. 5.13). Between twelve and eighteen occurrences are known. This grass occupies the edges of wet meadows where there is less competition from more mesic species. However, the non-native *P. pratensis* can grow at the same locations and there is potential for genetic absorption to occur (USFWS 1995b).

Occurrences at the southern end of the species' range appear relatively stable. Four occurrences were located in Laguna Meadow in 1979. Two occurrences (each containing an estimated fifty plants) were found in 1993 and more plants were found in 1994. The species has also been located in Bear Valley southwest of the Lagunas, and at Mendenhall Valley in the Palomar Mountains (D. Volgarino, San Bernardino NF, unpubl. notes 1998). The majority of occurrences in San Diego County are protected on federal and state lands; however, grazing is still occurring at three locations. The species is included in a habitat management guide for riparian montane meadows (Winter 1991b).

At the northern end of its range, *P. atropurpurea* appears to be declining. At least 70 percent of the occupied habitat is privately owned with potential for development (USFWS 1995b). Two areas with confirmed occurrences (Wildhorse Meadow and Holcomb Valley) are located partly on the San Bernardino National Forest. In Holcomb Valley, some of these occurrences are affected by gold prospecting activities (i.e., digging and dry washing), mountain biking, and unauthorized vehicle use. Additional fencing, signing, and patrols have been implemented to increase protection in the area. Surveys in 1999 located more occurrences on national forest system land in Holcomb Valley. One occurrence at North Baldwin is managed by CDFG. For more detailed information on this species see the final listing rule (USFWS 1998k).

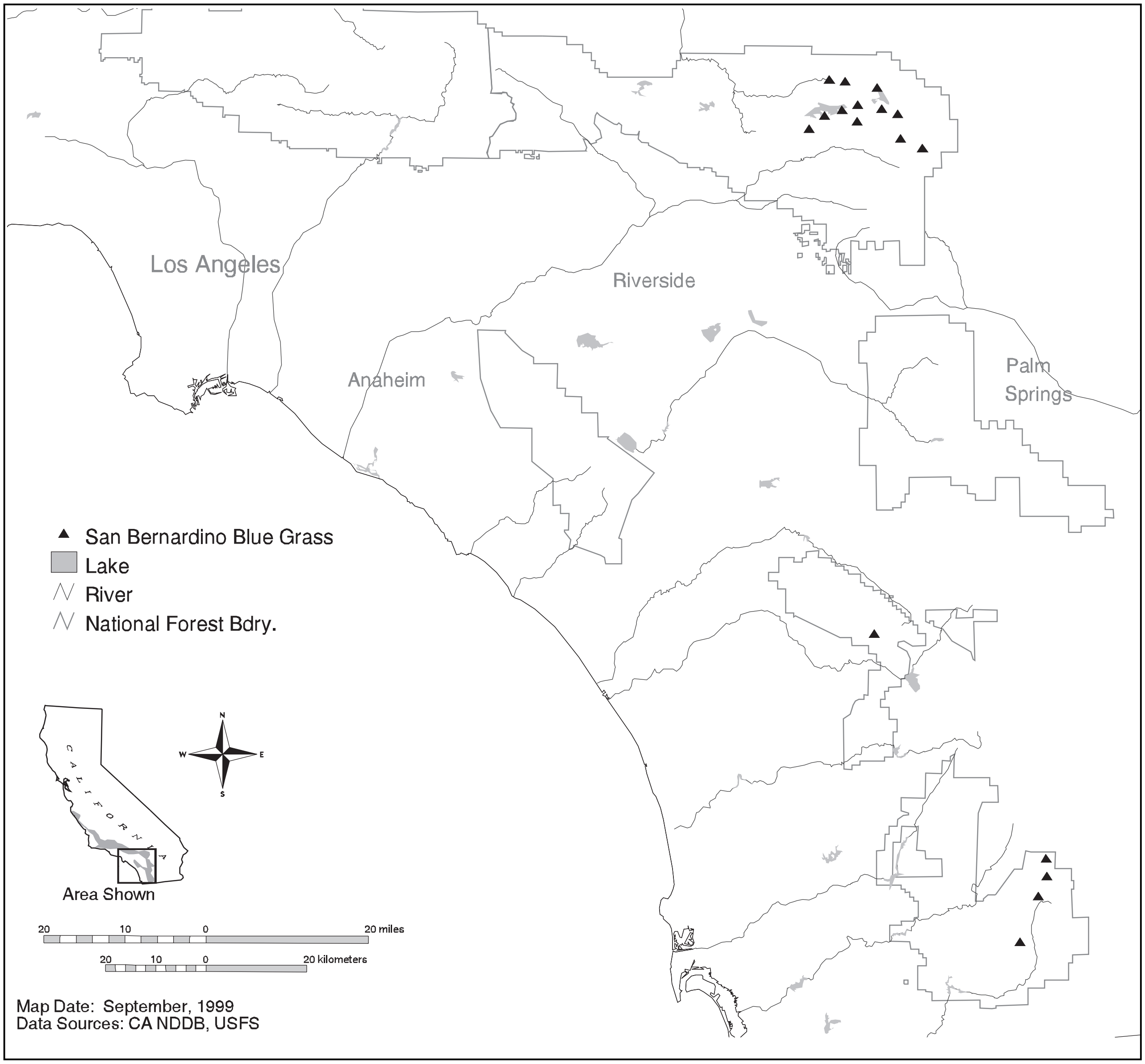


Figure 5.13. Documented locations of *Poa atropurpurea,* the San Bernardino blue grass.

Sidalcea pedata
(bird-footed checkerbloom)

Sidalcea pedata is a federally and state-listed endangered species endemic to montane wet meadows in the Big Bear Valley of the San Bernardino Mountains (fig. 5.14). The plant is known from seventeen locations totaling fewer than 20 acres of occupied habitat (USFWSb 1998). The north Baldwin Lake site, managed by CDFG, is the only occurrence currently receiving full protection. Five other sites receive partial protection and the remaining eleven occurrences are unprotected, degraded, or threatened. One occurrence is located on federal lands (San Bernardino National Forest) on the shore of Big Bear Lake. This occurrence is one acre in size and appears to be increasing. Measures to protect the site are being implemented with a completion date of summer 1999. A recovery plan for this species has been completed (USFWS 1998b). See also the final lisitng rule for more detailed information (USFWS 1984).

Taraxacum californicum
(California dandelion)

Taraxacum californicum is a federally endangered species endemic to the northeastern San Bernardino Mountains. Occurrences range from Big Bear and Holcomb valleys to South Fork Meadows in the Santa Ana River watershed (fig. 5.14). The CNDDB lists twenty-five extant occurrences. Plants occupy the edges of meadows, and occurrences are declining primarily from damage to this habitat type. Though some occurrences are found on private lands, most are located on the San Bernardino National Forest where high levels of recreation use are believed to be a cause of this species' decline. Trampling by humans or livestock favors the establishment of the non-native dandelion, *T. officinale* (USFWS 1995b). This species is invading montane meadow habitats and hybridizing with *T. californicum,* creating concern about the future integrity of the species. *T. californicum* is the only native dandelion in the state and is of considerable interest to plant taxonomists.

Plants of Dry Meadows

Two rare plants are restricted to dry meadow habitat within the assessment area. Summary information is shown in table 5.13. Both of these taxa are endemic to the northeastern San Bernardino Mountains.

Pyrrocoma uniflora var. *gossypina* (Bear Valley pyrrocoma)

Pyrrocoma uniflora var. *gossypina* is a Forest Service Sensitive Species. It is known from twelve occurrences in Big Bear and Holcomb

Figure 5.14. Documented locations of *Sidalcea pedata*, the bird-footed checkerbloom, and *Taraxacum californicum,* the California dandelion.

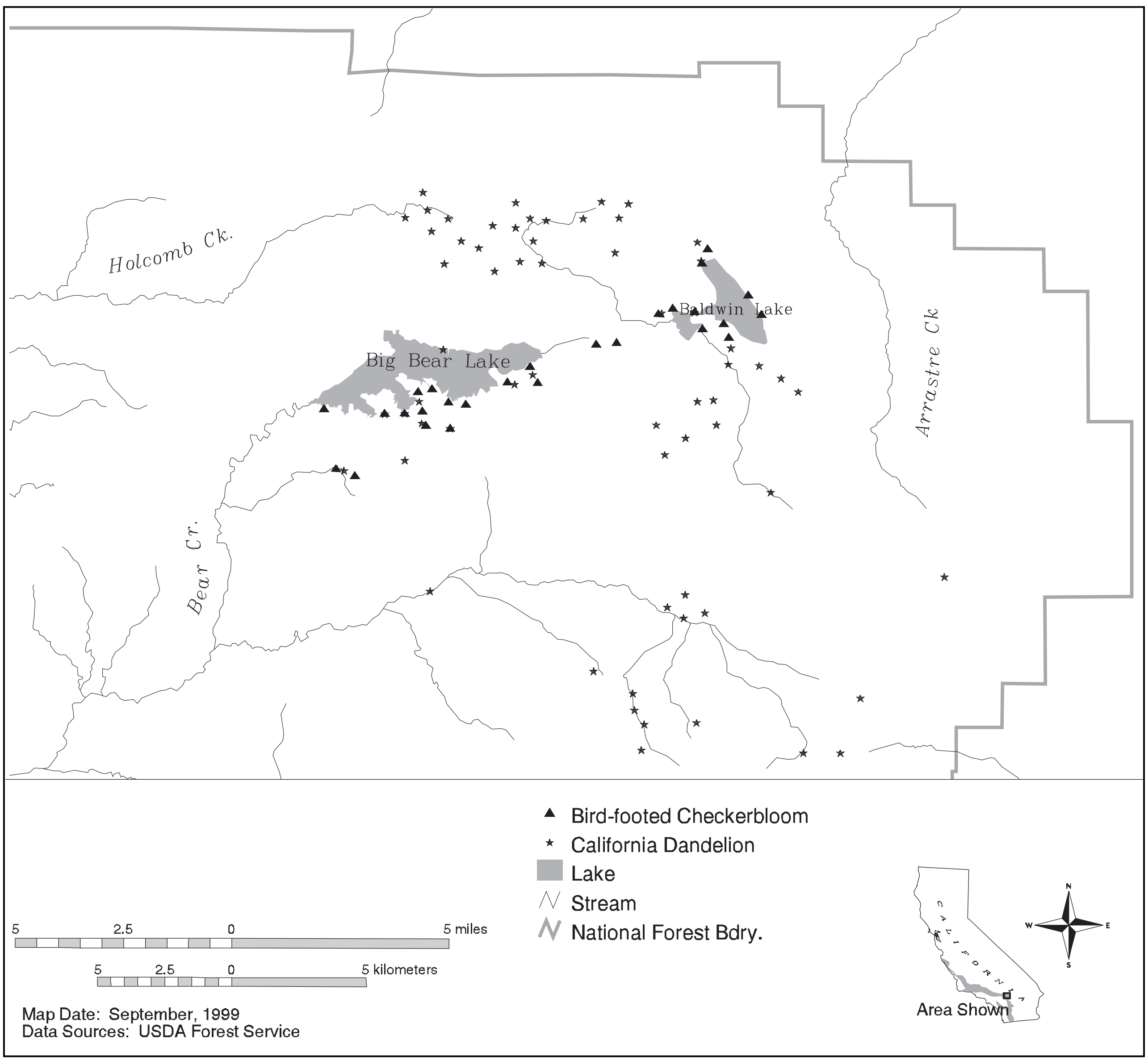


Table 5.13. Rare plants found in dry montane meadows. y = the taxon occurs on the forest; p = has potential to occur. Assessments of trend, knowledge of distribution, and vulnerability were made by forest botanists/biologists and generally refer to occurrences on national forest system lands (decl. = declining; unkn. = unknown; incr. = increasing).

Scientific Name (common name) *listing status*	Acres of Known Habitat				Trends	Vulner-ability on NFS lands	Overall Distribution (Knowledge of distribution on NFS lands)
	CNF	SBNF	ANF	LPNF			
Pyrrocoma uniflora var. *gossypina* (Bear Valley pyrrocoma) *FS sensitive*		27			decl.	high	San Bernardino Mtns.; (moderate)
Senecio bernardinus (San Bernardino ragwort) *FS sensitive*		188			unkn./ decl.[1]	high	San Bernardino Mtns.; (moderate)

[1] two occurrences are reportedly declining, trend for other occurrences is unknown

valleys within the San Bernardino Mountains. Occurrences are documented at Baldwin Lake, Arrastre Flat, and Metcalf Meadow, as well as other locations. The taxon is thought to be declining due to loss of habitat. Factors affecting this plant include grazing, alteration of meadow hydrology, trampling by vehicles and horses, soil compaction, high levels of recreation use, competition from exotic species, brush clearing, and development projects. Some occurrences on the San Bernardino National Forest are protected by fencing and one is located within a CDFG reserve. However, the majority of occurrences are located on private lands. A botanical investigation was completed for this taxon and included surveys of all meadow areas in Big Bear and Holcomb valleys, in the San Bernardino National Forest (Krantz 1979).

Senecio bernardinus (San Bernardino ragwort)

Senecio bernardinus is a Forest Service Sensitive Species. It is a perennial species known from about fifteen occurrences in Big Bear and Holcomb valleys of the San Bernardino Mountains. Occurrences range from upper Holcomb Valley in the northwest to Arrastre Flat in the northeast to Aspen Glen in the southwest and Erwin Lake in the southeast (Barrows 1989). A significant occurrence is located near Caribou Creek, with an estimated one thousand to fifteen hundred plants found during surveys in 1989. The plant typically grows in drier meadows with alkaline clay soils; however, it can also be found in openings within basin sagebrush scrub, at the edges of pebble plains, and on dry, rocky slopes in the understory of Jeffrey pine woodlands. It has been found with *Castilleja cinerea,* singleleaf pinyon pine, and western juniper.

Common habitat parameters at all locations include alkaline, loosely compacted soils; open areas with low accumulations of organic material; an elevational range between 6,600 and 7,400 feet; and shallow slopes of no greater than 30 percent (Barrows 1989). The species does not require soil disturbance but appears tolerant of it. In historic mining areas, plants have been observed growing on overburden piles. Other occurrences have been found in areas disturbed by seasonal flooding, in mudflows at the edges of roads and the base of boulders, and along the margins of ski slopes (e.g., at Snow Forest). This species is affected by recreation activities (foot, horse, and off-highway vehicle trampling and prospecting), cattle grazing, and residential/commercial development. Occurrences on the San Bernardino National Forest experience lower levels of recreation activity than surrounding areas, but additional protective fencing, signing, and monitoring by patrols have been implemented to enhance habitat for this species.

Subalpine/Alpine Plants

Fifteen rare plants are found or have potential to occur in subalpine or alpine habitat within the assessment area. Summary information is shown in table 5.14.

***Arabis breweri* var. *pecuniaria* (San Bernardino rock cress)**

Arabis breweri var. *pecuniaria* is a Forest Service Sensitive Species. A perennial plant, it is endemic to the San Bernardino Mountains. It grows in subalpine coniferous forest on rocky substrates (e.g., cliffs, ledges, and talus). Just two occurrences are known in the San Gorgonio Wilderness Area of the San Bernardino National Forest. One of these occurrences is located near a hiking trail and contained about twenty-five individuals in 1980. In 1994 just six plants were located at this site and the occurrence is now thought to be declining, though the exact cause is unknown. The second occurrence is known from a cliff area near Dollar Lake and has not been relocated since 1980.

***Claytonia lanceolata* var. *peirsonii* (Peirson's spring beauty)**

Claytonia lanceolata var. *peirsonii* is a Forest Service Sensitive Species. It is a perennial taxon endemic to the eastern San Gabriel Mountains. Occurrences are scattered along the boundary between the Angeles and San Bernardino national forests, from the eastern side of Mount San Antonio east to the Kelly's Camp area (Mistretta and Brown 1987b). The taxon appears briefly each year after the spring thaw, growing on rocky substrates within upper montane conifer and subalpine forest habitat. It usually grows on north-facing slopes in protected bowls or depressions where snows persist later in the year. Tree canopy cover is a requirement of the species; however, shrub cover or deep litter is not well tolerated. *C. lanceolata* var. *peirsonii* has been found in the understory of lodgepole pines, sugar pine, and white fir. Associated understory elements include *Allium burlewii, A. monticola, Fritillaria pinetorum, Oreonana vestita* (another focal species), *Lithophragma tenellum, Pedicularis semibarbata,* and *Collinsia torreyi.* The substrate is described as granitic talus or granitic cobbles with a sandy or fine soil component.

A species management guide was adopted by the Angeles National Forest in 1987, and surveys during the same year located an estimated 1,675 plants at Ontario Ridge, Timber Mountain, Telegraph Peak, Thunder Mountain, and Devil's Backbone Ridge (Mistretta and Brown 1987b). Monitoring continued at three of these sites until 1993 and showed fluctuations in population sizes, though the changes appear to have been within a normal range of variation. The Telegraph Peak population is within the Cucamonga Wilderness Area. Construction of ski runs within the Mount Baldy Ski Area (at Thunder Mountain) significantly reduced the amount of conifer overstory (a key habitat component) and partially eliminated the species at this locale. Populations at Timber Mountain and Kelly's Camp have been adversely affected by trampling from hiking and camping activities. Potential habitat for this plant occurs on the northern slopes of Cucamonga, Ontario, and Etiwanda peaks, and surveys are needed to determine its presence or absence.

***Erigeron breweri* var. *jacinteus* (San Jacinto Mountains daisy)**

Erigeron breweri var. *jacinteus* is a watchlist plant on the San Bernardino and Angeles national forests. Occurrences are known from the San Jacinto, San Bernardino, and San Gabriel mountains. Four occurrences are recorded in the CNDDB. The perennial grows in upper montane and subalpine coniferous forests, in rocky areas above approximately 8,800 feet. Little is known regarding occurrences or threats to this taxon. The variety is difficult to identify and easily confused with other more common taxa.

Table 5.14. Rare plants found in subalpine/alpine habitats. y = the taxon occurs on the forest; p = has potential to occur. Assessments of trend, knowledge of distribution, and vulnerability were made by forest botanists/biologists and generally refer to occurrences on national forest system lands (decl. = declining; unkn. = unknown).

Scientific Name (common name) *listing status*	Acres of Known Habitat				Trends	Vulnerability on NFS lands	Overall Distribution (Knowledge of distribution on NFS lands)
	CNF	**SBNF**	**ANF**	**LPNF**			
Arabis breweri var. *pecuniaria* (San Bernardino rock cress) *FS sensitive*		3			decl.	high	San Bernardino Mtns. (San Gorgonio Wilderness Area); (moderate)
Claytonia lanceolata var. *peirsonii* (Peirson's spring beauty) *FS sensitive*		8	11		stable	high	E San Gabriel Mtns.; (high)
Erigeron breweri var. *jacinteus* (San Jacinto Mtns. daisy)		y	y			unkn.	San Gabriel, San Bernardino, & San Jacinto mtns.; (unknown)
Eriogonum kennedyi var. *alpigenum* (southern alpine buckwheat) *FS sensitive*		y		y	unkn.	low	San Bernardino Mtns.; (low)
Eriogonum microthecum var. *johnstonii* (Johnston's buckwheat) *FS sensitive*		2	2		unkn.	mod.	San Gabriel & E San Bernardino mtns.; (low)
Eriogonum umbellatum var. *minus* (alp. sulfur-flowrd. buckwht.)		y	y		unkn./ stable[1]	mod.	San Gabriel & San Bernardino mtns.; (low)
Heuchera abramsii (Abram's alumroot)		p	y		unkn.	low	San Gabriel Mtns.; (unknown)
Heuchera hirsutissima (shaggy-haired alumroot) *FS sensitive*		p			unkn.		San Jacinto & Santa Rosa mtns.; (low)
Hulsea vestita ssp. *pygmaea* (pygmy hulsea)		y			unkn.	low	San Bernardino Mtns., Kern Plateau (Tulare Co.); (high)
Leptodactylon jaegeri (San Jacinto prickly phlox) *FS sensitive*		36			unkn.	mod.	San Jacinto Mtns.; (moderate)
Monardella cinerea (gray monardella)		p	1		unkn.		San Gabriel Mtns.; (low)
Oreonana vestita (woolly mountain-parsley)		1+	y		unkn.	low	San Bernardino & San Gabriel mtns.; (low)
Podistera nevadensis (Sierra podistera)		h/p				unkn.	San Bernardino Mtns., Sierra Nevada, WA, ID
Potentilla rimicola (cliff cinquefoil) *FS sensitive*		y			unkn.	low	San Jacinto Mtns., Sierra San Pedro Martir (Baja); (low)
Viola pinetorum ssp. *Grisea* (grey-leaved violet) *FS sensitive*		h/p			unkn.		San Bernardino Mtns., Fresno, Tulare, & Kern cos.; (low)

[1] Reveal 1979

Eriogonum microthecum var. *johnstonii* (Johnston's buckwheat)

Eriogonum microthecum var. *johnstonii* is a Forest Service Sensitive Species. It is endemic to the San Gabriel and eastern San Bernardino mountains where it occurs generally above 6,000 feet (Mistretta and Brown 1997a). The shrub is associated with dry sites in upper montane and subalpine coniferous forests, typically on steep slopes with loose rocky soils. It has been found on limestone soils (as well as granitic) but an obligate relationship between the taxon and a specific substrate is not apparent (Mistretta and Brown 1997a). Associated species include white fir, California juniper, Jeffrey pine, curl-leaf mountain-mahogany, sugar pine, and lodgepole pine.

There are six confirmed occurrences: one in a remote area of the San Bernardino Mountains and five in the San Gabriel Mountains. The six occurrences together are estimated to contain between 3,280 and 3,950 plants. Another two occurrences are suspected in the San Gabriel Mountains but need confirmation and are not yet recorded in the CNDDB. Three of the populations within the San Gabriels—one on the western slope of Mount San Antonio, and two in the upper Little Rock Creek drainage—together contain between 2,100 and 2,600 plants and cover an estimated 150 acres. These three populations constitute about 64 percent of the known extant individuals (Mistretta and Brown 1997a). Some occurrences are protected by their remoteness or inaccessibility—the Burkhart Trail population in the upper Little Rock Creek drainage, the Mount San Antonio population located within the Sheep Mountain Wilderness Area, and two populations at Cucamonga Peak within the Cucamonga Wilderness Area. Other occurrences are experiencing disturbance; one population in the upper Little Rock Creek drainage is bisected by the Angeles Crest Highway (State Highway 2) and granitic outcrops make the area popular with rock climbers. Other populations are located adjacent to camping areas and hiking trails. The Angeles National Forest has completed a species management guide for this plant (Mistretta and Brown 1997a).

Eriogonum umbellatum var. *minus* (alpine sulfur-flowered buckwheat)

Eriogonum umbellatum var. *minus* is distributed in the San Gabriel and San Bernardino mountains where it grows on dry, sandy or stony soils within upper montane and subalpine conifer forest habitats. One occurrence is reported for the San Jacinto Mountains but is considered to be a misidentification (Reveal 1981). Several large occurrences are known on the Angeles and San Bernardino national forests (e.g., in the Cucamonga Wilderness Area); however, they are unrecorded in both the CNDDB and our GIS species coverage. A *CNPS Rare Plant Status Report* from 1979 indicated that populations are stable (Reveal 1979). However, one apparently disjunct occurrence on the north slope of the San Bernardino Mountains could be affected if a proposed mine expansion occurs, and occurrences in the Mount Baldy area of the Angeles National Forest could be affected by ski area expansion. The plant appears to be disturbance oriented however, with occurrences found near trails and along roads.

Heuchera abramsii (Abram's alumroot)

Heuchera abramsii is an uncommon perennial species found at elevations above 9,000 feet in dry, rocky areas of the San Gabriel Mountains. Potential habitat occurs in both the Cucamonga and Sheep Mountain wilderness areas on the Angeles and San Bernardino national forests, but the presence or absence of the species has not been confirmed.

Heuchera hirsutissima (shaggy-haired alumroot)

Heuchera hirsutissima is a Forest Service Sensitive Species. It occurs in the San Jacinto and Santa Rosa mountains (fig. 5.15), at elevations above 3,500 feet in montane conifer and subalpine forest habitats. Seven occurrences are recorded in the CNDDB. Some occurrences are located in the San Jacinto Mountain Wilderness Area and in Mount San Jacinto State Park. The plant grows among

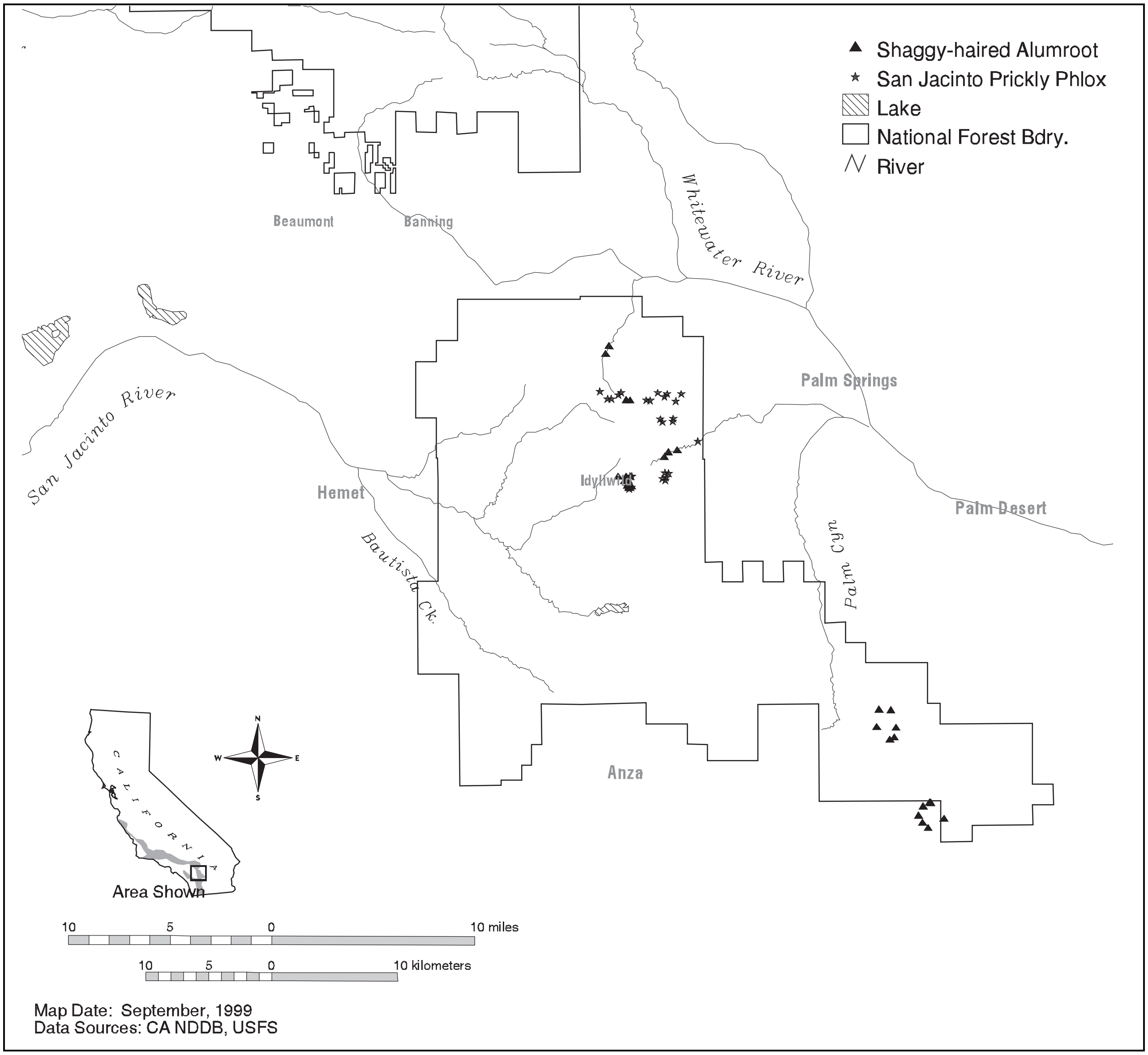


Figure 5.15. Documented locations of *Heuchera hirsutissima,* the shaggy-haired alumroot, and *Leptodactylon jaegeri*, the San Jacinto prickly phlox.

rocks and in crevices of granite boulders. Rock climbing and trampling may be affecting the species.

Hulsea vestita ssp. *pygmaea* (pygmy hulsea)

Hulsea vestita ssp. *pygmaea* is a perennial taxon known from collections made at San Gorgonio Peak and Sugarloaf Peak in the San Bernardino Mountains (S. White, Scott White Biological Consulting, in litt. 1998). Habitat at these locations is described as subalpine forest and alpine barrens. The taxon also occurs on subalpine volcanic barrens at the Kern Plateau in Tulare County, outside of our assessment area (Wilken 1975). At least one of the collections made at San Gorgonio Peak appears to intergrade with *H. vestita* ssp. *parryi,* another of our focal subspecies.

Leptodactylon jaegeri (San Jacinto prickly phlox)

Leptodactylon jaegeri is a Forest Service Sensitive Species. It occurs in the San Jacinto Mountains of Riverside County (fig. 5.15). The CNDDB contains records for fifteen occurrences, most of them relatively small. For example, the largest occurrence sampled in 1983 contained fewer than thirty plants. Some of the same locations were visited again in

1994 and the largest contained more than two hundred twenty plants. A perennial plant, it grows on dry, granitic soils (specifically from rock crevices in granitic outcrops) in upper montane and subalpine conifer forests. Occurrences are generally well protected in the San Jacinto Wilderness Area of the San Bernardino National Forest; however, the level of impact from rock climbing and hiking activity is unknown.

Monardella cinerea (gray monardella)

Monardella cinerea is known from three occurrences, all above 5,900 feet, in the San Gabriel Mountains (Horse Flats, Crystal Lake, and Mount Harwood). The species is locally common in these areas, growing on loose, granitic talus within upper montane and subalpine conifer forest habitat. Potential habitat exists in the San Jacinto Mountains.

Oreonana vestita
(woolly mountain-parsley)

Oreonana vestita is distributed in the San Bernardino and San Gabriel mountains. Plants are found at high elevations on ridgetops and on rocky soils in montane conifer and subalpine habitat. At least four extant occurrences and one historic occurrence are documented on the San Bernardino National Forest, including two occurrences in the San Gorgonio Wilderness Area. Plants occur on the Angeles National Forest at San Antonio Summit, Mount Lewis, and in the Mount Baldy area. Occurrences may be vulnerable to trampling.

Podistera nevadensis (Sierra podistera)

Podistera nevadensis is a watch-list species on the San Bernardino National Forest. Occurrences are known from northern and central California, in the Sierra Nevada Mountains (in Alpine, Eldorado, Mono, Placer, and Tuolomne counties), and into Washington and Idaho, with one disjunct and historic occurrence noted in the San Bernardino Mountains. The perennial grows in alpine boulder and rock fields, and on granitic scree. Plants are fairly common along the Sierran Crest, usually occurring above timberline. Threats to this species are unknown.

Potentilla rimicola (cliff cinquefoil)

Potentilla rimicola is a Forest Service Sensitive Species known from occurrences in the San Jacinto Mountains and Sierra San Pedro Martir in Baja California, Mexico. The CNDDB contains records for five occurrences, some historical, and one recent collection made in 1987. A perennial plant, it grows in granitic crevices within upper montane and subalpine coniferous forest. Some occurrences are located in the San Jacinto Wilderness Area and may be affected by rock climbing activities.

Viola pinetorum ssp. _grisea_
(grey-leaved violet)

Viola pinetorum ssp. *grisea* is a Forest Service Sensitive Species. It is known from extant occurrences in Fresno, Tulare, and Kern counties, and historic occurrences in San Bernardino County. The taxon grows in upper montane conifer and subalpine conifer forests, on dry slopes and peaks form 4,900 to over 11,000 feet in elevation (Hickman 1993). On the Kern Plateau, plants are "scattered and locally common" at Olancha Peak and "occasional on slopes and sand flats." *The Preliminary Check List of the Flowering Plants of the Kern Plateau* notes occurrences bordering meadows in the higher elevation red fir forests, through the foxtail pine forests, to above timberline. *V. pinetorum* is a variable species in need of further study. Historic occurrences are documented in the San Jacinto and San Bernardino mountains, and at Mount Pinos in the southern Los Padres region. Plants at these locations were previously referred to as *V. purpurea* ssp. *xerophyta* (Munz 1974).

Desert Montane Plants

Twenty-six rare plants are primarily associated with desert montane habitats in the assessment area. Summary information is shown in table 5.15. One federally endangered species is included in this group.

Arabis dispar (pinyon rock cress)

Arabis dispar is a relatively wide-ranging perennial species occurring in four California counties (Inyo, Mono, Tulare, and San Bernardino) and southwestern Nevada. Occurrences are known from the White Mountains, the Dome Land Wilderness, the Panamint Mountains, the Argus Range, and other mountains bordering the Mojave Desert. Within the assessment area it occurs in the northern San Bernardino Mountains and is associated with desert montane plant communities (i.e., pinyon-juniper woodlands, Joshua tree woodlands, and Mojavean desert scrub). It grows in granitic soils, on gravelly substrates (including pebble plains), and on compact talus. The CNDDB contains records for fifteen occurrences in California, presumed to be extant but not revisited since the 1920s, 1930s, and 1960s. The species is rarer in the San Bernardino Mountains than in any other area, and occurrences found on the San Bernardino National Forest grow in habitat affected by mining, shooting, off-highway vehicles, and other recreation activities. This plant is also found in Joshua Tree National Park.

Astragalus douglasii var. *perstrictus* (Jacumba milk-vetch)

Astragalus douglasii var. *perstrictus* is a Forest Service Sensitive Species. It occurs in San Diego and Imperial counties, as well as Baja California, Mexico (Skinner and Pavlik 1994; Reiser 1994). A northern disjunct occurrence may be located in Riverside County near Temecula Creek. There are about twenty-five known locations in all, found on rocky soils in open chamise chaparral, cismontane woodlands, valley-foothill grasslands, and pinyon-juniper woodlands. However, Reiser (1994) describes the habitat as primarily transmontane, high desert chaparral. Plants seem to favor areas with mild soil disturbance; scattered individuals have been seen on road shoulders where there is little competition from other species. Another focal species, *Geraea viscida,* may grow sympatrically with this taxon. Occurrences in desert-side habitats appear to be stable, probably owing to the limited development in this region (Reiser 1994). This species appears to be declining on private lands due to habitat loss from urbanization. Occurrences on the Cleveland National Forest (approximately ten) are considered stable or increasing.

Astragalus lentiginosus var. *sierrae* (Big Bear Valley milk-vetch)

Astragalus lentiginosus var. *sierrae* is a Forest Service Sensitive Species known from the eastern San Bernardino Mountains, specifically in Big Bear and Holcomb valleys, the Baldwin Lake area, and in the upper Santa Ana River watershed. The CNDDB contains records for seven occurrences in all, and other occurrences are known but not yet recorded in the database. Plants grow in arid areas, on gravelly or sandy soils in meadows, in the understory of montane conifer forest, in pinyon-juniper woodlands, sagebrush flats, and Mojavean desert scrub. In the Santa Ana River watershed the taxon occurs with rabbitbrush, sagebrush, and Jeffrey pine (M. Lardner, San Bernardino NF, in litt. 1998). This plant responds positively to disturbance and is now believed to be more common than previously mapped.

Astragalus leucolobus (Big Bear Valley woollypod)

Astragalus leucolobus is a Forest Service Sensitive Species known from twenty-four documented occurrences and seventeen general locations in the mountain regions of San Bernardino, Riverside (San Jacinto Mountains), Los Angeles (San Gabriel Mountains), and San Benito counties (CNDDB 1997). Potential habitat exists in San Diego County as well. Other occurrences are known but not yet recorded in the CNDDB. The species is locally common in the Big Bear Valley of the San Bernardino Mountains. Plants are found on pebble plains, in openings of yellow pine forest and pinyon-juniper woodland, and in dry, rocky areas with sagebrush. The species also occurs in areas with disturbed soils—on fuel breaks, within residential tracts, and adjacent to roads.

Canbya candida (pygmy poppy)

Canbya candida is a Forest Service Sensitive Species. It is distributed in Los Angeles, San Bernardino, Kern, and Inyo counties. The CNDDB contains records for twenty-nine occurrences in all, most located on private lands. In the assessment area, occurrences are known from the Cajon Pass area of the San Bernardino Mountains. No occurrences are documented on national forest system lands; however, there is potential habitat on the San Bernardino National Forest based on the nearness of the Cajon Pass occurrences. Other occurrences are known from the western Mojave Desert and adjacent areas of the Sierra Nevada. Occurrences are documented in Kern County near Lake Isabella, Walker Pass, and Kelso Peak/Valley. The annual is found on sandy soils in Joshua tree woodlands and Mojavean desert scrub habitat.

Castilleja plagiotoma (Mojave Indian paintbrush)

Castilleja plagiotoma is a watch-list species on the San Bernardino National Forest. Occurrences are also known on the Angeles National Forest. Plants have not been found on the Los Padres National Forest, although a fair amount of potential habitat may exist (M. Foster, Los Padres NF, pers. comm.). In all, occurrences are documented in Los Angeles, San Bernardino, San Luis Obispo, and Kern counties. The plant grows in Great Basin alluvial scrub and pinyon-juniper woodlands, where it is a green root parasite on other plants (Hickman 1993). Munz (1974) also notes occurrences in Joshua tree woodlands. The plant is "usually among shrubs . . . at Caliente Mountain, Chalk Mountains to Temblor Range" (Smith 1976). These locations are just north of the Los Padres National Forest. Plants are also known from the Hamilton Preserve. In the San Bernardino Mountains, plants are found on the ridge above Coxey Meadow, at Little Pine Flats, Las Flores Ranch, and Round Mountain (Krantz, Thorne, and Sanders 1995). When dry, the yellow-green inflorescence of this species resembles the federally threatened *Castilleja cinerea,* and microscopic observation may be needed to differentiate the two. Threats on national forest system lands include facilities development and recreational activities.

Caulanthus californicus (California jewelflower)

Caulanthus californicus is a federally endangered species known from extant occurrences in the Santa Barbara Canyon area of Santa Barbara County, the Carrizo Plain in San Luis Obispo County, and the Kreyenhagen Hills of Fresno County (fig. 5.16). Occurrences have declined from fifty-five to about twenty known today. An annual plant, it grows on gravelly or sandy soils in grasslands, chenopod scrub, and pinyon-juniper woodlands between elevations of 200 and 3,300 feet. The Santa Barbara Canyon occurrences consist of nineteen different sites along a 6-mile stretch of terrace habitat on the western side of the Cuyama River (M. Foster, Los Padres NF, pers. comm.). The total area of occupied habitat is estimated at 30 acres, on both private and BLM-administered lands.

This species has not been found on national forest system lands; however, the Santa Barbara Canyon occurrences are located within 3 miles of the Los Padres National Forest. Despite suitable habitat on the forest, repeated field surveys over a period of years have been unsuccessful in locating the species. Magney (1988) and Danielsen et al. (1994) have conducted the most comprehensive surveys of national forest system lands. Results of these surveys and maps showing the areas visited are on file at the Los Padres National

Table 5.15. Rare plants found in desert montane habitats. y = the taxon occurs on the forest; p = has potential to occur. Assessments of trend, knowledge of distribution, and vulnerability were made by forest botanists/biologists and generally refer to occurrences on national forest system lands (unkn. = unknown; decl. = declining).

Scientific Name (common name) *listing status*	Acres of Known Habitat CNF	SBNF	ANF	LPNF	Trends	Vulner-ability on NFS lands	Overall Distribution (Knowledge of distribution on NFS lands)
Arabis dispar (pinyon rock cress)		99			unkn.	high	San Bernardino, Inyo, Mono, & Tulare cos., SW Nevada; San Bernardino Mtns. & mtns. bordering the Mojave Desert; (moderate)
Astragalus douglasii var. *perstrictus* (Jacumba milk-vetch) *FS sensitive*	y				stable[1]	low	San Diego & Imperial cos., Baja; (moderate)
Astragalus lentiginosus var. *sierrae* (Big Bear Valley milk-vetch) *FS sensitive*		185			unkn.	low	E San Bernardino Mtns.; (moderate)
Astragalus leucolobus (Big Bear Valley woollypod) *FS sensitive*	p	y	y	p	unkn.	low	San Gabriel, San Bernardino, & San Jacinto mtns., mtns. in San Benito Co.; (high)
Canbya candida (pygmy poppy) *FS sensitive*		p	y		unkn.		LA, San Bernardino (San Bernardino Mtns.), Kern, & Inyo cos., W Mojave Desert, Sierra Nevada; (low)
Castilleja plagiotoma (Mojave Indian paintbrush)		y	1	p	unkn.	mod.	Los Angeles, San Bernardino, Kern, & SLO cos.; (low)
Caulanthus californicus (California jewelflower) *federally endangered*				p	decl.		Santa Barbara, SLO, & Fresno cos., (high)
Caulanthus simulans (Payson's jewelflower) *FS sensitive*	22	1			unkn.	low	Riverside & SD cos.; (low)
Chorizanthe xanti var. *leucotheca* (white-bracted spineflower)		y			unkn.	unkn.	E San Gabriel, San Bernardino, San Jacinto, & Santa Rosa mtns., also Inyo & Kern cos.; (low)
Cordylanthus eremicus ssp. *eremicus* (desert bird's-beak)		p			unkn.		N San Bernardino Mtns. & mtn. ranges of the Mojave Desert
Delphinium inopinum (unexpected larkspur) *FS sensitive*				41	unkn.	low	Mt. Pinos; (low)
Dudleya abramsii ssp. *affinis* (San Bern. Mtns. dudleya) *FS sensitive*		y			unkn.	mod.	San Bernardino Mtns.; (moderate)
Ericameria cuneata var. *macrocephala* (Laguna Mtns. goldenbush)	y				stable	low	Laguna Mtns. (SD Co.); (moderate)

Scientific Name (common name) *listing status*	Acres of Known Habitat				Trends	Vulner-ability on NFS lands	Overall Distribution (Knowledge of distribution on NFS lands)
	CNF	**SBNF**	**ANF**	**LPNF**			
Eriogonum foliosum (leafy buckwheat)	p	h/p			decl.		San Bernardino Mtns., Garner Valley, San Jacinto Mtns., Sierra San Pedro Martir (Baja), SD Co.; (low)
Geraea viscida (sticky geraea)	y				stable[1]	low	desert areas of San Diego & Imperial cos., Sierra Juarez & Sierra San Borja (Baja); (moderate)
Heuchera brevistaminea (shaggy-haired alumroot)	45				stable	low	Laguna & Cuyamaca mtns. (SD Co.), also w Riverside Co.; (high)
Lepidium flavum var. *felipense* (Borrego Vly. pepper-grass)	p						(low)
Linanthus floribundus ssp. hallii (Snta. Rosa Mtns. linanthus) *FS sensitive*		y					Santa Rosa Mtns.; (low)
Marina orcuttii var. *orcuttii* (California marina) *FS sensitive*		y			unkn.	mod.	Santa Rosa Mtns., Sierra Juarez & Sierra de las Palmas (Baja); (low)
Muilla coronata (crowned muilla)		y					base of San Bernardino Mtns., Mojave Desert, also LA, Inyo, Kern, Tulare cos., NV
Opuntia basilaris var. *brachyclada* (short-joint beavertail) *FS sensitive*	p	219	29		unkn.	mod.	desert-side of San Gabriel & W San Bernardino mtns., Volcan Mtn. (SD Co.), Providence Mtns. (San Bernardino Co.); (high)
Streptanthus campestris (southern jewel-flower) *FS sensitive*	y	y		2	stable[1]	mod.	Riverside, San Bernardino, SD, & Santa Barbara cos., N Baja, San Bernardino, Little San Bernardino, San Jacinto, & In-Koh-Pah mtns.; (moderate)
Stylocline masonii (Mason neststraw)			y	y	unkn.	unkn.	LA, Kern, Monterey, & SLO cos., NW Tehachapi Mtns.; (low)
Swertia neglecta (pine green-gentian) *FS sensitive*		y	6	y	unkn.	mod.	Transverse Ranges; (low)
Syntrichopappus lemmonii (Lemmon's syntrichopappus)		y	y	p	unkn.	low	LA, San Bernardino, Riverside, Kern, & Monterey cos.; (low)
Viola aurea (golden violet)	p	y	p	p			SD, San Bernardino, Kern, & Mono cos.; San Gabriel, San Bernardino, & Tehachapi mtns. SW to Mt. Pinos; NV

[1] Reiser 1994 (refers to all known occurrences)

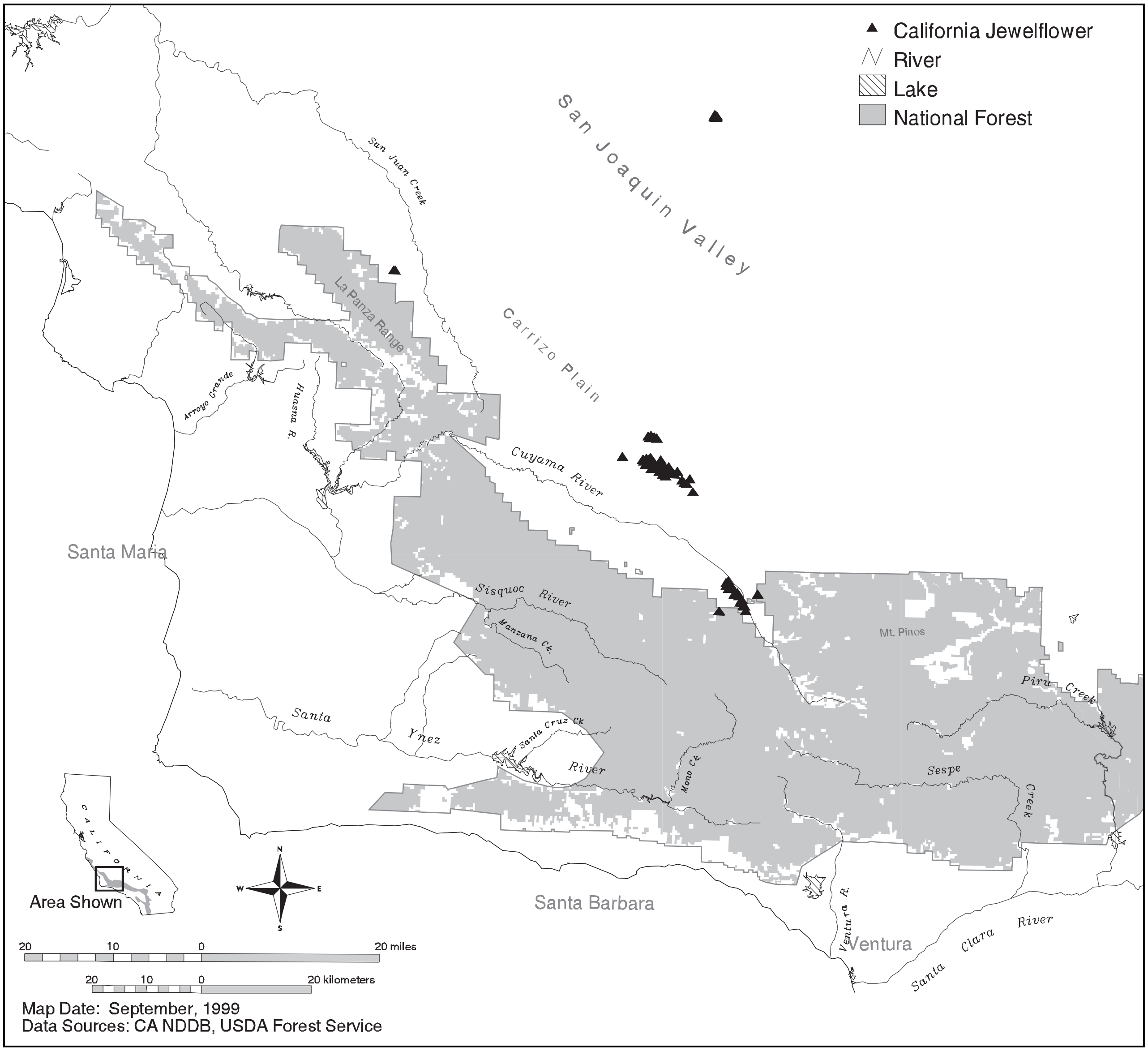


Figure 5.16. Documented locations of *Caulanthus californicus,* the California jewelflower.

Forest. Essentially all areas mapped as suitable habitat have been visited by botanists during the appropriate time of year. Two attempts were made to grow the plant from seed at suitable locations on the forest (Santa Barbara and Deer Park canyons). Germination and subsequent production of seed was successful in 1989; however, the number of individuals produced each year after that gradually declined until 1995 when no plants were found at either site. Monitoring in 1997 and 1998 found no plants evident at either site, despite favorable weather conditions. The range, distribution, abundance, and habitat requirements of this species are described in detail in the *Recovery Plan for Upland Species of the San Joaquin Valley, California* (USFWS 1998l). Occurrences are vulnerable to agricultural practices, urbanization, energy development, and overgrazing. See the final listing rule for additional information (USFWS 1990).

Caulanthus simulans (Payson's jewelflower)

Caulanthus simulans is a Forest Service Sensitive Species that occurs in Riverside and San Diego counties. The CNDDB contains records for at least thirty-six occurrences and thirty-six general locations. Some of these locations, however, may contain the species *C. heterophyllus* and are in need of further study. *C. simulans* is easily confused with *C. heterophyllus* var. *pseudosimulans,* a more coastal taxon that, unlike *C. simulans,* appears after fires. Many historic locations in the Santa Ana Mountains have proved to be misidentifications of this variety. *C. simulans* is an annual species that grows in openings within chaparral and coastal sage scrub, including burned areas and disturbed sites. It also is found in streambeds and on steep, rocky slopes. In San Diego County, plants are typically found on the desert side of the mountains. The species is vulnerable to overgrazing, trampling, and development projects. Many of the known occurrences are located on private lands. In addition, fires that are too frequent may lead to type conversion of habitat for this species. Other potential disturbances include flooding, erosion, and road maintenance. Other populations are found on lands managed by the BLM, Anza Borrego Desert State Park, and the Forest Service.

***Chorizanthe xanti* var. *leucotheca* (white-bracted spineflower)**

Chorizanthe xanti var. *leucotheca* is known from approximately four to five locations on the San Bernardino National Forest. The occurrences are scattered in the eastern San Gabriel, San Bernardino, San Jacinto, and Santa Rosa mountains. No occurrences are recorded in the CNDDB; however, the draft *Flora of the San Bernardino Mountains* notes occurrences in Inyo and Kern counties (Krantz et al. 1995). The species is found in Mojavean desert scrub and pinyon-juniper woodland communities.

***Cordylanthus eremicus* ssp. *eremicus* (desert bird's-beak)**

Cordylanthus eremicus ssp. *eremicus* is an annual taxon known mainly from occurrences in mountain ranges of the Mojave Desert (e.g., the Nelson Range in Inyo County) and in Death Valley National Park. One occurrence is located at a spring near Cushenbury in the northern San Bernardino Mountains. This occurrence is close to but not actually on the San Bernardino National Forest. Due to its potential to occur on the forest, the species has been placed on a watch list. The plant is a root parasite and grows in rocky soils within Joshua tree woodland and Mojavean desert scrub communities.

***Delphinium inopinum* (unexpected larkspur)**

Delphinium inopinum is a Forest Service Sensitive Species. There are thirty-two reported occurrences of this perennial species. The smaller occurrences each contain from ten to one hundred plants and the larger occurrences (which are more frequent) contain hundreds and thousands of individual plants. In the assessment area, a historic occurrence is reported at Mount Pinos on the Los Padres National Forest. The occurrence is protected within the Mount Pinos Summit Botanical Area but needs to be confirmed. Plants typically grow in dry areas among rock outcrops and on open, rocky ridges in pine and red fir forest habitat.

***Dudleya abramsii* ssp. *affinis* (San Bernardino Mountains dudleya)**

Dudleya abramsii ssp. *affinis* is a Forest Service Sensitive Species found in the San Bernardino Mountains. It occurs in desert-side montane, upper montane conifer, and subalpine habitats (including pebble plains and pinyon-juniper woodlands). Plants grow on soil outcrops and talus slopes composed of granite, quartzite, or rarely limestone/carbonate. The CNDDB contains records on nine occurrences, and additional populations in the Big Bear Valley have not yet been reported to the database. Some occurrences are adversely affected by limestone mining. Many of the occurrences associated with pebble plains are protected by fencing on the San Bernardino National Forest.

Ericameria cuneata var. *macrocephala* (Laguna Mountains goldenbush)

Ericameria cuneata var. *macrocephala* is a shrub species endemic to the Laguna Mountains of San Diego County. Although its range is limited, occurrences are fairly common along the crest and desert-side slopes of these mountains. Reiser (1994) cites occurrences at Garnet Peak and Desert View Point. Most of the occurrences are located on public lands which are relatively well protected, including BLM and state park lands. The only known potential threat to the plant is development of electronic sites in its habitat on the tops of steep, rocky slopes. Occurrences on the Cleveland National Forest currently appear stable.

Eriogonum foliosum (leafy buckwheat)

Eriogonum foliosum is an annual species known historically from Big Bear Valley in the San Bernardino Mountains and more recently from Garner Valley in the San Jacinto Mountains. The species is also known to occur in the Sierra San Pedro Martir in Baja California, Mexico. The *CNPS Inventory* cites two occurrences in the San Diego ranges (Pine Valley and Warner Springs) (Skinner and Pavlik 1994), and potential habitat exists on the Cleveland National Forest, but the plant has not been confirmed there. The CNDDB contains records for at least three occurrences but the *CNPS Inventory* cites occurrences on seven USGS 7.5-minute quad maps. The plant inhabits sandy areas of chaparral, meadows, yellow pine forest, closed-cone conifer forest, and pinyon-juniper woodlands. It is easily confused with other annual buckwheats (e.g., *E. davidsonii)* and difficult to key.

Geraea viscida (sticky geraea)

Geraea viscida is a rare, short-lived perennial species known from a number of locations in the border region and desert areas of San Diego and Imperial counties, as well as areas of Baja California, Mexico (e.g., the Sierra Juarez Mountains and Sierra San Borja) (Reiser 1994). Occurrences range from approximately 1,500 feet to over 5,500 feet in elevation. A large occurrence is found in the Smuggler's Cave region east of Jacumba. Approximately half of the known occurrences are protected on federal and state lands. Occurrences are presumed to be stable based on limited development of the plant's habitat. It occupies sandy soils in chamise chaparral and appears to be disturbance oriented, appearing in sparsely vegetated areas, along roads, and after burns.

Heuchera brevistaminea (Mount Laguna alumroot)

Heuchera brevistaminea is a perennial species found primarily on the desert side of the Laguna Mountains in San Diego County. Occurrences are known from Garnet and Monument peaks, Oasis Spring, and Mount Laguna. It has also been located below the summit of Cuyamaca Peak in the Cuyamaca Mountains. One occurrence growing near Santa Rosa and Toro peaks in western Riverside County may represent a northern disjunct or range extension (Reiser 1994). The plant grows in dry areas on rocky soils in desert montane communities (e.g., montane chaparral). About twelve occurrences are known, some of them relatively large. Most of these occurrences are located on the Cleveland National Forest. Other occurrences are protected on state lands. The species is also naturally protected by its preference for relatively inaccessible terrain—it grows on steep, rock faces and crevices or on exposed rock slabs (Reiser 1994).

Linanthus floribundus ssp. *hallii* (Santa Rosa Mountains linanthus)

Linanthus floribundus ssp. *hallii* is a Forest Service Sensitive Species. It is a perennial taxon known from occurrences in the Santa Rosa Mountains. Plants grow in desert montane habitats (e.g., canyons with Sonoran desert scrub). The CNDDB contains records for at least four occurrences. One occurrence on the San Bernardino National Forest is located in the Santa Rosa Wilderness Area. Plants grow in open areas along a wash within pinyon-juniper woodland habitat. High levels of recreation, trail maintenance, and trail construction are potential impacts to this taxon.

Marina orcuttii var. *orcuttii* (California marina)

Marina orcuttii var. *orcuttii* is a Forest Service Sensitive Species. It is a perennial plant found in the Santa Rosa Mountains and in the Sierra Juarez and Sierra de las Palmas of Baja California, Mexico (Barneby 1977). Two occurrences are known in the Santa Rosa Wilderness Area, both along the Cactus Springs Trail. This species occupies desert montane habitat—gravelly hillsides in pinyon-juniper woodland and Sonoran desert scrub. Potential impacts to the plant include high levels of recreation use, trail maintenance, and trail construction.

Muilla coronata (crowned muilla)

Muilla coronata is a perennial species known from at least two occurrences along the northern base of the San Bernardino Mountains. Occurrences are also documented in Inyo, Kern, Tulare, and Los Angeles counties, and in Nevada. The plant grows on heavy soils in openings within pinyon-juniper woodland, Mojavean desert scrub, and Joshua tree woodland. Potential threats on the forest include off-road vehicle activities, high levels of recreation use, and mining.

Opuntia basilaris var. *brachyclada* (short-joint beavertail)

Opuntia basilaris var. *brachyclada* is a Forest Service Sensitive Species found on desert-side slopes of the San Gabriel and western San Bernardino mountains, and at Cajon Pass between the two mountain ranges where desert vegetation occurs. Plants are found between 3,000 and 6,000 feet elevation in loose, sandy to gravelly mineral soils. They grow within chaparral communities (i.e., chamise chaparral, semi-desert chaparral, northern mixed chaparral, and southern mixed chaparral), chaparral transition zones, Joshua tree woodlands, Mojavean desert scrub, Mojavean pinyon woodlands, pinyon-juniper woodlands, and southern sycamore-alder riparian woodland (Mistretta and Parra-Szijj 1991b).

Approximately thirty occurrences are known, twelve recorded in the CNDDB. Surveys in 1990 identified fifteen localities and approximately nine hundred individual plants. Most of these occurrences are located on national forest system lands, and a species management guide was developed in 1991 for the Angeles National Forest (Mistretta and Parra-Szijj 1991b). Known populations appear to be stable and represent a variety of age classes. Vegetation management (e.g., chemical and mechanical removal of biomass, establishment of conifer plantations, and prescribed burning) has had the greatest effect on occurrences on the Angeles National Forest; however, the effects of fire on its distribution and abundance are unknown (Mistretta and Parra-Szijj 1991b).

Streptanthus campestris (southern jewel-flower)

Streptanthus campestris is a Forest Service Sensitive Species found in Riverside, San Bernardino, San Diego, and Santa Barbara counties as well as in northern Baja California, Mexico. Occurrences are known from the San Bernardino, Little San Bernardino, San Jacinto, and In-Koh-Pah mountains. The species is a short-lived perennial that grows on rocky soils in chaparral (including high desert transitional chaparral), conifer forest, and pinyon-juniper woodlands. One occurrence is located among large boulders in the partial shade of western junipers. At another locale, the plant grows in open chamise chaparral (Reiser 1994). The CNDDB contains records for fifteen occurrences, and additional locations are known but not yet entered into the database. There are two historic and one confirmed extant occurrence on the Los Padres National Forest.

Stylocline masonii (Mason neststraw)

Stylocline masonii is an annual species known from occurrences in Los Angeles, Monterey, San Luis Obispo, and Kern counties.

The plant is found in the northwestern Tehachapi Mountains, the southern San Joaquin Valley, and the Santa Lucia Ranges. It grows on sandy soils and in washes within chenopod scrub habitat and pinyon-juniper woodlands. Most occurrences are reported between 300 and 1,400 feet elevation (Hickman 1993). Just one collection has been documented since 1971.

Swertia neglecta **(pine green-gentian)**

Swertia neglecta is a Forest Service Sensitive Species known from the desert slopes of the San Bernardino and San Gabriel mountains, and the western Transverse Ranges. Small, scattered occurrences are found within yellow pine forests, dry open woodlands, and pinyon-juniper woodlands. Five occurrences are known on the San Bernardino National Forest, including two discovered in 1998 on carbonate soils growing with the federally endangered, *Oxytheca parishii* var. *goodmaniana.* Four occurrences are documented on the Los Padres National Forest, and the Angeles National Forest contains almost twenty locations. One occurrence on the San Bernardino National Forest is located in an area proposed for a limestone mine overburden site. In other areas, the species is vulnerable to mining activities, road maintenance, and recreation impacts from hiking, camping, horseback riding, and off-highway vehicle use. A review of all pre-1998 vegetation plot data sheets and maps created for the carbonate plant conservation study (USDA 1996) may yield other locations of this taxon on the San Bernardino National Forest.

Syntrichopappus lemmonii **(Lemmon's syntrichopappus)**

Syntrichopappus lemmonii is a watch-list species on the San Bernardino and Angeles national forests. At least five occurrences are documented on the San Bernardino National Forest. Occurrences are known from Los Angeles, San Bernardino, Riverside, Kern, and Monterey counties. An annual plant, it grows on sandy or gravelly soils within chaparral and Joshua tree woodlands between 2,900 and 4,900 feet elevation. It appears abundantly after fires.

Viola aurea **(golden violet)**

Viola aurea is a perennial species known from occurrences in San Diego, San Bernardino, Kern, and Mono counties as well as Nevada, where it may be more common. Plants grow in sandy places within Great Basin scrub and pinyon-juniper woodlands between 3,200 and 5,900 feet. Five locations are documented in California, including one at Cajon Pass between the San Gabriel and San Bernardino mountains and another in Doane Valley at Palomar Mountain State Park (CNDDB 1998). The occurrence at Cajon Pass is located on the San Bernardino National Forest, where the species is placed on a watch list. Potential habitat occurs on the Cleveland National Forest. Other occurrences are reported from the eastern slopes of the Tehachapi Mountains southwest to Mount Pinos (Moe and Twisselmann 1995), and possibly at Pine Mountain Ridge in the southern Los Padres region (Smith 1976). Occurrences are vulnerable to overgrazing, off-road vehicle activity, and development projects.

Carbonate Plants

Ten rare plants are specifically associated with carbonate (e.g., limestone, dolomite) substrates that occur in localized areas on the desert side of the San Bernardino Mountains (table 5.16). Four federally endangered species and one federally threatened species are included in this group.

Abronia nana **ssp.** ***covillei*** **(Coville's dwarf abronia)**

Abronia nana ssp. *covillei* is a Forest Service Sensitive Species that occurs on dry slopes with carbonate soil and in sandy places within the San Bernardino, Inyo, New York, and White mountains. Occurrences are also found in the Sheep Range in southwestern Nevada. The plant is typically found growing in pinyon-juniper and Joshua tree woodlands,

Table 5.16. Rare plants found in association with carbonate soils. y = the taxon occurs on the forest; p = has potential to occur). Assessments of trend, knowledge of distribution, and vulnerability were made by forest botanists/biologists and generally refer to occurrences on national forest system lands (unkn. = unknown; decl. = declining).

Scientific Name (common name) *listing status*	Acres of Known Habitat				Trends	Vulner-ability on NFS lands	Overall Distribution (Knowledge of distribution on NFS lands)
	CNF	**SBNF**	**ANF**	**LPNF**			
Abronia nana ssp. *covillei* (Coville's dwarf abronia) *FS sensitive*		y			decl.	high	San Bernardino, Inyo, White, & New York mtns., SW NV (Sheep Range); (moderate)
Allium parishii (Parish's onion)		y			unkn.	high	San Bernardino, Riverside, & Inyo cos., W AZ, San Bernardino & Little San Bernardino mtns., Mojave Desert; (low)
Arabis shockleyi (Shockley's rock cress) *FS sensitive*		141			unkn.	high	San Bernardino (NE San Bernardino Mtns.) & Inyo cos., NV, Great Basin; (moderate)
Astragalus albens (Cushenbury milk-vetch) *federally endangered*		552			decl.	high	San Bernardino Mtns.; (high)
Erigeron parishii (Parish's daisy) *federally threatened*		489			decl.	high	Riverside & San Bernardino cos., San Bernardino Mtns.; (high)
Erigeron uncialis var. *uncialis* (limestone daisy) *FS sensitive*		p			unkn.		San Bernardino & Inyo cos., central NV, San Bernardino Mtns., Mojave Desert (Clark Mtn.), White & Inyo mtns., Grapevine Mtns., Tin Mtn.; (low)
Eriogonum microthecum var. *corymbosoides* (San Bern. buckwheat)		4	p		unkn.	high	San Bernardino Mtns.; (high)
Eriogonum ovalifolium var. *vineum* (Cushenbury buckwheat) *federally endangered*		839			decl.	high	San Bernardino Mtns.; (high)
Lesquerella kingi ssp. *bernardina* (San Bern. Mtns. bladderpod) *federally endangered*		128			decl.	high	San Bernardino Mtns.; (high)
Oxytheca parishii var. *goodmaniana* (Cushenbury oxytheca) *federally endangered*		312			decl.	high	San Bernardino Mtns.; (high)

dry conifer forests, and Great Basin scrub. Five occurrences are known on the San Bernardino National Forest. Plants are affected by limestone mining operations and high levels of recreation use, particularly from unauthorized off-road vehicles.

Allium parishii **(Parish's onion)**

Allium parishii occurs in San Bernardino, Riverside, and Inyo counties, as well as western Arizona. Occurrences are generally located above 4,000 feet elevation, on the desert-side slopes of the San Bernardino Mountains and Little San Bernardino Mountains, and in the Mojave Desert. The habitat is described as open and rocky slopes in Joshua tree woodlands. There appears to be an association with carbonate soils but the species may grow in other soil types. Two occurrences are located in an active limestone mining area. One new occurrence was found in 1998 in Furnace Canyon, growing on carbonate soil with *Erigeron parishii* and *Astragalus albens.* Mining activities and high levels of recreation use, particularly from off-road vehicles, may be affecting populations in the assessment area.

Arabis shockleyi **(Shockley's rock cress)**

Arabis shockleyi is a Forest Service Sensitive Species found in Inyo and San Bernardino counties, and also Nevada. In California the plant grows on carbonate or quartzite soil in pinyon-juniper woodlands. In 1998, this plant was found within fifty-one 0.1-acre plots randomly placed in an area known to support one of the five listed carbonate species on the San Bernardino National Forest. These occurrences are not included in the acres of occupied habitat reported for this species in table 5.16. Disjunct occurrences are found in the mountains east and north of the Mojave Desert and in portions of the Great Basin. The CNDDB contains records on twenty-two occurrences.

Astragalus albens **(Cushenbury milk-vetch)**

Astragalus albens is a federally endangered species endemic to the San Bernardino Mountains. A draft recovery plan (USFWS 1997b) cites thirty-three known occurrences, distributed from the east side of Dry Canyon, north to approximately 1/2 mile north of Cushenbury Springs and southeast to 1/2 mile east of Arrastre Creek. Henderson and Volgarino (1997) estimated 559 acres of *A. albens* on national forest system lands and 11 acres on BLM lands. More occurrences were mapped during 1998 surveys. Occurrences are known to expand in years of good rainfall; during a drought year in the 1980s, the total number of plants at all known locations was estimated at two thousand. Favorable rainfall in 1992, combined with a more thorough survey effort, increased the estimate to between five thousand and ten thousand plants at all known sites. The largest occurrence was located in the Top Spring-Smarts Ranch Road area and contained several thousand individuals (USFWS 1997b; B. Henderson, San Bernardino NF, pers. comm.).

Astraglus albens is usually found on carbonate or granitic soils between 3,600 and 6,200 feet (USFWS 1997b). It occupies pinyon and juniper woodlands, sandy or stony flats, rocky hillsides, and canyon washes and fans. Significant differences between occupied and unoccupied habitat are described by Gonella (1994). This species is also addressed in the *Conservation Study for Five Carbonate Plant Species: a study of land use conflict in the San Bernardino National Forest* (USDA Forest Service 1996). The species is vulnerable to mining operations and mineral exploration. At least 97 percent of the known occurrences are located on public land claimed for mining or on private land (USFWS 1997b). Road and powerline construction, utility corridors, unauthorized vehicle use, and unauthorized grazing from trespass cattle are other actions that affect this species.

Erigeron parishii (Parish's daisy)

Erigeron parishii is a federally threatened species known from at least twenty-six occurrences in Riverside and San Bernardino counties (CNDDB 1996). The plant is distributed within a 35-mile stretch of carbonate habitat and is the most wide-ranging of the five listed species in this group. Occurrences are found between 3,600 and 6,400 feet in pinyon woodlands, pinyon-juniper woodlands, black bush scrub, Mojavean desert scrub, and Joshua tree woodlands. Plants usually occupy shallow drainages, rocky slopes, and outwash plains on limestone or dolomite soils (USFWS 1997b). Some populations occur on a granite/limestone interface—usually granitics overlain with limestone—and on limestone alluvium above quartz monzonite substrates. Approximately fifty populations are now known, consisting of an undefined number of plants. Prior to listing, the plant was known from fewer than twenty-five occurrences totaling about sixteen thousand individual plants (USFWS 1997b). Henderson and Volgarino (1997) estimated 396 acres of occupied habitat on national forest system lands and 186 acres on BLM lands. The species is addressed in the draft recovery plan (USFWS 1997b) and the *Conservation Study for Five Carbonate Plant Species: a study of land use conflict in the San Bernardino National Forest* (USDA Forest Service 1996). The species is vulnerable to the same activities affecting *Astragalus albens:* mining, mineral exploration, road and powerline construction, utility corridors, unauthorized vehicle use, and unauthorized grazing.

Erigeron uncialis var. *uncialis* (limestone daisy)

Erigeron uncialis var. *uncialis* is a Forest Service Sensitive Species. It is found within San Bernardino and Inyo counties as well as central Nevada. Occurrences are known from the San Bernardino Mountains, the Mojave Desert, and the White and Inyo mountains east of the Sierra Nevada. Disjunct occurrences are located in the Schell Creek and White Pine ranges of Nevada. Records from botanist Mary Decker indicate occurrences near Death Valley in the Grapevine Mountains and at Tin Mountain, and in the Mojave Desert at Clark Mountain. The Nevada Natural Heritage Program (NNHP) records three to five occurrences of *E. cavernensis* which is now lumped with *E. uncialis* var. *uncialis* (Cronquist 1994). The plant occurs within the assessment area in desert montane and subalpine/alpine habitats. It grows from limestone crevices within Great Basin scrub and subalpine coniferous forest. Limestone mining and off-road vehicle use are threats to its habitat in the San Bernardino Mountains. Habitat in Nevada (carbonate rock and crevices) is relatively widespread and not considered vulnerable at this time (J. Morefield, NNHP, pers. comm.).

Eriogonum microthecum var. *corymbosoides* (San Bernardino buckwheat)

Eriogonum microthecum var. *corymbosoides* is a deciduous shrub known from the northern slopes of the San Bernardino Mountains. Occurrences are found in pinyon-juniper woodlands and associated with carbonate and granitic soils. In 1998, this taxon was found within forty-nine 0.1-acre plots, randomly located in an area known to support one of the five listed carbonate plant species on the San Bernardino National Forest. These occurrences are not included in the acres of occupied habitat reported for this species in table 5.16.

Eriogonum ovalifolium var. *vineum* (Cushenbury buckwheat)

Eriogonum ovalifolium var. *vineum* is a federally endangered taxon distributed from west of the White Mountain Management Unit east to Rattlesnake Canyon (fig. 5.17). The total number of individual plants is estimated at thirteen thousand, with about one-quarter of the known occurrences containing more than one thousand plants (USFWS 1997b). The CNDDB contains records for twenty-seven occurrences. Known locations on limestone

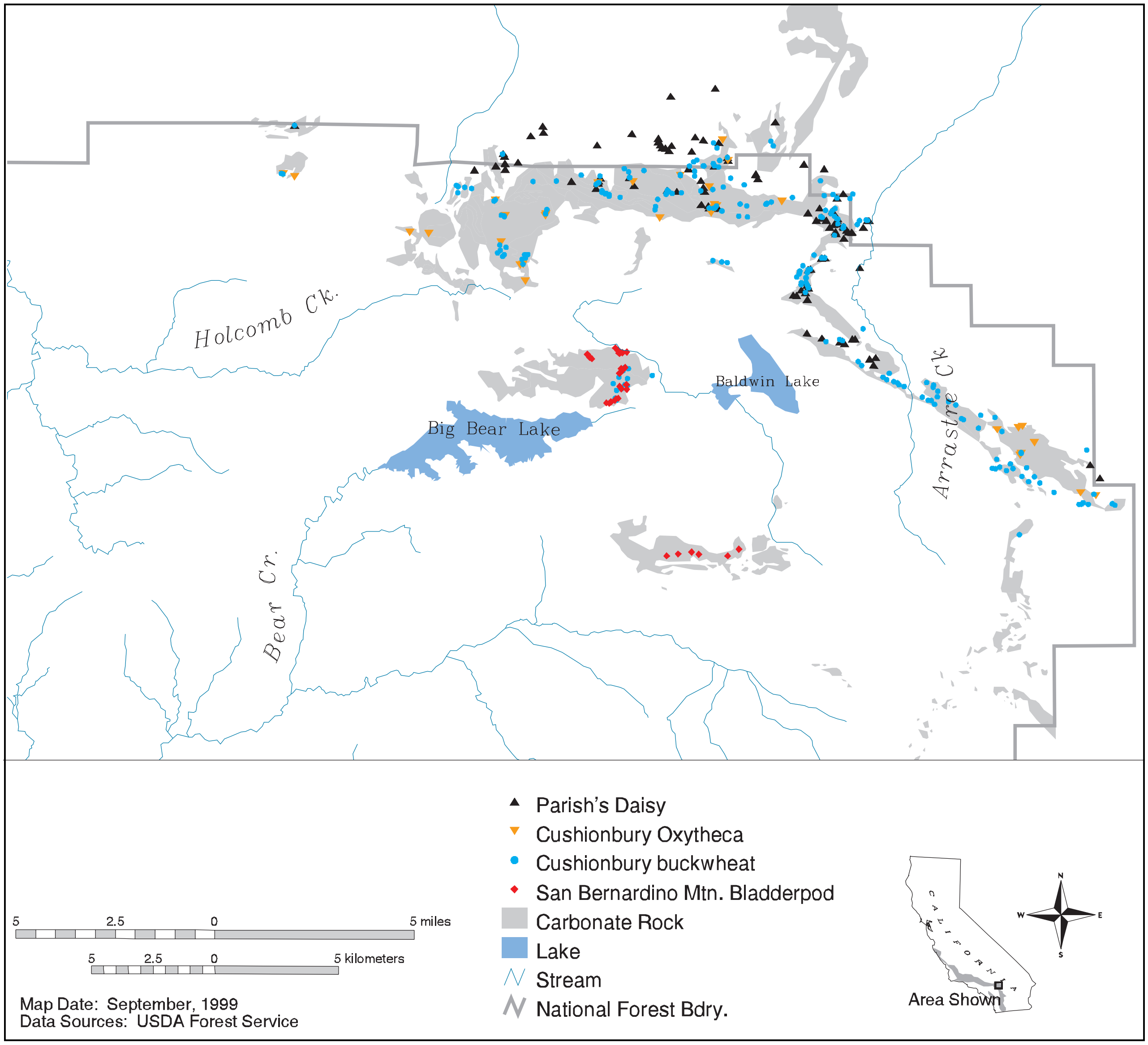


Figure 5.17. Documented locations of *Eriogonum ovalifolium* var. *vineum* (Cushenbury buckwheat), *Lesquerella kingii* ssp. *bernardina* (San Bernardino Mountains bladderpod), and *Oxytheca parishii* var. *goodmaniana* (Cushenbury oxytheca).

include the White Knob area, Arctic/Bousic Canyon west to Terrace Springs, south to Top Spring, and along the north side of Lone Valley to Tip Top Mountain. The plant also occurs on dolomite in the Bertha Ridge area, in northern Holcomb Valley, in Jacoby Canyon, and along Nelson Ridge (USFWS 1997b). A population at Furnace Canyon grows on a mix of granite, limestone, and dolomite. Recent surveys done by the San Bernardino National Forest located two new populations, one near Jacoby Springs and one just north of Mineral Mountain.

This plant is found between 4,800 and 7,800 feet in openings of pinyon woodland, pinyon-juniper woodland, Joshua tree woodland, black bush scrub, Mojavean desert scrub, and dry coniferous forest. Site conditions include a low accumulation of organic material, usually less than 15 percent canopy cover, moderate slopes, and rock cover that exceeds 50 percent in fine soils. Some occurrences on north-facing slopes are found with *Astragalus albens* (USFWS 1997c). The taxon is addressed in a draft recovery plan (USFWS 1997b) and the *Conservation Study for Five*

Carbonate Plant Species: a study of land use conflict in the San Bernardino National Forest (USDA Forest Service 1996). Occurrences are affected by mining, mineral exploration, road and powerline construction, utility corridors, unauthorized vehicle use, and unauthorized grazing.

Lesquerella kingii ssp. *bernardina* (San Bernardino Mountains bladderpod)

Lesquerella kingii ssp. *bernardina* is a federally endangered plant found in the Big Bear Valley area. It occupies the smallest area of the five listed carbonate taxa (USFWS 1997b). Occurrences are known from two areas that encompass an estimated 149 acres on the San Bernardino National Forest (Henderson and Volgarino 1997). All but 21 acres are mapped in our GIS database. One site is located on the northern side of the valley near the eastern end of Bertha Ridge and next to the community of Big Bear City (fig. 5.17). The total number of individuals at this location was estimated to be twenty-five thousand in 1980, and less than ten thousand in 1988. The decline may reflect real change brought on by prolonged drought conditions and/or apparent change due to differences in sampling technique (USFWS 1997b). The other area is centered on the north-facing slope of Sugarlump Ridge, south of Big Bear Valley and about 6 miles south of the Bertha Ridge populations. This area contained approximately ten thousand plants in 1991. Resource personnel from the San Bernardino National Forest and CDFG observed increased abundance in the years following the drought (USFWS 1997b).

This plant is found between 6,500 and 8,200 feet in elevation, on dolomite soils within Jeffrey pine-western juniper woodlands and white fir forests. Plants grow in open areas with little accumulation of organic material. The northern-most occurrence grows with *Eriogonum ovalifolium* var. *vineum.* Although plants have been observed growing in old road beds, established populations can be easily extirpated by unauthorized off-road vehicle use and mountain biking. Fence construction, signing, and closure of non-system roads in occupied habitat near the Big Bear rifle range enhanced habitat for one occurrence near the north shore of Big Bear Lake in 1998. Potential disturbances to the Lakeview cabin tract population are being assessed in 1999. Generally, the plant is vulnerable to unauthorized off-road vehicle use, woodcutting, and mining. The taxon is addressed in a draft recovery plan (USFWS 1997b) and the *Conservation Study for Five Carbonate Plant Species: a study of land use conflict in the San Bernardino National Forest* (USDA Forest Service 1996).

Oxytheca parishii var. *goodmaniana* (Cushenbury oxytheca)

Oxytheca parishii var. *goodmaniana* is a federally endangered taxon. It occupies the second smallest area of the listed carbonate plants. In 1990 the estimated number of plants was fewer than three thousand in four known populations (USFWS 1997b); however, abundance varies with rainfall. Surveys conducted by the San Bernardino National Forest from 1992 to 1995 located eleven new populations. More populations were located following the El Nino event in 1998. Occurrences range from South Peak east to 1/2 mile south and east of Terrace Springs (some plants in the Terrace Springs area have now been identified as *O. parishii* var. *cienegensis)*. Other known sites include Cushenbury Spring; Cushenbury, Marble, Arctic, Wild Rose and Furnace canyons; near the abandoned Green Lead gold mine; north of Holcomb Valley; and in the White Mountain Management Unit (fig. 5.17). In addition, three other morphologically distinct populations were found at the eastern end of the known range of this plant—along the Helendale Fault near Tip Top Mountain, at Mineral Mountain, and at Rose Mine. Occurrences are generally found between 4,200 and 7,800 feet, on limestone and dolomite soils within pinyon and juniper woodland. The taxon is addressed in a draft Recovery Plan (USFWS 1997b) and in the *Conservation Study for Five Carbonate Plant Species: a study of land use conflict in the San*

Bernardino National Forest (USDA Forest Service 1996). The primary disturbances to this taxon come from limestone mining operations and exploration.

Desert Floor Plants

Two rare plants are primarily found in desert floor habitat at the eastern edge of the assessment area. Summary information is shown in table 5.17. Both of these taxa are federally endangered.

***Astragalus lentiginosus* var. *coachellae* (Coachella Valley milk-vetch)**

Astragalus lentiginosus var. *coachellae* is a federally endangered species known from the Coachella Valley area of Riverside County. Habitat for this annual plant is found at low elevations (below 1,200 feet) in sandy flats, outwash fans, and on dunes in Sonoran desert scrub, creosote bush scrub, or sagebrush dominated communities. The CNDDB contains records for seventeen occurrences, five located within the Coachella Valley Preserve (jointly managed by the BLM, CDFG, USFWS, and TNC). Occurrences in the preserve are monitored annually. One occurrence showed a decline in abundance from 1979 (209 plants) to 1982 (2 plants). Surveys during 1987 (a drought year) located fewer than 300 plants at all locations (USFWS 1992a). Two other occurrences are found on the Agua Caliente Indian Reservation, one occurrence is located on land owned by Southern California Edison, and the remaining occurrences are located on private lands. There are no known occurrences on the San Bernardino National Forest; however, one area at Snow Creek Canyon (1,400 feet) may be low enough in elevation to provide some potential habitat. The main threat to this taxon is habitat loss due to urban development (USFWS 1992a).

***Astragalus tricarinatus* (triple-ribbed milk-vetch)**

Astragalus tricarinatus is a federally endangered, short-lived perennial known from areas bordering the Sonoran Desert in Riverside and San Bernardino counties. The CNDDB contains records for seven occurrences and seven general locations; however, the U.S. Fish and Wildlife Service confirms only four sites in the Coachella Valley (USFWS 1992a). Occurrences are reported near Whitewater Canyon and Morongo Valley (northwestern end of the Coachella Valley), and Agua Alta Canyon (southern end of the Coachella Valley). Two of these occurrences are protected in an Area of Critical Environmental Concern (ACEC) by the BLM, and also managed as a preserve by the BLM and TNC. Since 1987, plants have not been found at either site or at Whitewater and Agua Alta canyons. When the proposed listing rule was published in 1992,

Table 5.17. Rare plants found in desert floor habitats. p = the taxon has potential to occur on the forest. Assessments of trend, knowledge of distribution, and vulnerability were made by forest botanists/biologists and generally refer to occurrences on national forest system lands.

Scientific Name (common name) *listing status*	Acres of Known Habitat				Trends	Vulnerability on NFS lands	Overall Distribution (Knowledge of distribution on NFS lands)
	CNF	**SBNF**	**ANF**	**LPNF**			
Astragalus lentiginosus var. *coachellae* (Coachella Valley milk-vetch) *federally endangered*		p					Coachella Valley, potential habitat at low elevation on desert side of San Jacinto Mtns.; (low)
Astragalus tricarinatus (triple-ribbed milk-vetch) *federally endangered*		p					Coachella Valley, potential habitat at low elevation on desert side of San Jacinto Mtns.; (low)

no live plants were known, but a viable seed pool was presumed to exist in the soil and the species is expected to reappear when climatic conditions are favorable (USFWS 1992a). Plants typically occupy habitat below 2,600 feet, reportedly growing on canyon walls or on decomposed granite or gravelly soils at the base of canyon slopes. Plants have also been found on sandy or gravelly soils along the edges of boulder- strewn washes in Joshua tree woodland or Sonoran desert scrub (USFWS 1992a). Occurrences have not been found on the San Bernardino National Forest; however, potential habitat occurs in the San Jacinto Mountains.

Monterey and San Luis Obispo Coast Plants

Five rare plants are primarily associated with habitats along the coast of Monterey and San Luis Obispo counties. Summary information is shown in table 5.18.

Arctostaphylos cruzensis (La Cruz manzanita)

Arctostaphylos cruzensis is a Forest Service Sensitive Species. It is an evergreen shrub known from occurrences in southern Monterey and northwestern San Luis Obispo counties, where the species is found on sandy soils along the coast. Skinner and Pavlik (1994) report occurrences within several distinct vegetation types: broadleaved upland forest, coastal bluff scrub, closed-cone conifer forest, chaparral, coastal scrub, and valley-foothill grassland. Hickman (1993) describes habitat for this species as sandy bluffs below 500 feet elevation. Fewer than twenty occurrences are known, ranging in size from one plant to an estimated one thousand individual plants. Half of the known occurrences are located on private lands owned by the Hearst Corporation and may be subject to development. In Monterey County, one occurrence is found at Pacific Valley on the Los Padres National Forest (Matthews 1997).

Table 5.18. Rare plants found in Monterey Coast habitats. p = the taxon has potential to occur on the forest. Assessments of trend, knowledge of distribution, and vulnerability were made by forest botanists/biologists and generally refer to occurrences on national forest system lands (decl. = declining; unkn. = unknown).

Scientific Name (common name) *listing status*	Acres of Known Habitat				Trends	Vulner-ability on NFS lands	Overall Distribution (Knowledge of distribution on NFS lands)
	CNF	SBNF	ANF	LPNF			
Arctostaphylos cruzensis (La Cruz manzanita) *FS sensitive*				1	decl.	low	S Monterey & NW SLO cos., Monterey Coast; (moderate)
Delphinium hutchinsoniae (Hutchinson's larkspur) *FS sensitive*				2	decl.	low	Monterey Coast; (low)
Galium californicum ssp. *luciense* (Cone Peak bedstraw) *FS sensitive*				569	unkn.	low	Monterey Co., (N. Santa Lucia Rng.); (low)
Perideridia gairdneri ssp. *gairdneri* (Gairdner's yampah)	p		p	4		low	Monterey Co. north to Del Norte Co. (scarce south of Monterey Co.); (low)
Raillardiopsis muirii (Muir's raillardella) *FS sensitive*				8	stable	low	Monterey Coast, N Santa Lucia Rng., S Sierra Nevada; (moderate)

Delphinium hutchinsonae (Hutchinson's larkspur)

Delphinium hutchinsonae is a Forest Service Sensitive Species that is endemic to Monterey County. Occurrences are found from sea level to 1,300 feet elevation, on moist soils within broad-leaved upland forest, chaparral, coastal prairie, and coastal scrub habitats. Fewer than ten occurrences are known, the largest containing an estimated one hundred plants. Most of the known occurrences are located on private lands; however, one occurrence is located on the Los Padres National Forest and another occurs on land managed by the U.S. Coast Guard.

Galium californicum ssp. *luciense* (Cone Peak bedstraw)

Galium californicum ssp. *luciense* is a perennial taxon endemic to the northern Santa Lucia Range in Monterey County. Occurrences are found growing on talus or duff within broad-leaved upland forest, cismontane woodland, and conifer forest habitats. Between five and ten occurrences are known, four of them located in designated wilderness areas on the Los Padres National Forest.

Perideridia gairdneri ssp. *gairdneri* (Gairdner's yampah)

Perideridia gairdneri ssp. *gairdneri* was once widely distributed in California but is now thought to be extirpated in the southern portion of its range (i.e., Los Angeles, Orange, and San Diego counties) (Skinner and Pavlik 1994). Extant occurrences are found from Monterey County north to Del Norte County, California. The subspecies grows at sea level to about 1,200 feet in elevation, in mesic places (including vernal pools) within coastal flats, valley-foothill grasslands, chaparral, broad-leaved upland forests, and pine stands. Occurrences are mapped on the Monterey Ranger District of the Los Padres National Forest; however, this taxon is no longer identified as a sensitive species.

Raillardiopsis muirii (Muir's raillardella)

Raillardiopsis muirii is a Forest Service Sensitive Species known from nineteen occurrences that range across an estimated 200-mile section of the southern Sierra Nevada, from Fresno to Kern counties. One disjunct occurrence is found 160 miles to the west near the coast of Monterey County. This occurrence is located in the Ventana Wilderness Area (at Ventana Double Cone) on the Los Padres National Forest. The species grows from granite ledges and crevices and on gravelly or sandy flats in openings of montane chaparral, ponderosa pine forest, and mixed conifer forest.

Serpentine Plants

Ten rare plants are found primarily in association with serpentine soils. Within the assessment area, serpentine soils occur mainly in Monterey and San Luis Obispo counties. Summary information for these species is shown in table 5.19.

Calochortus obispoensis (San Luis mariposa lily)

Calochortus obispoensis is a Forest Service Sensitive Species. It is endemic to San Luis Obispo County and concentrated around the city of San Luis Obispo. Occurrences are known from Cuesta Ridge, Reservoir Canyon, and Brizzolari Canyon (fig. 5.18). The plants at Indian Knob grow on tar sands that may be a type of carbonate soil (McLeod 1984). There are eighteen recorded occurrences ranging in abundance from fewer than fifty plants to an estimated one thousand plants. One occurrence is protected in the Cuesta Ridge Botanical Area of the Los Padres National Forest, another occurrence is located in a county and city biosphere reserve, and several others are found on land owned by California Polytechnic San Luis Obispo (Cal Poly). Records kept by Forest Service resource personnel indicate that the species responds positively to wildfire.

Table 5.19. Rare plants found in association with serpentine soils. y = the taxon occurs on the forest. Assessments of trend, knowledge of distribution, and vulnerability were made by forest botanists/biologists and generally refer to occurrences on national forest system lands (unkn. = unknown; decl. = declining; incr. = increasing).

Scientific Name (common name) *listing status*	Acres of Known Habitat				Trends	Vulner-ability on NFS lands	Overall Distribution (Knowledge of distribution on NFS lands)
	CNF	**SBNF**	**ANF**	**LPNF**			
Calochortus obispoensis (San Luis mariposa lily) *FS sensitive*				520	unkn.	mod.	SLO Co., Santa Lucia Rngs.; (moder ate)
Carex obispoensis (San Luis Obispo sedge) *FS sensitive*				218	stable	mod.	SLO Co., Santa Lucia Rngs.; (low)
Caulanthus amplexicaulis var. *barbarae* (Santa Barbara jewelflower) *FS sensitive*				136	unkn.	low	San Rafael Mtns. (Santa Barbara Co.); (moderate)
Chlorogalum pomeridianum var*. minus* (dwarf soaproot)				290		low	SLO, Colusa, Lake, Sonoma, & Tehama cos.
Chorizanthe breweri (Brewer's spineflower) *FS sensitive*				1,081	stable	low	SLO Co., Santa Lucia Rngs.; (moder ate)
Fritillaria falcata (talus fritillary) *FS sensitive*				y	unkn.	low	Monterey, San Benito, Santa Clara, Stanislaus, & Alameda cos.; (moder ate)
Fritillaria viridea (San Benito fritillary) *FS sensitive*				36	unkn.	low	SLO, Monterey, & San Benito cos.; (low)
Galium hardhamiae (Hardham's bedstraw) *FS sensitive*				221	stable	low	Monterey & SLO cos., Santa Lucia Rngs.; (moderate)
Sanicula maritima (adobe sanicle) *FS sensitive*				3	decl.	high	coastal prairies in Monterey & SLO cos.; (moderate)
Sidalcea hickmanii ssp. *anomala* (Cuesta Pass checkerbloom) *FS sensitive*				522	stable/ incr.	low	SLO Co., Santa Lucia Rngs.; (high)

Carex obispoensis (San Luis Obispo sedge)

Carex obispoensis is a Forest Service Sensitive Species known from San Luis Obispo County. Potential habitat also exists in southern Monterey County (fig. 5.18). The sedge is found in ephemeral seeps with Sargent cypress at Cuesta Ridge, Reservoir Canyon, and as far north as Arroyo de la Cruz (McLeod 1984). It also grows under drier conditions in serpentine chaparral. About seventeen occurrences are documented. One is located on Department of Defense (DOD) land, three are within the Los Padres National Forest (one located in the Cuesta Ridge Botanical Area), and the rest occur on private lands owned for the most part by the Hearst Corporation.

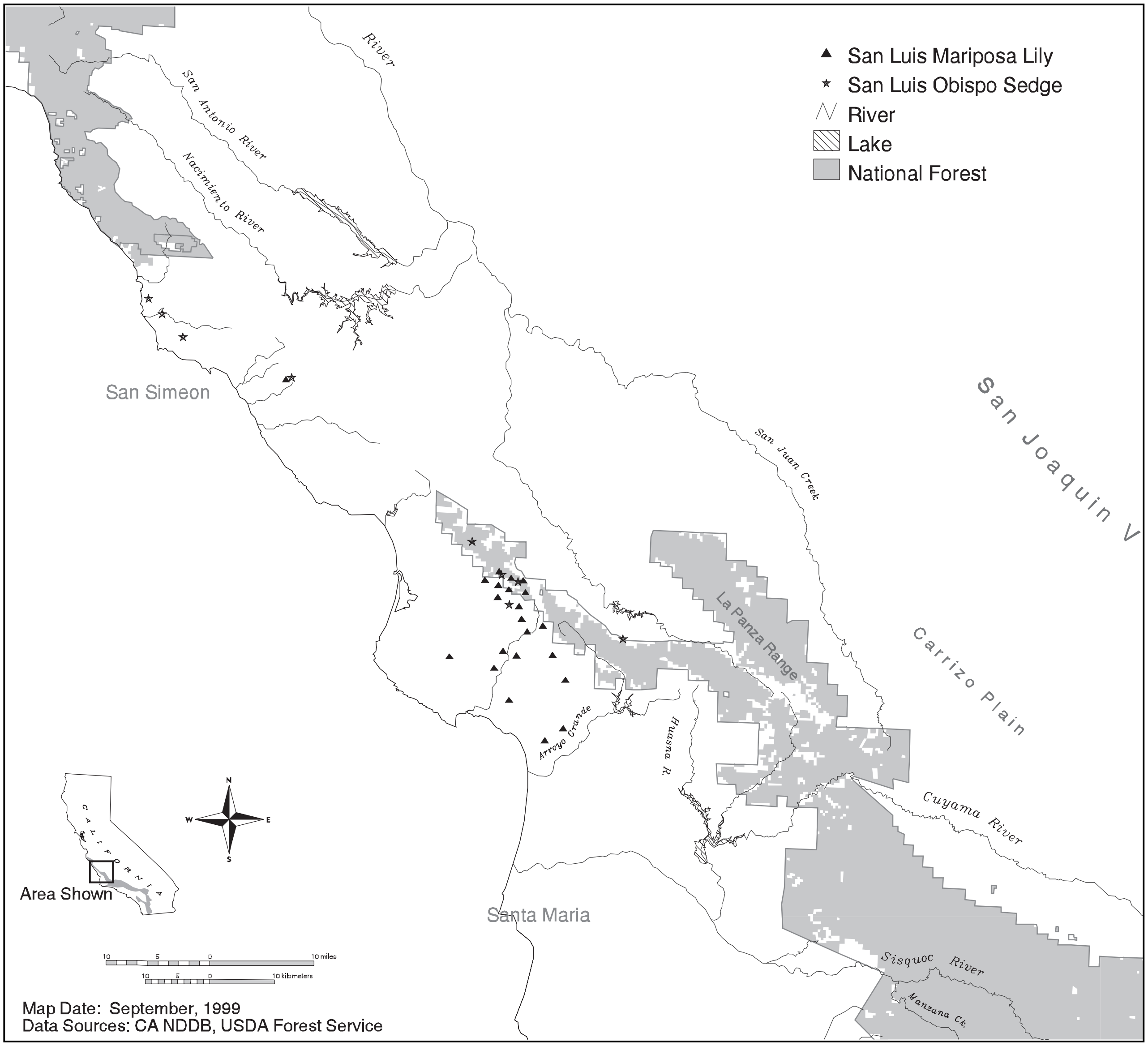


Figure 5.18. Documented locations of *Calochortus obispoensis*, the San Luis mariposa lily, and *Carex obispoensis,* the San Luis Obispo sedge.

Caulanthus amplexicaulis var. *barbarae* (Santa Barbara jewelflower)

Caulanthus amplexicaulis var. *barbarae* is a Forest Service Sensitive Species. An annual plant, it is found within the San Rafael Mountains of Santa Barbara County. About six occurrences are documented, five located within the Los Padres National Forest. The plant appears to respond positively to fall fires.

Chlorogalum pomeridianum var. *minus* (dwarf soaproot)

Chlorogalum pomeridianum var. *minus* is known from Colusa, Lake, Sonoma, Tehama, and San Luis Obispo counties. The species is no longer considered a Forest Service Sensitive Species.

Chorizanthe breweri (Brewer's spineflower)

Chorizanthe breweri is a Forest Service Sensitive Species. An annual plant, it is found on the Santa Lucia Ranger District of the Los Padres National Forest, from Cerro Alto to Lopez Mountain and at various other sites in San Luis Obispo County. Occurrences are known from Cuesta Ridge, Reservoir Canyon and Brizzolari Canyon. The *CNPS Inventory* cites about twenty occurrences. Four out of the thirteen occurrences recorded in the

CNDDB are located on national forest system lands. One known site on private land is threatened by development.

Fritillaria falcata (talus fritillary)

Fritillaria falcata is a Forest Service Sensitive Species. It occurs in Stanislaus, San Benito, Alameda, Santa Clara and Monterey counties. The CNDDB lists eleven occurrences. The number of plants recorded at each site is low, with only two having more than one hundred individuals. The taxon appears to grow almost exclusively on talus slopes derived of serpentine. Two occurrences within the Los Padres National Forest are protected in designated wilderness areas; however, they are not mapped (M Foster, unpubl. notes, 1998). Another two occurrences are found within the Hollister Resource Area on BLM land.

Fritillaria viridea (San Benito fritillary)

Fritillaria viridea is a Forest Service Sensitive Species known from West Cuesta Ridge in San Luis Obispo County and Mount San Carlos in San Benito County (Jenkins 1981). There are also reports from Monterey County; however, plants at this location may be another taxon. The CNDDB contains records for just six occurrences, yet the *CNPS Inventory* mentions that the species is more common than previously thought in San Benito County. One occurrence is protected within the Cuesta Ridge Botanical Area of the Los Padres National Forest and two occurrences are found in the Hollister Resource Area managed by the BLM. The species occurs on slopes within serpentine chaparral in the foothill and lower montane conifer zones. Most sources cite an adaptation to serpentine soils, but it has also been linked to calcareous shale on the Monterey Ranger District of the Los Padres National Forest (K. Danielsen, pers. comm). Habitat for the species has been negatively impacted by unauthorized OHV use and mining activities.

Galium hardhamiae (Hardham's bedstraw)

Galium hardhamiae is a Forest Service Sensitive Species that is endemic to Monterey and San Luis Obispo counties. This perennial plant occurs primarily with Sargent cypress in the Santa Lucia Ranges as far south as Cypress Mountain. The species occurs to a lesser degree in openings within serpentine chaparral where there are no cypress (Hardham 1962). The CNDDB lists seventeen occurrences. Nine occurrences, covering about 221 acres, are mapped within the Los Padres National Forest.

Sanicula maritima (adobe sanicle)

Sanicula maritima is a Forest Service Sensitive Species known from Monterey and San Luis Obispo counties, where it grows in coastal prairie habitat. Historic occurrences are documented for Alameda and San Francisco counties but are now believed to be extirpated. There are fewer than ten recorded occurrences of this perennial plant. The largest occurrence contained an estimated one thousand plants in 1983 and is located on land owned by the Hearst Corporation. One occurrence located on the Monterey Ranger District of the Los Padres National Forest consisted of three hundred plants in 1985. Two year later this estimate dropped to fewer than one hundred plants. Another occurrence is found on state park land and was reported in 1987 and 1990 to contain fewer than one hundred plants. The non-native grass, *Pennisetum clandestinum* (kikuyu grass) appears to be outcompeting *Sanicula maritima* in some areas.

Sidalcea hickmanii ssp. *anomala* (Cuesta Pass checkerbloom)

Sidalcea hickmanii ssp. *anomala* is a Forest Service Sensitive Species that is endemic to Cuesta Ridge in San Luis Obispo County. A perennial plant, it is known from three locations, mapped over 558 acres, in clearings among Sargent cypress. Most of these acres fall within the Los Padres National Forest and some populations are protected further within the Cuesta Ridge Botanical Area.

Habitat Generalist Plants

Seventeen rare plants either lack a strong association with a broad habitat type or their habitat associations are poorly understood. Summary information for these species is shown in table 5.20.

Androsace elongata ssp. *acuta* (California androsace)

Androsace elongata ssp. *acuta* is known from occurrences in Garner Valley (San Jacinto Mountains) and along the northern slope of the San Bernardino Mountains. In San Diego County, it reportedly occurs in the Cuyamaca Mountains, Montezuma Valley, and Warner Springs (Beauchamp 1986). These last two locations are inland desert valley grasslands which are privately owned. Potential habitat also occurs on BLM land in the San Felipe Hills and at Anza-Borrego Desert State Park. Its presence on the Los Padres National Forest is documented from herbarium specimens stored at the Santa Barbara Botanic Garden (D. Wilken, Santa Barbara Botanic Garden, in litt. 1998). More occurrences are reported in Kern County and south to Baja California, Mexico. In addition to grasslands, the species is found in chaparral, coastal sage scrub, and cismontane woodlands, but occurrences are highly localized.

Astragalus oocarpus (San Diego milk-vetch)

Astragalus oocarpus is a Forest Service Sensitive Species that is endemic to the mountains of San Diego County. Populations are located in the Palomar and Cuyamaca mountains, and near Volcan Mountain (Reiser 1994). About twenty occurrences are recorded in all, most on private lands, and about six on national forest system lands. Reiser writes that populations of this taxon are stable; however, Forest Service resource personnel consider it to be declining due to limited available habitat (Reiser 1994). The plant occurs at elevations from roughly 2,000 to 5,000 feet, in openings within chaparral, in oak woodland, and at the periphery of meadows. Known associates include manzanita and chamise. Like other *Astragalus, A. oocarpus* appears to be disturbance oriented; mild (but not prolonged) soil disturbance may be necessary to establish new individuals (Reiser 1994). The species is included in a conservation strategy for coastal sage scrub (USFS/USFWS/CDFG 1997).

Astragalus pachypus var. *jaegeri* (Jaeger's milk-vetch)

Astragalus pachypus var. *jaegeri* is a Forest Service Sensitive Species that is endemic to northern San Diego and southern Riverside counties. About seven occurrences are known, including in the Vail Lake area, south and east of Vail Lake towards Aguanga, at the northwestern edge of the Sonoran Desert, in the San Jacinto Mountains, and in the Agua Tibia Wilderness Area . One historical record is from near Warner Springs in San Diego County. The shrub has been located between roughly 1,600 and 3,000 feet elevation in sandy or rocky soil within coastal sage scrub, chaparral, cismontane woodland, and valley-foothill grasslands. California buckwheat and the federally endangered species, *Berberis nevinii,* are associates at the Vail Lake location (Reiser 1994). In San Diego County the taxon is presumed to be stable; however, those occurrences in Riverside County are at risk of removal due to proposed development projects near Potrero Creek and Vail Lake (Reiser 1994).

Atriplex parishii (Parish's brittle scale)

Atriplex parishii is a Forest Service Sensitive Species that is typically found on drying soils in alkali meadows, vernal pools, playas, and in chenopod scrub at low elevations within desert habitats (though some locations are reported up to 4,700 feet). The CNDDB contains records for eleven occurrences. Most of the recent collections are from the San Jacinto Valley in Riverside County. Historic occurrences are noted for Los Angeles, San Bernardino, and Orange counties. One of these occurrences may be from Vandeventer

Table 5.20. Rare plants with general or unknown habitat parameters. y = the taxon occurs on the forest; p = has potential to occur. Assessments of trend, knowledge of distribution, and vulnerability were made by forest botanists/biologists and generally refer to occurrences on national forest system lands (decl. = declining; unkn. = unknown).

Scientific Name (common name) *listing status*	Acres of Known Habitat CNF	SBNF	ANF	LPNF	Trends	Vulnerability on NFS lands	Overall Distribution (Knowledge of distribution on NFS lands)
Androsace elongata ssp. *acuta* (California androsace)	y	y		y	unkn.	unkn.	Garner Vlly. (San Jacinto Mtns.), San Bern. Mtns., Peninsular Ranges & desert of SD Co., San Felipe Hills, S Los Padres area, Kern Co., S to Baja; (low)
Astragalus oocarpus (San Diego milk-vetch) *FS sensitive*	123				decl.	low	Palomar, Cuyamaca, & Volcan mtns. (SD Co.); (moderate)
Astragalus pachypus var. *jaegeri* (Jaeger's milk-vetch) *FS sensitive*	y	p			unkn./ stable[1]	unkn.	N San Diego & S Riverside cos. (Vail Lake area, nw edge of Sonoron Desert, San Jacinto Mtns., desert areas of SD Co.); (low)
Atriplex parishii (Parish's brittle scale)		p					San Jacinto Valley & Palm Springs (Riverside Co.), h in LA, San Bern. & Orange cos., p in Sta. Rosa Mtns., Baja
Calystegia peirsonii (Peirson's morning-glory)			1				Los Angeles Co. (n San Gabriel Mtns. & adjacent areas of Mojave Desert (Antelope Valley); (low)
Fritillaria ojaiensis (Ojai fritillary) *FS sensitive*				40	unkn.	low	Ventura, Sta. Brbra, & SLO cos. (outer South Coast Ranges & W Transverse Ranges or S Los Padres region); (mod.)
Galium angustifolium ssp. *gabrielense* (San Antonio Cyn. bedstraw)		p	1		unkn.		E San Gabriel Mtns. (low)
Galium grande (San Gabriel bedstraw) *FS sensitive*			1				San Gabriel Mtns.
Hulsea vestita ssp. *gabrielensis* (San Gabriel Mtns. sunflower)		p	y	y			San Gabriel Mtns. & southern Los Padres region (Frazier & Alamo mtns.)
Hulsea vestita ssp. *parryi* (Parry's sunflower)		y					San Bernardino & Little San Bernar dino mtns.
Layia heterotricha (pale-yellow layia) *FS sensitive*				41	decl.	mod.	southern Los Padres region (Santa Barbara & Ventura cos.), Fresno Co.; (moderate)
Linanthus orcuttii (Orcutt's linanthus) *FS sensitive*	197		p		stable	mod.	Palomar and Laguna mtns. (SD Co.), Riverside & LA cos., Baja; (moderate)
Monardella macrantha ssp. *hallii* (Hall's monardella) *FS sensitive*	115	133	y		unkn./ decl.	low[2]/ mod.[3]	San Gabriel, San Bernardino, San Jacinto, Santa Ana, Palomar, & Cuyamaca mtns.; (high)
Phacelia exilis (Transverse Range phacelia)		y					San Bernardino Mtns., also LA, Ventura, Kern, & Tulare cos.
Phacelia mohavensis (Mojave phacelia)		y					San Gabriel & San Bernardino mtns.
Rupertia rigida (Parish's rupertia)	y	y			stable[2]/ unkn.[3]	low	San Bernardino & San Jacinto mtns., Peninsular Ranges of SD Co., Baja
Satureja chandleri (San Miguel savory) *FS sensitive*	273				stable	low	Santa Ana, San Miguel, Palomar & Laguna mtns., also foothills of SD Co., McGinty & Otay mtns., Jamul Mtns., Santa Rosa Plateau, Baja; (mod.)

[1] Reiser 1994 (refers to all known occurrences)
[2] on Cleveland National Forest
[3] on San Bernardino National Forest

Flats on the Santa Rosa Indian Reservation in the Santa Rosa Mountains (near the San Bernardino National Forest). Other historic occurrences close to the forest are reported for Palm Springs and Cushenbury Springs. The species is also known to occur in Baja California, Mexico.

Calystegia peirsonii (Peirson's morning-glory)

Calystegia peirsonii is a perennial species known from occurrences in Los Angeles County, in the northern San Gabriel Mountains and adjacent areas of the Mojave Desert (Antelope Valley). It grows on rocky slopes in coastal scrub, chaparral, chenopod scrub, cismontane woodland, and lower montane conifer forest habitats.

Fritillaria ojaiensis (Ojai fritillary)

Fritillaria ojaiensis is a Forest Service Sensitive Species that is known from about five occurrences in Ventura and Santa Barbara counties. The occurrences are distributed within the southern Los Padres region on the Los Padres National Forest. Potential habitat exists in San Luis Obispo County as well. Plants are found between 900 and 1,700 feet in elevation, growing on rocky soils in moist areas of chaparral, in mesic broad-leaved upland woodlands (often near drainages), and in lower montane conifer forests (Hickman 1993).

Galium angustifolium ssp. *gabrielense* (San Antonio Canyon bedstraw)

Galium angustifolium ssp. *gabrielense* is an uncommon perennial species distributed within the eastern San Gabriel Mountains near San Antonio Canyon. The CNDDB has no records for this taxon. It grows on drier slopes and ridges in chaparral and open forest and is associated with granitic, sandy, or rocky soil types. Occurrences range from lower montane conifer to subalpine habitats. The species is found on the Angeles National Forest and potential habitat also occurs on the San Bernardino National Forest.

Galium grande (San Gabriel bedstraw)

Galium grande is a Forest Service Sensitive Species. A deciduous shrub, it is known from occurrences in the San Gabriel Mountains. The species occupies chaparral, open broad-leaved upland forests, cismontane woodlands, and lower montane conifer forests, between 1,400 and 5,000 feet in elevation.

Hulsea vestita ssp. *gabrielensis* (San Gabriel Mountains sunflower)

Hulsea vestita ssp. *gabrielensis* is known from at least ten locations on national forest system lands in the San Gabriel Mountains and southern Los Padres region (at Frazier and Alamo mountains) (Wilken 1975, 1977). There is potential for this plant to occur in the western portion of the San Bernardino National Forest as well. This perennial plant grows on rocky soils in open areas of montane coniferous forest. Some collections appear intermediate to *H. vestita* ssp. *vestita* in the Sierra Nevada and *H. vestita* ssp. *parryi* in the San Bernardino Mountains; however, a numerical analysis and review of morphological variation have indicated that populations in the western Transverse Ranges represent a discrete taxon (S. White, Scott White Biological Consulting, in litt. 1998; Wilken 1977).

Hulsea vestita ssp. *parryi* (Parry's sunflower)

Hulsea vestita ssp. *parryi* is endemic to the eastern San Gabriel, San Bernardino, and Little San Bernardino mountains (S. White, Scott White Biological Consulting, in litt. 1998; Wilken 1975). At least ten occurrences are known in the San Bernardino Mountains, including one in the San Gorgonio Wilderness Area. Another occurrence is known at Joshua Tree National Monument. The San Bernardino National Forest maintains this subspecies on its watch list. A perennial plant, it typically grows on rocky soils or talus slopes in open areas of conifer forest between 6,500 and 8,900 feet. Recent collections on limestone soils in both conifer forest and pinyon-juniper woodland have tentatively been identified as this taxon; however, the species is highly variable.

Layia heterotricha **(pale-yellow layia)**

Layia heterotricha is a Forest Service Sensitive Species. It is known from extant populations in the southern Los Padres region of Santa Barbara and Ventura counties, and areas of Fresno County. It appears to be declining; historically the species was distributed in eight counties (Fresno, Kings, Kern, Monterey, Santa Barbara, San Benito, San Luis Obispo, and Ventura). The CNDDB contains records for twenty-nine occurrences, the majority based on herbarium specimens from the 1930s, 1940s, and 1950s. One occurrence, located in the Hollister Resource Area and managed by the BLM, contained an estimated five hundred plants in 1993. An occurrence on the Mount Pinos Ranger District of the Los Padres National Forest contained twelve plants in 1994. Many occurrences are believed to be extirpated. Four occurrences have been documented in the last fifteen years and the species is included in a conservation strategy (USFS/USFWS 1996). Construction of the San Antonio Reservoir, conversion of habitat for agricultural use, livestock grazing, invasion of non-native annuals, and possibly altered fire regimes are factors believed to have negatively affected this annual species. Occurrences range across foothill, lower montane, and montane conifer forest habitat. Plants are found in grasslands and open areas in foothill and pinyon-juniper woodlands. They grow on fragile soils variously described as sandy, calcareous, or an alkaline clay. On the Los Padres National Forest the species is associated with calcareous potreros (J. O'Hare, Angeles NF, pers. comm.).

Linanthus orcuttii **(Orcutt's linanthus)**

Linanthus orcuttii is a Forest Service Sensitive Species found in the Palomar and Laguna mountains of San Diego County, in Riverside and Los Angeles counties, and in Baja California, Mexico. There are approximately twenty-five known occurrences, most on public lands where they are fairly well protected. The species occurs in lower montane and montane conifer habitats, usually growing in vernally moist, open sites of chaparral or pine forest (D. Wilken, Santa Barbara Botanic Garden, in litt. 1998).

Monardella macrantha **ssp.** ***hallii*** **(Hall's monardella)**

Monardella macrantha ssp. *hallii* is a Forest Service Sensitive Species. It is an increasingly rare perennial taxon that occurs in the San Gabriel, San Bernardino, San Jacinto, Santa Ana, Palomar and Cuyamaca mountains. The plant occupies valley-foothill grasslands, chaparral, cismontane woodlands, broad-leaved upland forests, and lower montane conifer forests. It grows in rocky places and in openings in the vegetation. The CNDDB contains records for thirty-one occurrences and fourteen general locations. Graduate work done by Linda Allen at Cal Poly San Luis Obispo has shown that some of these occurrences are really an intermediate with *M. macrantha* ssp. *macrantha* (Allen 1994). Three occurrences on the San Bernardino National Forest are believed to be the subspecies *hallii.* One of these occurrences is located within the Cahuilla Mountain RNA where a portion of the population burned in the 1996 Diego Fire. Plants appeared to be thriving following this fire. Photographs of the area taken in 1998 show higher densities of the plant than before the fire (M. Lardner, San Bernardino NF, in litt. 1998). Another population grows partly along a flume line and an access road, indicating the plant may be somewhat disturbance oriented.

Phacelia exilis **(Transverse Range phacelia)**

Phacelia exilis is a watch-list plant on the San Bernardino National Forest. Occurrences are also known in Los Angeles, Ventura, Kern, and Tulare counties. The species is found in montane conifer forests, subalpine forests, meadows, and pebble plains. It can be locally common but is known from fewer than ten occurrences.

Phacelia mohavensis (Mojave phacelia)

Phacelia mohavensis is known from occurrences in the San Gabriel and San Bernardino mountains and is a watch-list plant on the San Bernardino National Forest. The species grows on sandy or gravelly soils, including dry streambeds, within pinyon-juniper woodlands and dry meadows. It also is found in cismontane woodlands and lower montane conifer forests.

Rupertia rigida (Parish's rupertia)

Rupertia rigida is a watch-list species on the San Bernardino and Cleveland national forests. Occurrences are known in Riverside, San Bernardino, and San Diego counties, and Baja California, Mexico. The perennial is uncommon but widely scattered in the San Bernardino and San Jacinto mountains and known from at least a dozen locations in the San Diego ranges (Beauchamp 1986). It grows within chaparral, cismontane woodlands, and montane conifer forests below 8,200 feet elevation. Cattle apparently avoid it, but the species is vulnerable to development projects which remove habitat on private lands. It has shown tolerance to stand thinning and prescribed burning at Palomar Mountain on the Cleveland National Forest.

Satureja chandleri (San Miguel savory)

Satureja chandleri is a Forest Service Sensitive Species found in the Santa Ana Mountains, several San Diego County mountains (San Miguel, McGinty, Otay, Jamul, Palomar and Laguna mountains), also near San Vicente Reservoir, at Sandia Creek near where it meets the Santa Margarita River, and on the Santa Rosa Plateau. It also occurs in Baja California, Mexico. There are an estimated twenty-five known occurrences, on federal, state, and private lands. The shrub grows on gabbro or volcanic soils in shaded areas of chamise chaparral, coastal scrub, oak woodlands, riparian woodlands, and valley-foothill grasslands. Disjunct occurrences in the Santa Ana Mountains occupy habitat that is more mesic than habitat in San Diego County and Baja (Reiser 1994). One large occurrence in the Santa Anas is located near a proposed development project; however, other occurrences in those mountains appear stable. Occurrences in San Diego County also appear to be stable. The species may be vulnerable to horticultural collecting.

Chapter 4 – Potentially Vulnerable Species: Animals

The last word in ignorance is the man who says of an animal or plant: 'What good is it?' If the land mechanism as a whole is good, then every part is good, whether we understand it or not. If the biota, in the course of aeons, has built something we like but do not understand, then who but a fool would discard seemingly useless parts? To keep every cog and wheel is the first precaution of intelligent tinkering.

—Aldo Leopold (1953)

Key Questions

- **Which species are rare or at risk in the coastal mountains and foothills of southern California?**
- **What is known about the status and distribution of each?**
- **What factors threaten their continued persistence?**
- **What is the potential for conserving on existing public lands?**
- **To what extent are they vulnerable to current agents of change?**

In chapters 4 and 5 we examine the current status and trends of species that, for a variety of reasons, may be vulnerable to extinction in the assessment area. Here in chapter 4 we address animals, and plants are considered in chapter 5. Taxa were selected using various "species of concern" lists that state and federal wildlife agencies and private conservation organizations have developed (fig. 4.1). Also identified were species that are considered common elsewhere but are rare or potentially at risk within the assessment area. Each identified species possesses one or more of the following traits: (1) occurs in only a few limited areas, (2) is particularly vulnerable to prevailing landscape changes, (3) has a small population size, (4) has large area requirements, or (5) there is a great deal of uncertainty about its distribution and abundance.

Using the fine-filter screening criteria, we identified 181 animals occurring within or near the assessment area which warrant individual consideration (fig 4.2). Thirty-one of these species are officially listed as threatened or endangered (table 4.1), and thus legally protected under the federal Endangered Species Act. The remaining 150 species could become candidates for federal listing in the future if measures are not taken to assure their conservation. Our primary objective was to use the available data on these species to

Figure 4.1. The fine-filter criteria used to identify rare or at-risk species. These species are addressed individually in this chapter.

- Threatened, Endangered, and Proposed Species (federal and state lists)
- A former USFWS Candidate (C1 and C2) Species
- A Forest Service, Region 5 Sensitive Species
- A California Species of Special Concern
- A Riparian Obligate Species of Concern (as defined by California Partners in Flight)
- A species determined to have viability concerns at a local level

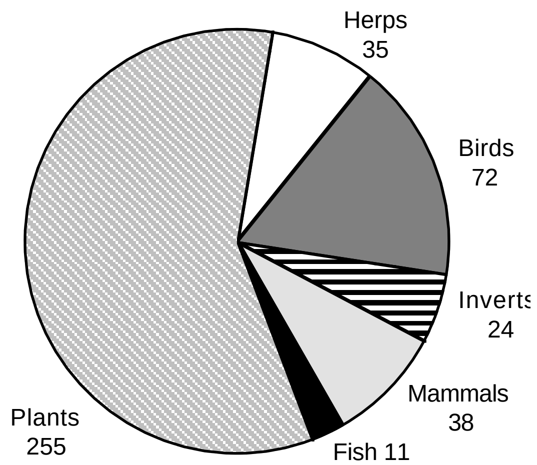


Figure 4.2. The breakdown of rare or at-risk species by taxonomic group.

assess their current status and vulnerability within the assessment area, and identify their conservation needs. This information can then be used when developing management priorities.

Several species that occurred within the assessment area as recently as 50 to 150 years ago are not addressed here because they are known to have been extirpated. These are the California grizzly bear *(Ursus arctos californicus)*, gray wolf *(Canis lupus fuscus)*, long-eared kit fox *(Vulpes macrotis macrotis)*, and pronghorn antelope *(Antilocapra americana)* (Williams 1986).

Evaluating Status and Conservation Potential

The potential for conservation, and the actions needed to conserve, vary considerably depending on the individual characteristics of each species. To evaluate those characteristics, we compiled information on species-habitat associations and used GIS coverages to predict habitat suitability across the landscape. Databases of habitat and life history information were compiled for both animals and plants. In addition, the locations of current and historic observations of these species were compiled and stored in a GIS database.

For vertebrate animals, we utilized information on distribution and habitat relationships from the CWHR database, but with modifications to tailor it more specifically to the habitats and geographic subregions in southern California. Following the ideas of Hansen and Urban (1992), we also collected available information on territory size, patch size requirements, resilience to stressors, feeding strategy, and nest height. This type of life history information was not available for many species.

There are some clear differences in the distribution of various taxa that have important ramifications for conservation and management. For example, many rare plants and invertebrates are narrowly endemic to a particular area (e.g., restricted to a single mountain range or watershed), while most rare vertebrates tend to be more widespread (fig. 4.3). Successful conservation strategies for more widespread species generally require a higher level of coordination and cooperation between landowners and jurisdictions.

Borrowing an approach developed by the Southern Orange County NCCP Scientific Advisory Committee (Atwood et al. 1996), we evaluated each species and placed it into a conservation category based on criteria that (1) consider its conservation needs, (2) assess the ability to meet those needs on public lands within the assessment area, and (3) evaluate the type of actions needed.

Determinations were made after analyzing available information on life history characteristics, degree of rarity or endemism, regional context, response to land use, extant population size and trend, and other variables as necessary. A matrix of species-specific characteristics was created to assist in this process. The categories and their associated criteria are described in table 4.2. A complete listing of all species by conservation category is located in appendix A. The findings from our species evaluations are summarized in the following sections.

Table 4.1. The thirty-one federally listed animal species occurring within or near the assessment area and their distribution by national forest (y = occurs, h = historically occurred, p = potential to occur, hyb = hybrid).

Common Name	Scientific Name	Federal Status	Year Listed	CNF	SBNF	ANF	LPNF
Invertebrates:							
Smith's blue butterfly	*Euphilotes enoptes smithi*	Endangered	1976				y
Quino checkerspot butterfly	*Euphydryas editha quino*	Endangered	1997	y	p	p	
Laguna Mountains skipper	*Pyrgus ruralis lagunae*	Endangered	1997	y			
Longhorn fairy shrimp	*Branchinecta longiantenna*	Endangered	1994				p
Vernal pool fairy shrimp	*Branchinecta lynchi*	Threatened	1994	p			p
Fish:							
Southern steelhead	*Oncorhynchus mykiss*	Endangered	1998	h/p	h	h	y
Mojave tui chub	*Gila bicolor mohavensis*	Endangered	1970		y^{hyb}		
Unarmored 3-spined stickleback	*Gasterosteus aculeatus williamsoni*	Endangered	1970		y	y	h
Tidewater goby	*Eucyclogobius newberryi*	Endangered	1994				p
Amphibians:							
Arroyo toad	*Bufo californicus*	Endangered	1994	y	y	y	y
California red-legged frog	*Rana aurora draytonii*	Threatened	1996	h/p	h/p	y	y
Reptiles:							
Desert tortoise	*Xerobates agassizii*	Threatened	1980		p	p	
Blunt-nosed leopard lizard	*Gambelia silus*	Endangered	1967				p
Birds:							
California brown pelican	*Pelecanus occidentalis californicus*	Endangered	1970				y
Western snowy plover	*Charadrius alexandrinus nivosus*	Threatened	1993				p
Marbled murrelet	*Brachyramphus marmoratus*	Threatened	1992				y
California condor	*Gymnogyps californianus*	Endangered	1967	h	h	h/p	y
Bald eagle	*Haliaeetus leucocephalus*	Threatened	1978	y	y	y	y
American peregrine falcon*	*Falco peregrinus anatum*	Endangered	1970	y	y	y	y
Southwestern willow flycatcher	*Empidonax traillii extimus*	Endangered	1995	y	y	y	p
California gnatcatcher	*Polioptila californica californica*	Threatened	1993	y	p		
Least Bell's vireo	*Vireo bellii pusillus*	Endangered	1986	y	p	p	y
Mammals:							
Pacific pocket mouse	*Perognathus longimembris pacificus*	Endangered	1994	p			
Giant kangaroo rat	*Dipodomys ingens*	Endangered	1987				h/p
Stephens' kangaroo rat	*Dipodomys stephensi*	Endangered	1988	p	p		
San Bernardino kangaroo rat	*Dipodomys merriami parvus*	Endangered	1998		y	p	
San Joaquin kit fox	*Vulpes macrotis mutica*	Endangered	1967				y
Peninsular bighorn sheep	*Ovis canadensis "cremnobates"*	Endangered	1998		y		
Southern sea otter	*Enhydra lutris nereis*	Threatened	1977				y
Steller sea lion	*Eumetopias jubatus*	Threatened	1990				y

* delisted in 1999 (USFWS 1999)

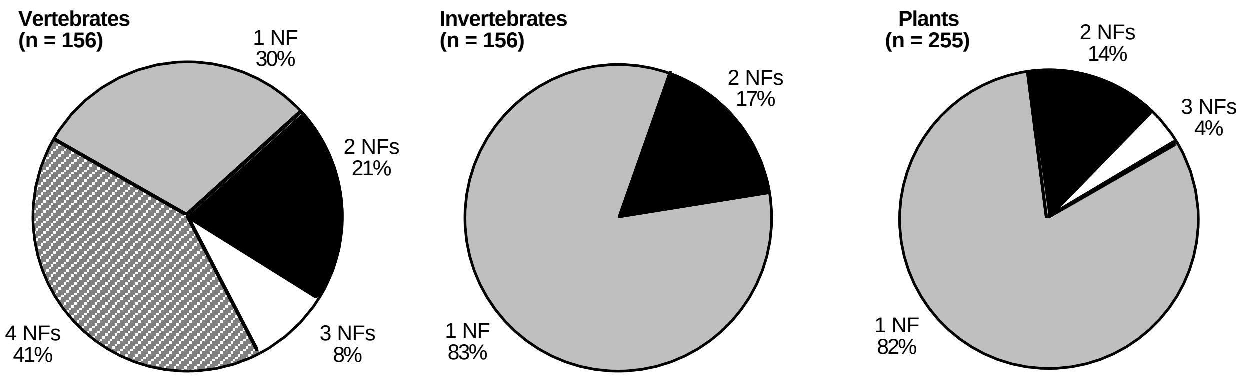


Figure 4.3. The distribution of rare species varies by type. Invertebrate and plant species tend to be much more localized, with over 80 percent occurring on only one national forest (NF) in the assessment area. Rare vertebrates are more widely distributed, with 41 percent occurring on all four national forests.

Table 4.2. The categories and criteria used to evaluate each species' conservation potential and needs on public lands within the assessment area.

Minimal Influence: Minimal ability to conserve on public lands within the assessment area
Species whose conservation is affected minimally by management of public lands in the mountains and foothills. Suitable habitat for these species occurs outside the assessment area (or at least outside of public lands within the assessment area), but they occur within the area only incidentally or in insignificant numbers.

Landscape Level: Species best conserved through habitat or landscape-level management
Species that can be conserved through management activities at the habitat or landscape scale. These species have relatively robust populations and/or have life history characteristics that respond to habitat-scale conservation. They tend to be predictable occupants of a broad habitat type or structural stage; thus, species-specific surveys are not crucial in order to conserve. Their persistence can be relatively accurately inferred in a well-managed, functioning landscape that is within the natural range of variability.

Site Specific: Species requires site-specific conservation attention
Organisms requiring species-level conservation action (including protection of individual locations) in order to ensure their persistence in the planning area. Species in this category have one or more of the following characteristics: extremely small populations, narrow endemism within the landscape, highly specialized life history requirements, high sensitivity to small changes in habitat, dependence on intensive conservation activities (e.g., exotic species control). The species in this category require one or more of the following conservation actions: (1) site-specific protections or habitat enhancements, (2) reintroductions, (3) additional data collection and research to determine basic needs.

To structure the evaluation process, we separated species into groups based on primary habitat associations. The groupings are clearly generalizations and few of the species fit perfectly within their assigned habitat group. Many species occupy additional habitats and others, particularly invertebrates, occur in only a small portion of the defined habitat association. Still, it is useful to organize species based on general factors that help predict their occurrence. The groups are defined primarily by associations with vegetation types, but soil, geology, moisture, and elevation were also used as habitat indicators.

Species Accounts

In the following sections, organized by habitat groups, we summarize what is known about the 165 potentially vulnerable animal species. We focus primarily on information that is specific to populations in or near the assessment area. The individual accounts vary considerably in length and specificity, reflecting the variability of available information. Some species have received a lot of research attention, while others have been almost entirely ignored. Because of the public interest and regulatory requirements associated with listed T&E species, there tends to be much more information about them. For many of the nonlisted species, the amount of information on specific occurrences or even habitat associations within the assessment area is remarkably small. Thus, we have tried to identify important information needs in the species accounts.

Tables in each section summarize the distribution of each species within the assessment area. Also provided are general estimates of (1) how much information exists documenting locations of the species in the southern California region, (2) what percentage of those locations are on national forest system lands, and (3) how vulnerable the species is to land uses and habitat changes occurring on national forest system lands in the assessment area. Population trend information is also shown if available and the assigned conservation category, based on criteria in table 4.2, is provided.

The estimates of distributional knowledge, percent of occurrences on national forest system lands, and overall vulnerability should be regarded as educated guesses based on available information and consultations with local experts. There is a particularly high level of uncertainty associated with the estimated percentage of occurrences that fall on national forest system lands. The vulnerability categories were based on sensitivity to the prevailing agents of change described in chapter 3, such as current fire and stream flow regimes, nonnative species, human land use activities, and pollution.

Habitat Generalists

Seventeen animal species that warrant individual consideration are best described as habitat generalists. Key habitat management issues identified for species in this group include (1) conservation of mesic microhabitats in arid upland plant communities, (2) protection of raptor cliff-nesting sites during the breeding season, and (3) protection of abandoned mine shafts that serve as important hibernacula and roosting habitat for several bat species. We conclude that only one of these species, the California condor, is highly vulnerable to existing agents of change on public lands within the assessment area (table 4.3).

California legless lizard *(Anniella pulchra)*

Status and Distribution: The legless lizard is a Forest Service Region 5 Sensitive Species and a California Species of Special Concern. Its geographic range overlaps extensively with the assessment area, although it is primarily found at low elevations. Its reported elevation range extends from sea level to approximately 5,700 feet in the Sierra Nevada foothills, but most historic localities along the central and southern California coast are below 3,500 feet (Jennings and Hayes 1994). Legless lizards are particularly well documented in coastal dune habitats, but the distribution map in Jennings and Hayes

Table 4.3. Habitat generalist animals that received individual consideration.
Displayed for each species: (1) the level of knowledge about where it occurs in southern California and, in parentheses, the estimated percentage of locations that are on national forest system lands; (2) the mountain subareas occupied (y = occurs in breeding season, h = historically occurred, p = potentially occurs, t = transient, w = winter visitor)—if the species is localized and data are available, the approximate number of occurrences may be displayed; (3) the vulnerability of populations on national forest system lands to existing threat factors; (4) population trends; and (5) the assigned conservation category.

Habitat Generalist Animals of Concern *federal status*	(1) Knowledge of SoCal Locations (% on NFs)	(2) areas occupied or estimated # of occurrences if spp. localized: Cleveland NF		San Bern. NF		Angeles NF		Los Padres NF			(3) Vulner-ability on NFs	(4) Pop. Trend	(5) Conser-vation Category
		San Diego Rngs	Snta Ana Mts	San Jac Mts	San Bern Mts	San Gab Mts	Cas-taic Rngs	So. LP Rngs	So. SL Rng	No. SL Rng			
Reptiles													
California legless lizard	Mod-Low (10-40%)	y	y	y	p	y	y	y	y	y	Low	Unkn	Landscape level
Coronado skink	Mod (10-50%)	y		y							Low	Unkn	Landscape level
San Bernardino ringneck snake	Mod-Low (10-40%)		y		y	y	p	p			Low	Unkn	Landscape level
San Diego ringneck snake	Mod-Low (10-30%)	y	p	y							Low	Unkn	Landscape level
Cliff-Nesting Birds													
California condor *endangered*	High (> 70%)	h	h	h	h	h	h/p	16	12	p	**High**	Incr	Site specific
Golden eagle	High (30-60%)	y	y	y	y	y	y	y	y	y	Mod	Decl[1]	Landscape level
Peregrine falcon *endangered**	Mod (< 20%)	y	p	p	p	p	p	p	p	y	Mod	Incr[2]	Site specific (nest sites)
Prairie falcon	Mod (30-60%)	y	p	y	y	y	y	y	y	y	Mod	Unkn	Landscape level
Mammals													
Yuma myotis bat	Mod (20-40%)	y	y	y	y	y	y	y	y	y	Low	Unkn	Landscape level
Western small-footed myotis bat	Mod (40-70%)	y	y	y	y	y	y	y	y	y	Low	Unkn	Landscape level
Spotted bat	Low (?)	y	p	y	y	y	y	p			Low	Unkn	Landscape level
Townsend's big-eared bat	Mod (30-60%)	y	y	y	y	y	y	y	y	y	Mod	Unkn	Site specific (mine roosts)
Pallid bat	Low (10-30%)	y	y	y	y	y	y	y	y	y	Low	Unkn	Landscape level
Western mastiff bat	Mod (10-50%)	y	y	y	y	y	y	y	p	p	Low	Unkn	Landscape level
California chipmunk	Mod (40-70%)			y	y						Low	Unkn	Landscape level
Western spotted skunk	Low (30-70%)	y	y	y	y	y	y	y	y	y	Low	Unkn	Landscape level
American badger	Low (< 20%)	y	y	y	y	y	y	y	y	y	Mod	Decl[3]	Site specific

[1] Declining in San Diego County based on monitoring done by San Diego Golden Eagle Study Group
[2] Based on rangewide information from Cade et al. 1997
[3] Williams 1986
* formally removed from the Endangered Species List in 1999 (USFWS 1999)

(1994) suggests they probably occur in the lower reaches of all our mountain subareas with the possible exception of the San Bernardino Mountains.

Habitat: The California legless lizard is a burrowing species associated with sandy or loose loamy soils under the sparse vegetation of beaches, chaparral, or pine-oak woodland, or under sycamores, cottonwoods, or oaks growing on stream terraces (Jennings and Hayes 1994). It also occurs in desert scrub along the western edge of the Mojave Desert near Lancaster and in western portions of Anza-Borrego Desert State Park. Legless lizards are often found under surface objects such as logs, rocks, and leaf litter. Soil moisture is essential for them and legless lizards die if they are unable to reach a moist substrate (Bury and Balgooyen 1976).

Fisher and Case (1997) describe finding legless lizards at several locations in the eastern Santa Ana Mountains (i.e. Indian Canyon, Ortega Highway, and upper Tenaja Truck Trail) under oak woodland, chaparral, and coastal scrub vegetation in decomposing granite soils. They suggest that the distribution of these lizards in foothill and lower montane areas may be closely tied to decomposing granite soils.

Conservation Considerations: Given the legless lizard's habitat requirements, life history characteristics, and relatively broad distribution, we believe it is not highly vulnerable to existing agents of change in the mountains and foothills. Thus, populations on public lands within the assessment area can be adequately conserved through landscape-scale, habitat-based management. However, given the limited amount of information on the distribution and abundance of this species in foothill and lower montane areas, we do wonder if these upper-elevation habitats are productive enough to support self-sustaining populations. Habitat connections to wildland reserves in the coastal and inland valleys may be important for this species. Also, Jennings and Hayes (1994) describe problems associated with invasive non-native plants in coastal dune habitats. Exotic plants could be a problem for legless lizards in other habitats too, especially if they affect soil moisture.

Coronado skink
(Eumeces skiltonianus interparietalis)

Status and Distribution: A subspecies of western skink, the Coronado skink is a California Species of Special Concern. It reportedly inhabits the coastal plain and Peninsular Ranges west of the deserts from approximately San Gorgonio Pass southward into Baja California (Jennings and Hayes 1994). However, there are problems with the taxonomy of Pacific Coast skinks in general and with the morphological characteristics used to distinguish the Coronado skink in particular (Jennings and Hayes 1994).

Fisher and Case (1997) report that the characteristics used to identify the Coronado subspecies are ill defined and the main character (shape of the interparietal) is variable and never occurs in a large proportion of individuals, even at locations within the range of the proported subspecies. They found *Eumeces skiltonianus* at study sites near Big Bear in the San Bernardino Mountains; at the James Reserve in the San Jacinto Mountains; at Palomar Mountain, Otay Mountain, and Japatul in San Diego County; and at Starr Ranch in the Santa Ana Mountains. However, they could not reliably separate *E. s. interparietalis* from the more common *E. s. skiltonianus* based on morphological characteristics (Fisher and Case 1997).

Habitat: The Coronado skink reportedly occurs in a variety of plant associations including coastal sage scrub, chaparral, oak woodlands, pinyon-juniper woodlands, riparian woodlands, and coniferous forests. However, within these associations it is often restricted to more mesic microhabitats (Jennings and Hayes 1994).

Conservation Considerations: As suggested by Jennings and Hayes (1994) and Fisher and Case (1997), a review of the systematic status of the Coronado skink relative to other western skinks is needed to determine if it really warrants subspecies status and, if so, to better describe identifying characteristics. The Coronado skink has a relatively broad distribution, and the work of Fisher and Case (1997) suggests it is fairly common in areas of suitable habitat. Thus, we believe it can be adequately conserved through landscape-scale, habitat-based management. Jennings and Hayes (1994) express concern about the drying up of mesic microhabitats due to human use of surface and underground water resources and the effect it may have on this species. Management consideration should be given to identifying and conserving these microhabitats. It appears that trends in skink abundance can be effectively monitored using pitfall trap arrays (Fisher and Case 1997).

San Bernardino ringneck snake
(Diadophis punctatus modestus)

Status and Distribution: The San Bernardino ringneck snake is a Forest Service Region 5 Sensitive Species. Information on its distribution within the assessment area is scant. Most museum specimens are from coastal basins and inland valleys. Blanchard (1942) documents occurrences in Miller Canyon in the San Gabriel Mountains, Mill Creek and the upper Santa Ana River (near Lost Creek) in the San Bernardino Mountains, and in Trabuco Canyon in Orange County (potentially within the Santa Ana Mountains). Fisher and Case (1997) found ringneck snakes on Starr Ranch at the foot of the Santa Ana Mountains but did not identify them to subspecies.

Habitat: Ringneck snakes are found in a wide variety of habitats from sea level to 6,400 feet (Blanchard 1942). Existing distributional information is spotty, but it appears that these snakes are more common at low elevation sites (i.e., below 3,000 feet). Ringneck snakes are not strongly associated with riparian habitats, but the apparent importance of tree frogs and slender salamanders in their diet (Blanchard 1942; Stebbins 1972) suggests they may seek out and require moist microclimates. This is also suggested by their reported absence from desert-side habitats (Blanchard 1942). Ringneck snakes are rarely seen on the surface but rather are found under rocks, logs, or leaf litter.

Conservation Considerations: The ringneck snake's secretive nature, relatively broad distribution, and generalized habitat associations suggest it can be conserved through landscape-scale, habitat-based management. It does not seem particularly vulnerable to existing change agents on public lands. Mesic microhabitats in otherwise arid, upland vegetation types appear to be important to this species. Management consideration should be given to identifying and conserving these microhabitats. It would be very difficult to monitor population trends of ringneck snakes across a broad region in a reliable manner.

San Diego ringneck snake
(Diadophis punctatus similis)

Status and Distribution: The San Diego ringneck snake is a Forest Service Region 5 Sensitive Species. Recent information on its distribution within the assessment area is scant. Fisher and Case (1997) found ringneck snakes in Hall Canyon in the San Jacinto Mountains, and on Otay Mountain in San Diego County and also report them as being widespread at low-elevation inland valley sites in Riverside and San Diego counties. Other recently reported localities in the San Jacinto Mountains include Apple Canyon, upper Hurkey Creek, Idyllwild, Dark Canyon, and Vista Grande Fire Station (D. Freeman, San Jacinto Ranger District, unpubl. notes). In San Diego County, they have recently been detected in Pamo Valley and Barona Creek (D. Mayer, Merkel & Associates, pers. comm.).

Blanchard (1942) documents occurrences in Strawberry Canyon in the San Jacinto Mountains and in Pine Valley, Santa Ysabel, Warner Springs, Witch Creek, and Wynola in the mountains of San Diego County. Unpublished maps based on Laurence Klauber's work from the 1920s through the 1940s show the San Diego localities reported by Blanchard and also additional ones within the assessment area at Pine Valley, Laguna Mountain, Cuyamaca Lake, Boulder Creek, Pine Hills, and the south side of Palomar Mountain.

Habitat: Similar to that described for the San Bernardino ringneck snake. The highest recorded elevation is 5,500 feet. Blanchard (1942) reports that most specimens of this subspecies came from coastal areas, with smaller numbers from inland valleys and foothills, and only a few from the mountains. This pattern is also reflected in the maps of Klauber's collections. Fisher and Case (1997) report that ringneck snakes were widespread in coastal sage scrub and oak woodland habitats at coastal sites in San Diego and Orange counties and at inland valley sites in Riverside County. Holland and Goodman (1998) found this snake on Camp Pendleton in coastal sage scrub, chaparral, oak woodland, grassland, and riparian areas.

Conservation Considerations: Same as those described for the San Bernardino ringneck snake.

California condor *(Gymnogyps californianus)*

Status and Distribution: The California condor was federally listed as an endangered species in 1967. In 1987, after years of steady population declines, the last nine wild condors were captured on the Los Padres National Forest and brought into captivity. Since that time successful captive breeding programs have been ongoing at the Los Angeles Zoo and San Diego Wild Animal Park (AZA 1995).

In January 1992, the first two California condors were reintroduced into the Los Padres National Forest's Sespe Condor Sanctuary, along with two Andean condors. A total of thirteen California condors were released at the Sespe Sanctuary from 1992 to 1994. Five of these died, four from collisions with power lines and one from ingesting ethylene glycol, a poisonous ingredient of antifreeze (AZA 1995). The remaining eight were recaptured in March 1995 because of their tendency to use powerlines poles for day perches and overnight roosts.

Since that time, negative conditioning has been used prior to release to train the condors to avoid powerlines. Alternative release sites, in more remote locations, have also been used. Release sites on the Los Padres National Forest include the Sierra Madre Mountains and the Castle Crags area (Fig. 4.4) (AZA 1995). These actions have improved the success of subsequent releases. As of February 1999, there were reportedly 28 wild condors in the vicinity of the Los Padres National Forest release sites (CDFG 1999). Another 22 condors are in the wild on the Vermillion Cliffs of Arizona and 97 remain in captivity at three different breeding facilities, for a total population of 147 birds (CDFG 1999).

Habitat: Condors generally nest on cliffs, although they have been observed using cavities in large redwood trees (Jurek 1997). They are carrion feeders and often travel long distances in search of large dead animals such as deer, antelope, cattle, and sheep.

Conservation Considerations: Factors that led to the condor's century-long decline include illegal collection of adults and their eggs, poisoning from substances put out by ranchers to eradicate livestock predators, poisoning from ingesting lead fragments from bullets embedded in animal carcasses the condors feed on, and collisions with structures such as power lines. In addition, the roads, cities, housing tracts, and weekend mountain retreats of modern civilization have replaced much of the open country condors need to find food. Their slow rate of reproduction and years spent reaching breeding maturity undoubtedly make the condor population as a whole more vulnerable to these threats.

Keys to the success of the recovery program include successful breeding in the wild and maintenance of an ample food supply. The first nesting of released condors cannot be expected for at least three to five more years (sometime between 2000 and 2010) (Jurek 1997). Currently, supplemental food is hauled in for the wild birds. It remains to be seen if the natural supply of large carrion is sufficient to support a stable condor population.

Golden eagle *(Aquila chrysaetos)*

Status and Distribution: The golden eagle is a California Species of Special Concern. It

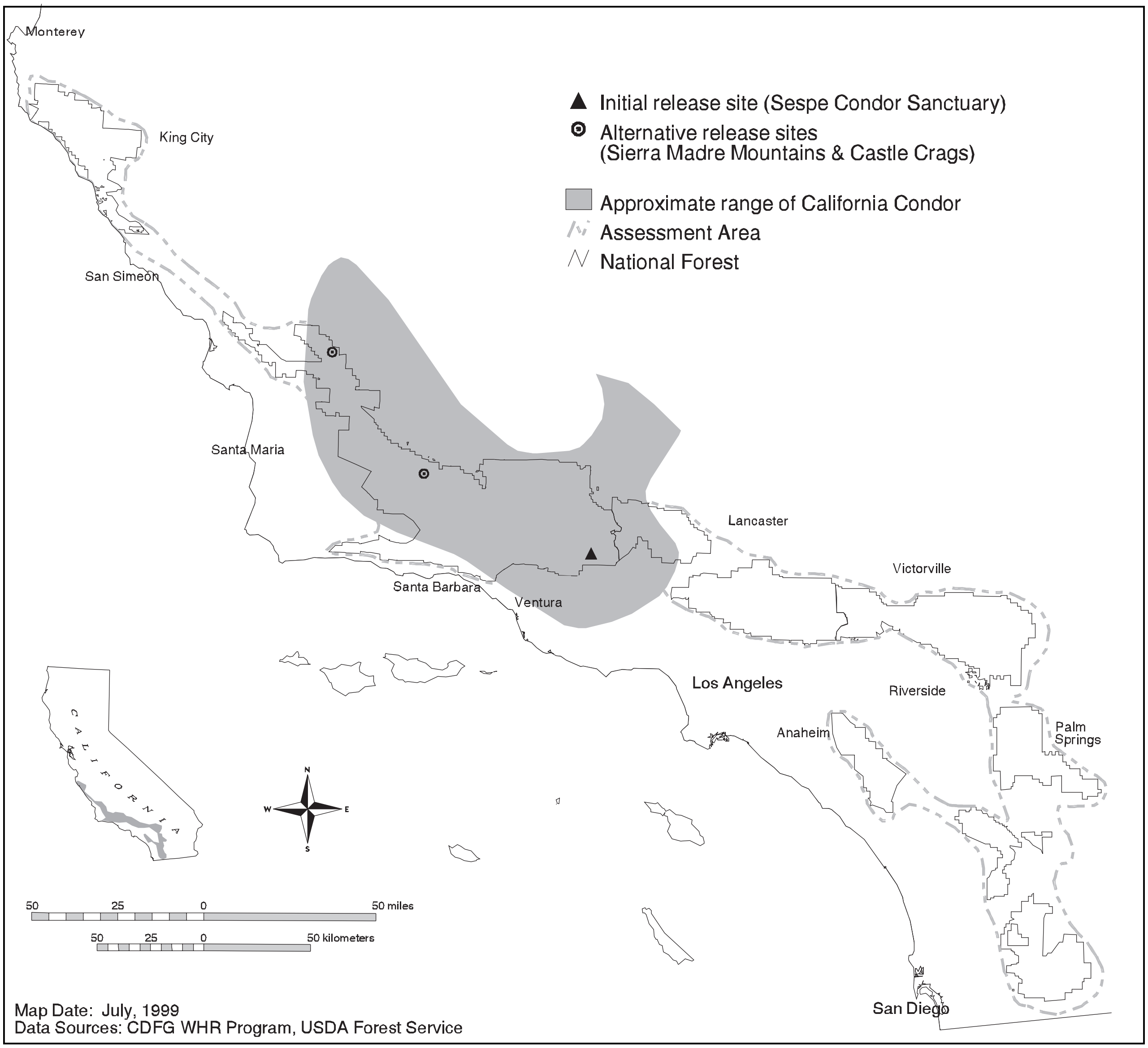


Figure 4.4. Areas currently occupied by California condors on the Los Padres National Forest.

is uncommon, but widely distributed throughout the assessment area, particularly in foothill, lower montane, and desert-montane habitats. Monitoring of historic territories by the San Diego Golden Eagle Study Group has documented a substantial decline in the San Diego County population (D. Bittner and J. Oakley, pers. comm.). Drops in territory occupancy are most apparent in the coastal foothills where there is rapid urban growth.

Habitat: Golden eagles nest primarily on cliffs and hunt for rabbits and other small mammals in nearby open habitats such as grasslands, oak savannas, and open shrublands.

Conservation Considerations: Developments on private lands that encroach on key foraging areas are a problem for golden eagles, particularly in the southern half of the assessment area. There appears to be ample nesting habitat on public land, but in many places the highest quality foraging areas are on private land. Increased recreational activity in the vicinity of cliff nests, particularly rock climbing, is also a problem in some areas and can cause eagles to abandon a site. Management consideration should be given to identifying and protecting active nest sites during the breeding season.

American peregrine falcon *(Falco peregrinus anatum)*

Status and Distribution: The peregrine falcon was removed from the Endangered Species List in August 1999. (USFWS 1999). It is rare but widely distributed across southern and central California, usually near the coast or in other areas where migrant waterfowl or shorebirds are concentrated (e.g., inland reservoirs) (Garrett and Dunn 1981). Peregrine falcons are more common in northern portions of the assessment area that are relatively close to coastal wetlands (i.e., the northern and southern Santa Lucia Ranges and the Santa Ynez Mountains).

Widespread and indiscriminate use of DDT in the middle of the century caused a drastic decline in U.S. peregrine populations. The pesticide, which accumulates in the aquatic food chain, causes a thinning of peregrine egg shells which lowers reproductive success. Bans on the use of DDT in the 1970s and a major reintroduction campaign led by the Peregrine Fund have resulted in an impressive increase in the distribution and abundance of this bird over the last twenty years (Cade et al. 1997). The population increase has been substantial enough to warrant the peregrine's delisting (Mesta et al. 1995; Cade et al. 1997), although this decision is controversial (Pagel et al. 1996; Pagel and Bell 1997).

In the 1980s, a number of peregrine reintroductions were attempted on the southern California national forests. Most of these birds did not remain in the vicinity of release sites.

Habitat: Peregrine falcons nest high on cliffs, usually near water. Much of the assessment area is not high-quality habitat for this species because of the lack of water bodies that concentrate its preferred prey.

Conservation Considerations: Protection of cliff nesting sites from human disturbance is an important conservation measure for peregrine falcons.

Prairie falcon *(Falco mexicanus)*

Status and Distribution: The prairie falcon is a California Species of Special Concern. It is uncommon but widely distributed in the assessment area. Like the golden eagle, it has declined in the coastal foothills, probably due to the loss of foraging habitat (Garrett and Dunn 1981).

The prairie falcon's diet of nonaquatic birds helped it escape the widespread, DDT-induced declines experienced by the peregrine falcon. However, localized occurrences of egg thinning in prairie falcons have been reported.

Habitat: Prairie falcons nest on cliffs, generally in arid open areas. Desert scrub and grasslands are preferred foraging habitats (Garrett and Dunn 1981).

Conservation Considerations: Same as those described for the golden eagle and peregrine falcon.

Yuma myotis bat *(Myotis yumanensis)*

Status and Distribution: The Yuma myotis bat is currently a California Species of Special Concern, although it may soon be removed based on a recent status review (P. Collins, Santa Barbara Nat. History Museum, pers. comm.). In bat surveys conducted by the Forest Service from 1996 to 1998, Yuma myotis was detected at eighteen of seventy-six sites surveyed (Simons et al. in prep.). It was observed at three or more locations on each of the four national forests. Yuma myotis was found at elevations ranging from 1,400 to 7,700 feet, but was most commonly detected at sites below 5,000 feet (thirteen of the eighteen sites).

Habitat: Yuma myotis occurs in a variety of habitats including riparian, arid scrublands, deserts, and forests (Bogan et al. 1998a). It is usually associated with permanent sources of water, typically rivers and streams, where it does most of its foraging. Yuma myotis roosts in bridges, buildings, cliff crevices, caves, mines, and trees (Bogan et al. 1998a).

Conservation Considerations: The Yuma myotis bat appears to be well represented on public lands in the assessment area, particularly at elevations below 5,000 feet on both coastal and desert slopes. The ability of this species to utilize a wide range of roost types reduces its vulnerability. Identification and protection of maturity colony sites (e.g., in caves, mines, or structures) is important to the conservation of this species.

Western small-footed myotis bat *(Myotis ciliolabrum)*

Status and Distribution: The small-footed myotis bat is a former C2 candidate species. It was detected at twenty-four of seventy-six sites surveyed from 1996 to 1998, at elevations ranging from 3,800 to 7,800 feet (Simons et al. in prep.). It was the fourth most commonly detected bat species in that survey and was observed at four or more locations on each of the four national forests.

Habitat: The small-footed myotis is said to occur in deserts, chaparral, riparian zones, and coniferous forest, and, most commonly, in pinyon-juniper forests (Bogan et al. 1998b). Local surveys found this species most frequently in montane conifer forests and desert montane habitats (Simons et al. in prep.). This bat utilizes a variety of roost types.

Conservation Considerations: The western small-footed myotis bat appears to be well represented on public lands in the assessment area and its habitat requirements indicate relatively low vulnerability to existing agents of change. The ability of this species to use a variety of roost types reduces its vulnerability. Identification and protection of maturity colony sites (e.g., in caves, mines, or structures) is important to the conservation of this species.

Spotted bat *(Euderma maculatum)*

Status and Distribution: The spotted bat is a California Species of Special Concern. There is little current information on its distribution in the assessment area. It was detected at only two of seventy-six sites surveyed from 1996 to 1998 (on Palomar Mountain and in the Sierra Madre Mountains), but it is not a species that is often caught in mist nets (Simons et al. in prep.).

Habitat: Spotted bats forage in a wide variety of habitats but roost strictly in cliffs, which may limit their distribution (Luce 1998).

Conservation Considerations: More information is needed on the distribution and abundance of spotted bats within the assessment area. Their habit of roosting in cliffs reduces vulnerability to land use activities.

Townsend's big-eared bat *(Corynorhinus townsendii)*

Status and Distribution: The Townsend's big-eared bat is a Forest Service Region 5 Sensitive Species and a California Species of Special Concern. It was detected at six of seventy-six sites surveyed from 1996 to 1998 in the mountains and foothills of southern California (one site on San Bernardino National Forest and five sites on Cleveland National Forest) (Simons et al. in prep.). More importantly, it was found at fourteen abandoned mine locations in the northeastern San Bernardino Mountains, with fifty-five individuals observed in one mine (Simons et al. in prep.). It has also been documented in several abandoned mines in the Laguna Mountains.

Habitat: The distribution of this species is strongly correlated with the availability of caves and cave-like roosting habitat, with population centers occurring in areas dominated by exposed, cavity forming rock and/or historic mining areas (Sherwin 1998a). Abandoned mines are particularly important in areas where there are not well developed caves.

Conservation Considerations: The Townsend's big-eared bat's dependence on abandoned mines for roosting makes it moderately vulnerable to ongoing activities. Mine vandalism and over-utilization of these sites are problems in a number of areas. Identification and protection of significant roost sites is key to the conservation of this species. Additional surveys are needed to identify roost sites. Several important roost sites have recently been identified and protected (by installing bat gates across mine entrances) in the San Bernardino Mountains (Lisa Underwood, Mountaintop District, pers. comm.).

Pallid bat *(Antrozous pallidus)*

Status and Distribution: The pallid bat is a Forest Service Region 5 Sensitive Species and a California Species of Special Concern. It was detected at seven of seventy-six sites surveyed from 1996 to 1998 in the mountains and foothills of southern California (four sites on Los Padres National Forest, three sites on Angeles National Forest), at elevations ranging from 1,100 to 6,600 feet (Simons et al. in prep.). It was not detected in abandoned mine surveys in the northeastern San Bernardino Mountains (Simons et al. in prep.).

Habitat: Pallid bats roost in rock crevices, tree hollows, mines, caves, and a variety of man-made structures (Sherwin 1998b). Local data suggest that this species may be most common at elevations below 6,000 feet on both coastal and desert sides (Simons et al. in prep.).

Conservation Considerations: It is difficult to determine how widely distributed or abundant pallid bats are in the assessment area and more information is needed. Their ability to roost in a wide variety of sites may help reduce their vulnerability to human activities.

Western mastiff bat *(Eumops perotis)*

Status and Distribution: The western mastiff bat is a California Species of Special Concern. It was detected at twenty-five of seventy-six sites surveyed from 1996 to 1998 in the mountains and foothills of southern California (Simons et al. in prep.). It was the third most commonly detected bat species in that survey and was found on all four national forests, in a variety of habitats, and across a broad elevation range (1,100 to 7,600 feet).

Habitat: The mastiff bat is primarily a cliff-dwelling species, where maternity colonies of thirty to several hundred (typically fewer than one hundred) roost generally under exfoliating rock slabs (e.g., granite, sandstone, or columnar basalt) (Pierson 1998). It can also be found in similar crevices in large boulders and buildings. Mastiff bats are found in a wide variety of habitats, but the species' distribution may be geomorphically determined, occurring primarily where there are significant rock features offering suitable roosting habitat (Pierson and Rainey 1996; Pierson 1998).

Conservation Considerations: The western mastiff bat appears to be widespread in the assessment area, although its abundance is unknown. The habitat requirements of this species indicate relatively low vulnerability to existing agents of change on public lands. Management attention should be given to conserving cliff and rock habitats that provide important roost sites. More complete information is needed on the distribution and abundance of this species in the assessment area.

California chipmunk *(Tamias obscurus davisi)*

Status and Distribution: The California chipmunk is not considered to be rare, but we include it as a local species of concern because its distribution is small and largely within the assessment area (Callahan 1977; Zeiner et al. 1990). The subspecies *T. o. davisi* is known only from the San Bernardino, Little San Bernardino, Eagle, San Jacinto and Santa Rosa mountains of southern California (fig. 4.5) (Callahan 1977). It is reportedly common on desert-facing slopes of the eastern San Bernardino Mountains eastward through the desert ranges of Joshua Tree National Monument and in montane conifer habitats in the San Jacinto and Santa Rosa mountains.

Habitat: North of San Gorgonio Pass, *T. o. davisi* is largely restricted to rocky areas in pinyon-juniper woodland below about 6,700 feet. It is replaced at higher elevations by the closely related Merriam's chipmunk *(Tamias merriami)*. South of San Gorgonio Pass, the species are distributed in an opposite pattern: The California chipmunk replaces the Merriam's chipmunk in plant communities higher than pinyon-juniper woodlands and occurs at elevations up to 8,700 feet (Callahan 1977).

Conservation Considerations: It would be helpful to have some current information on the status of this narrowly distributed species. However, most of the California chipmunk's range is on public land and its habitat requirements generally indicate low vulnerability to existing agents of change.

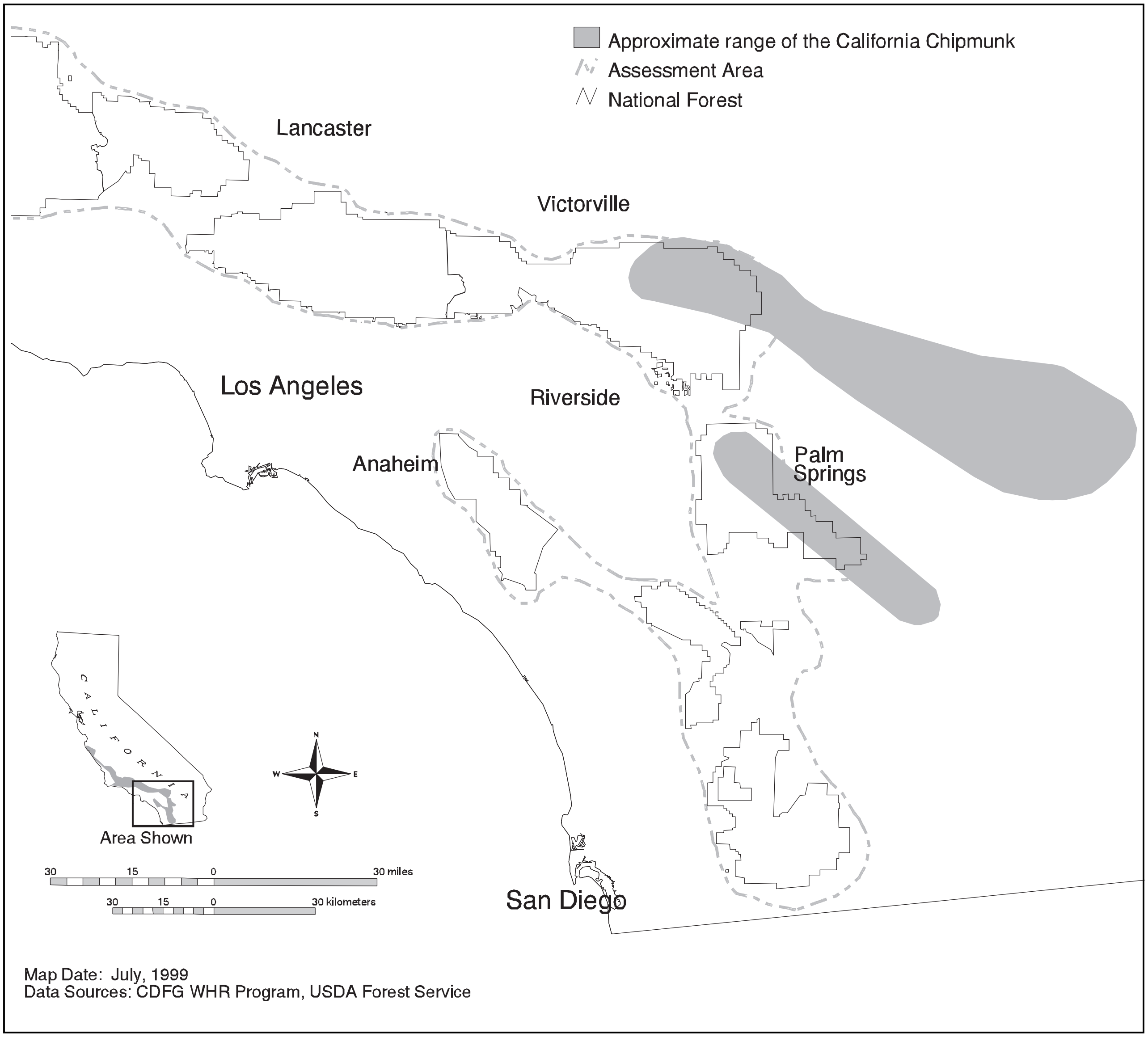


Figure 4.5. The known distribution of the California chipmunk.

Western spotted skunk *(Spilogale gracilis)*

Status and Distribution: The spotted skunk is not on any concern lists and it is believed to be relatively widespread (P. Collins, Santa Barbara Nat. Hist. Museum, pers. comm.). We include it as a local viability concern because there is essentially no recent, documented information on its distribution or status in the assessment area.

Habitat: Vaughan (1954) found spotted skunks in rocky canyons on the coastal side of the San Gabriel Mountains. He thought they also probably occurred in desert slope canyons. Grinnell et al. (1937) report an elevational range for spotted skunks in southern California of near sea level to at least 4,500 feet.

Conservation Considerations: Some current information is needed on the distribution and abundance of this species on public lands within the assessment area.

American badger *(Taxidea taxus)*

Status and Distribution: The badger is a California Species of Special Concern. Its geographic range is large and takes in the entire assessment area, but its local distribution is spotty and not well documented. Badgers can occur at high elevations in meadows near timberline, but we could find little information documenting occurrences at high elevations in the southern California mountains. Distributional records in Williams (1986) indicate the presence of badgers on Mount Pinos, but they are not reported from high meadows in the San Bernardino and San Jacinto mountains or the large mid-elevation meadows on Palomar and Laguna mountains.

Documented localities from the San Bernardino and San Jacinto mountains are largely from desert montane areas (e.g., Highway 243 south of Banning, Coxey Creek, Burnt Flats, Redonda Ridge, Lone Pine Canyon) and the Cajon Wash area (D. Freeman, San Bernardino NF, unpubl. notes). A similar pattern was reported by Vaughan (1954) for the San Gabriel Mountains, with badger sign being most common in Joshua tree woodlands and pinyon-juniper associations on the desert slope.

Localities in the San Diego County mountains are mainly from valleys in the coastal foothills (e.g., Ramona, Pamo Valley, Santa Ysabel, Witch Creek, and Sweetwater Reservoir) (Bond 1977). Most of these areas are on private land.

Habitat: Badgers can occur in a wide variety of arid open habitats but are most commonly associated with grasslands, savannas, mountain meadows, and openings in desert scrub. The principal requirements seem to be sufficient food (burrowing rodents), friable soils, and relatively open, uncultivated ground (Williams 1986). They seem to occur primarily in areas of low to moderate slope.

Conservation Considerations: Current information is needed on the distribution and abundance of this species on public lands within the assessment area, particularly in the mountain subareas where historic localities are mainly on private lands (e.g., San Diego ranges and Santa Lucia Ranges). The presence of this species can often be determined by sign of diggings and burrows.

Animals of Aquatic, Aquatic/ Upland, Riparian, and Lake Habitats

Aquatic and riparian habitats are important to a lot of species and they are of limited extent in arid southern California. Therefore, it is not surprising that thirty-nine rare or potentially at risk animals are closely associated with these habitat types. To address all of these species, we have further subdivided this group into six categories: fish (fully aquatic), aquatic/upland amphibians and reptiles, riparian birds, mammals, invertebrates, and lake-associated species.

Fish

There are few native fish in southern California streams and essentially all of them are rare and at risk. Nine native fish species are considered individually below (table 4.4).

Pacific lamprey *(Lampetra tridentata)*

Status and Distribution: This anadromous lamprey is not on any official concern lists, but we include it as a local viability concern species because its habitat requirements are similar to the steelhead (Swift et al. 1993) and it faces many of the same threat factors. Lampreys still maintain runs in several creeks along the coast in Monterey and San Luis Obsipo counties, in parts of the Santa Maria and Santa Ynez rivers, parts of the Ventura River, and the Sespe Creek portion of the Santa Clara River drainage (Swift et al. 1993).

Habitat: Similar to that described for the southern steelhead.

Conservation Considerations: See southern steelhead account.

Southern steelhead *(Oncorhynchus mykiss)*

Status and Distribution: West coast steelhead populations have been divided into fifteen evolutionarily significant units (ESUs) based on natural geographic boundaries that foster genetic isolation (NMFS 1997a). Each ESU is treated as a distinct population by the National Marine Fisheries Service (NMFS) for determinations on the need for listing as threatened or endangered. Our assessment area spans two ESUs: the south-central California coast ESU, which has been listed as threatened, and the southern California coast ESU,

Table 4.4. Rare or potentially at risk fish that are native to southern California.
Displayed for each species: (1) the level of knowledge about where it occurs in southern California and, in parentheses, the estimated percentage of locations that are on national forest system lands; (2) the mountain subareas occupied (y = occurs in breeding season, h = historically occurred, p = potentially occurs, t = transient, w = winter visitor)—if the species is localized and data are available, the approximate number of occurrences may be displayed; (3) the vulnerability of populations on national forest system lands to existing threat factors; (4) population trends; and (5) the assigned conservation category.

Fish of Concern *federal status*	(1) Knowledge of SoCal Locations (% on NFs)	(2) areas occupied or estimated # of occurrences if spp. localized — Cleveland NF: San Diego Rngs	Cleveland NF: Snta Ana Mts	San Bern. NF: San Jac Mts	San Bern. NF: San Bern Mts	Angeles NF: San Gab Mts	Angeles NF: Cas-taic Rngs	Los Padres NF: So. LP Rngs	Los Padres NF: So. SL Rng	Los Padres NF: No. SL Rng	(3) Vulner-ability on NFs	(4) Pop. Trend	(5) Conser-vation Category
Pacific lamprey	Mod (< 20%)		h/p		h	h	h	3-4	1	5	Mod	Unkn	Landscape level
Southern steelhead *endangered/threatened*	High (25-50%)	h	h/p		h		h	7-10	~6	~11	High	Decl[1]	Site specific
Mojave tui chub *endangered*	High (50-75%)			1[Hyb]							Mod	Unkn	Site specific
Arroyo chub	High (40-60%)	2	3	2	2	7-8	5 [Int]	9 [Int]	3 [Int]		Mod	Unkn	Landscape level
Santa Ana speckled dace	Mod (40-60%)		2	1-2	6-7	~9	h	2[SL]	2 [SL]		Mod	Unkn	Landscape level
Santa Ana sucker	High (50-75%)		h	h	h/p	4-5	2[Int]	2 [Int]			High	Decl[2]	Site specific
Unarmored three-spine stickleback *endangered*	High (40-60%)			2[Sh]	1	2					High		Site specific
Partially armored threespine stickleback	Mod (40-70%}	h/p	y	y	y [Int]	y [Int]	p	y	y	y	Mod	Unkn	Landscape level
Tidewater goby	High									p	None	Decl	Minimal Influence

[1] Source: NMFS (1997b).

[2] Source: Swift et al. (1993)

[Hyb] Mojave tui chubs in San Bernardino Mountains (Deep Creek) have hybridized with arroyo chubs.

[Int] Introduced populations, not part of historic range.

[SL] San Luis Obispo speckled dace may be a distinct subspecies (Swift et al. 1993).

[Sh] Unarmored 3-spine stickleback in San Bernardino Mountains is genetically distinct Shay Creek form (Haglund and Buth 1988).

which has been listed as endangered (NMFS 1997b).

The south-central coast ESU encompasses streams that drain the northern and southern Santa Lucia Ranges down to (but not including) the Santa Maria River in San Luis Obispo County. The primary rivers supporting steelhead runs in this ESU are the Pajaro, Salinas, Carmel, Little Sur and Big Sur rivers. However, an additional fifteen to twenty smaller streams along the Monterey and San Luis Obispo coast also support steelhead. Streams specified in the final rule on this ESU that occur at least partially on national forest system lands (all within the Los Padres National Forest) include Little Sur River, Big Sur River, Big Creek, Alder Creek, San Carpoforo Creek, and Morro Creek.

Maps of the southern California ESU in the west coast steelhead status review (NMFS 1997a) show it extending from the Santa Maria River south to the Mexican border. However, the final rule on listing (NMFS 1997b) defines the ESU as extending south to "the southern extent of the species' range," which is defined as Malibu Creek. This leaves some uncertainty as to whether a re-established population south of Malibu Creek would be considered part of this ESU and recognized as an endangered species. The primary streams supporting steelhead runs in this ESU are the Santa Ynez River, Gaviota Creek, Ventura River, Santa Clara River (including Sespe Creek) and Malibu Creek. Total run sizes in all of these streams were less than two hundred adults.

Historically, winter-run southern steelhead or coastal rainbow trout moved up most coastal streams in central and southern California (Behnke 1992), although spawning success south of the Los Angeles Basin may have been sporadic (Swift et al. 1993). Now Malibu Creek, Los Angeles County, is the southernmost stream recognized as supporting a persistent spawning steelhead population (NMFS 1997b)(fig. 4.6). However, in April 1999 trout believed to be southern steelhead were found in a tributary of San Mateo Creek in San Diego County (A. Vejar, CDFG pers. comm). Tissue samples of these fish were collected for DNA analysis to determine if they are indeed steelhead.

Habitat: The following synopsis is from Moyle et al. (1995). Major streams in southern California originate in the coastal mountains and many cross broad alluvial areas before flowing into the sea. These low-elevation alluvial flats present inhospitably warm and fluctuating temperatures and streamflows tend to be intermittent in these sections. The higher elevation headwaters, therefore, are the primary spawning and rearing areas for steelhead. It is likely that the largest steelhead populations historically occurred in major streams where the upstream spawning and rearing habitats were closest to the ocean, such as in the Ventura, Santa Clara, and Santa Ynez rivers. Streams still supporting steelhead runs today are primarily in small drainages whose headwaters are in mountains very close to the coast (e.g., the Santa Lucia, Santa Ynez, and Santa Monica mountains). These streams tend to be the only ones that don't have impassible barriers between spawning habitats and the ocean.

Conservation Considerations: The extensive decline of steelhead in central and southern California is due mostly to in-stream water developments that have resulted in inadequate flows, flow fluctuations, blockages, and dewatering of portions of rivers (NMFS 1997a). Suitable spawning and rearing habitats on national forest system lands are frequently located in upper elevation areas above currently impassable barriers. Efforts are ongoing to develop a strategy for restoring steelhead populations along the central coast and within the Los Padres National Forest. There has also been interest in trying to restore habitat conditions for steelhead on San Mateo Creek in San Diego County (A. Vejar, CDFG, pers. comm.).

Mojave tui chub *(Gila bicolor mohavensis)*

Status and Distribution: The Mojave tui chub was federally listed as endangered in 1970. The one remaining population within the assessment area is on lower Deep Creek on the San Bernardino National Forest. Unfortunately, this population has hybridized extensively with introduced arroyo chub (Swift et al. 1993).

Habitat: The Mojave tui chub's native range is restricted to the Mojave River and its tributaries (Swift et al. 1993).

Conservation Considerations: Moyle (1976) believed that the arroyo chubs had eliminated the Mojave chubs in Deep Creek, but a hybrid collected in 1991 showed that the parental influence of both species still exists (Swift et al. 1993). It is important to prevent further introductions of arroyo chubs into Deep Creek.

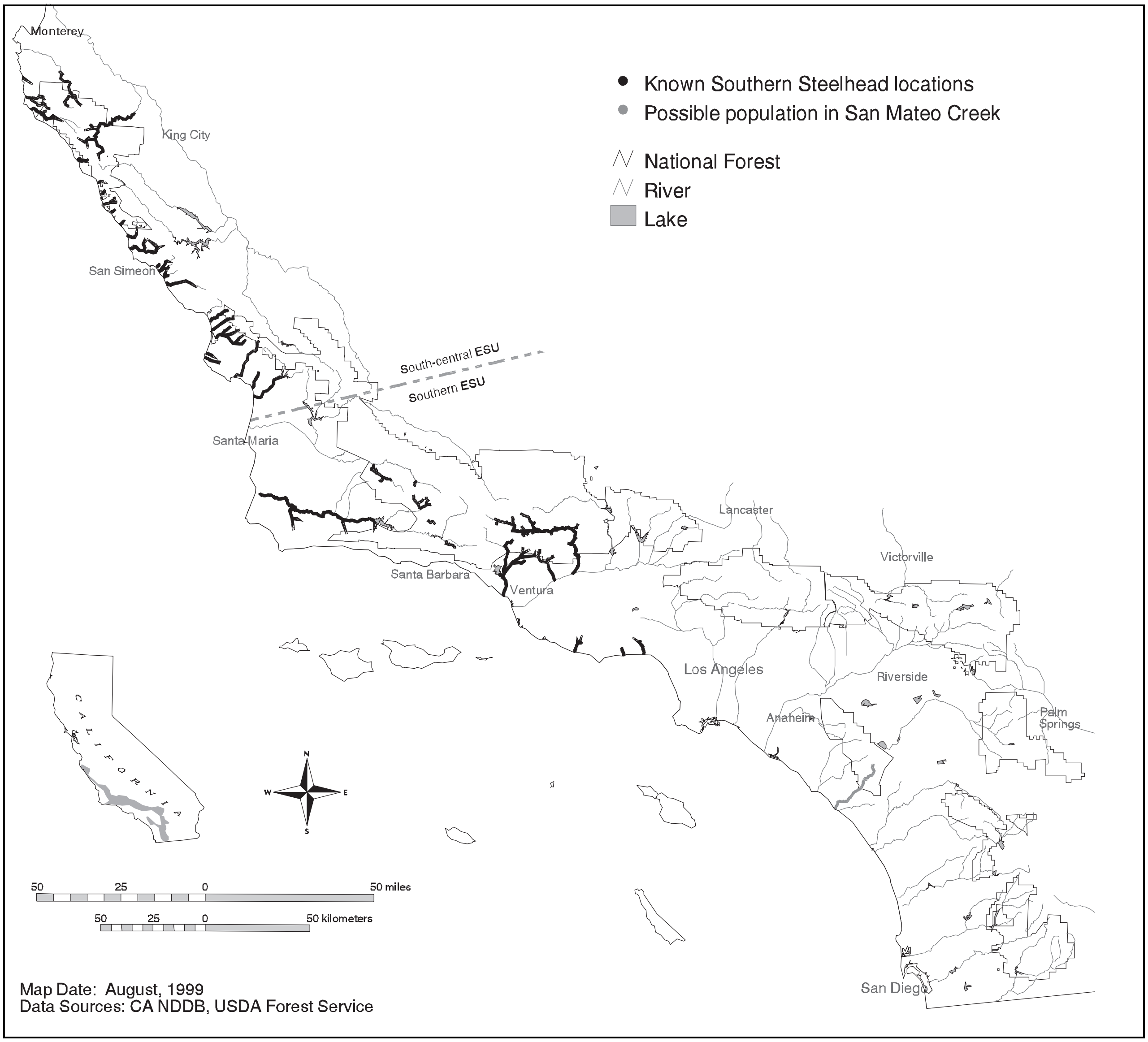


Figure 4.6. Current distribution of southern steelhead in the assessment area and the boundary between the south-central and southern California ESUs.

Arroyo chub *(Gila orcutti)*

Status and Distribution: The arroyo chub is a California Species of Special Concern. Its status is interesting in that it is now most abundant in areas outside of its native range (Swift et al. 1993). It was widely introduced in the 1930s and 1940s, as bait with trout plants or with mosquitofish, and now occurs in many reservoirs and in central-coast and desert-side streams that are outside its native range (Swift et al. 1993). Arroyo chubs are native to the Los Angeles, San Gabriel, Santa Ana, Santa Margarita, and San Luis Rey rivers and to Malibu and San Juan creeks (Moyle et al. 1995). They have been successfully introduced into the Santa Clara, Santa Ynez, Santa Maria, Cuyama, and Mojave river systems and other smaller coastal streams (e.g., Arroyo Grande Creek) (Swift et al. 1993; Moyle et al. 1995).

A number of native arroyo chub populations occur in the assessment area. On the Angeles National Forest, it is in Pacoima Creek, Big Tujunga Creek, the west, east, and north forks of the San Gabriel River, Cattle Canyon and Bear Creek. On the Cleveland National Forest, it is in San Juan Creek, Trabuco Creek, the West Fork of the San Luis Rey River and Agua Caliente Creek (above Lake Henshaw). The largest population is considered to be in the West Fork of the San Gabriel River (Wells et al. 1975).

Habitat: Arroyo chubs are found in slow-moving or backwater sections of low-elevation streams (Moyle et al. 1995). Wells et al. (1975) describe physical characteristics of stream sites where arroyo chub were collected.

Conservation Considerations: It is important to identify and maintain arroyo chub populations within the species' native range. This can be achieved by ensuring that there are adequate stream flows to maintain areas of permanent, year-round water in each of the occupied streams. Moyle et al. (1995) identify the West Fork of the San Gabriel River as a particularly important refugia for this species. A potential problem in some areas is introduced red shiners, which may competitively exclude chub in some areas (Moyle et al. 1989). Red shiners are known to occur in Big Tujunga Creek below Big Tujunga Reservoir.

Santa Ana speckled dace *(Rhinichthys osculus)*

Status and Distribution: The Santa Ana speckled dace is a Forest Service Region 5 Sensitive Species and a California Species of Special Concern. Its historic range is low-elevation streams in the Los Angeles, San Gabriel and Santa Ana river systems (Swift et al. 1993). The largest remaining population is within the Angeles National Forest on lower reaches of the east, north, and west forks of the San Gabriel River including Cattle Canyon, Bear Creek and Fish Canyon (Swift et al. 1993). Other reported occurrences on the Angeles include Pacoima Creek, Little Tujunga Creek and Big Tujunga Creek (Moyle et al. 1989), but more recent information indicates these populations may now be extinct (Moyle et al. 1995).

On the San Bernardino National Forest, small speckled dace populations are reported from the North Fork of Lytle Creek, Cajon Wash, Lone Pine Canyon, Strawberry Creek, Plunge Creek, City Creek, Mill Creek (this population is actually just downstream of the San Bernardino National Forest boundary), and the South Fork of the San Jacinto River (Moyle et al. 1995; S. Loe, SBNF, pers. comm.). On the Cleveland National Forest, there is a small population on Santiago Creek (R. Fisher, USGS Biological Resource Division, pers. comm.) and potentially in Silverado Canyon (a historic population that may have been extirpated) (Moyle et al. 1995).

A genetically different form of speckled dace occurs in San Luis Obispo and northern Santa Barbara counties. The "San Luis Obispo speckled dace" occurs within the Los Padres National Forest on the Cuyama and Sisquoc rivers, and Manzana and San Luis Obispo creeks (Swift et al. 1993).

Habitat: The Santa Ana speckled dace requires permanent flowing streams with summer water temperatures of 17 to 20 degrees Centigrade. The dace inhabit shallow cobble and gravel riffles (Wells et al. 1975). Deinstadt et al. (1990) provide a detailed description of speckled dace habitat in the West Fork of the San Gabriel River.

Conservation Considerations: Surveys are needed to better determine the current distribution and abundance of speckled dace. The primary threat to most of the small populations is maintaining areas of permanent, year-round surface water. Some populations (e.g., Silverado Canyon) suffered severe losses or extirpation during the drought in the late 1980s because streams dried up. Habitat degradation and the establishment of red shiners in Big Tujunga Canyon are cited as a cause of speckled dace decline (Moyle et al. 1989). The west, north, and east forks of the San Gabriel River are identified as the best remaining habitat for Santa Ana speckled dace (Moyle et al. 1995).

Santa Ana sucker *(Catostomus santaanae)*

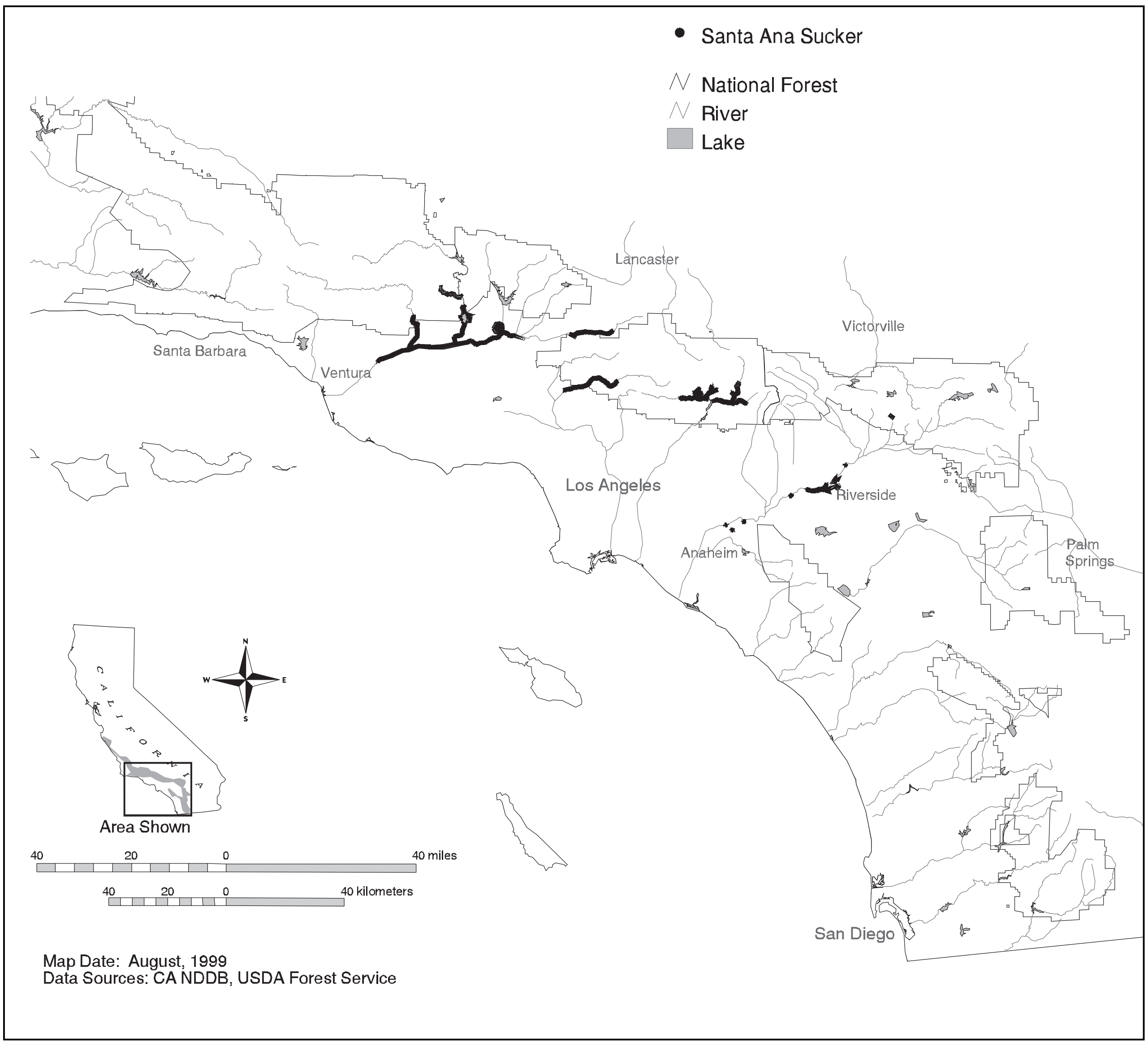
Status and Distribution: The U.S. Fish and Wildlife Service has made a determination that listing of the Santa Ana sucker as threatened or endangered is warranted but precluded at this time due to other pressing concerns (P. Barrett, USFWS, pers. comm.).

The historic range of this species is low-elevation streams in the Los Angeles, San Gabriel and Santa Ana river systems (Swift et al. 1993). Remaining native populations are concentrated within the Angeles National Forest in the east, north, and west forks of the San Gabriel River (including Cattle Canyon and Bear Creek), and Big Tujunga Creek (fig 4.7). The only other native population is in the lower Santa Ana River, outside the assessment area. Santa Ana suckers historically occurred in the upper Santa Ana River, on Cajon and City creeks in the foothills of the San Bernardino Mountains, and in Santiago Creek in the foothills of the Santa Ana Mountains (Moyle et al. 1995).

Introduced populations of the Santa Ana sucker are present in the Santa Clara River, Sespe Creek, Piru Creek and San Francisquito Creek. Some of these introduced populations are within the Los Padres and Angeles national forests. Hybridization with the non-native dusky sucker *(Catostomus fumeiventris)* is apparently a problem in the Sespe Creek and lower Santa Clara River populations, but the upper Santa Clara River (Soledad Canyon) population has not been affected (Greenfield et al. 1970, Swift et al. 1993).

Habitat: Santa Ana suckers are native to many of the same streams as the speckled dace and have similar habitat requirements. Preferred substrates are generally coarse gravel and

Figure 4.7. Current distribution of the Santa Ana sucker.



boulders, and suckers are often associated with algae, but not macrophytes (Moyle et al. 1995). Additional habitat and life history information for this species can be found in Greenfield et. al. (1970) and Moyle et al. (1995).

Conservation Considerations: The Angeles National Forest is the primary refugia for the Santa Ana sucker, and its few remaining populations require site-specific management attention. The primary threats to these populations are habitat degradation, streamflow alterations, and introduced species. Mining activities such as suction dredging are occurring in the upper San Gabriel River and have been implicated in the decline of suckers in Cattle Canyon (Moyle et al. 1995).

Variable and sometimes extreme releases of water from Big Tujunga and Cogswell reservoirs are constant threats to sucker populations on Big Tujunga Creek and the West Fork of the San Gabriel River (Moyle et al. 1995). Red shiners, which have been introduced into Big Tujunga Creek, are a potential egg predator, and green sunfish are likely to prey on juveniles. The elimination of Santa Ana suckers from the upper Santa Ana River in the San Bernardino Mountains is largely attributed to predation by introduced brown trout (Moyle et al. 1995). The west, north, and east forks of the San Gabriel River are identified as the best remaining habitat for Santa Ana suckers (Moyle et al. 1995).

Unarmored threespine stickleback
(Gasterosteus aculeatus williamsoni)

Status and Distribution: The unarmored threespine stickleback was federally listed as endangered in 1970. Historically widespread and abundant in the Los Angeles Basin, it is now restricted to three areas in the upper Santa Clara River watershed: an 8-mile stretch of Soledad Canyon, a portion of upper San Francisquito Canyon and in Escondido Canyon (a tributary of Agua Dulce Canyon) (Swift et al. 1989). All of these populations are within or near the Angeles National Forest (fig. 4.8). A recovery plan exists for this species (USFWS 1985) and a recovery team is in place that coordinates conservation activities.

The **Shay Creek threespine stickleback** is a morphologically similar, yet genetically distinct population that occurs at elevations over 6,000 feet in Baldwin Lake and its main tributary, Shay Creek, in the eastern San Bernardino Mountains (Haglund and Buth 1988). This stickleback is highly imperiled. Baldwin Lake is ephemeral; thus, Shay Creek is the primary refugia for the fish. However, Shay Creek is predominantly on private land and extraction of surface and groundwater in this basin has reduced the availability of water in the creek. The one remaining population within Shay Creek exists in a small pool that must have water artificially pumped in to sustain it. A transplant population from Shay Creek has become established on the San Bernardino National Forest in an artificial pond in Sugarloaf Meadows (Malcolm 1992).

Habitat: Sticklebacks prefer quiet-water habitat like pools with abundant aquatic vegetation, backwater areas, and stream margins where water velocity is low (Moyle et al. 1995).

Conservation Considerations: Currently, arundo is being removed along San Francisquito Creek and Soledad Canyon to increase available surface water and improve habitat for the stickleback. These localized populations are vulnerable to a wide variety of threats and require site-specific attention.

The Shay Creek stickleback is highly vulnerable to extinction because of the tenuous nature of the water supply in Shay Creek. Efforts are ongoing to secure a dependable supply of water and to establish additional populations.

Partially armored threespine stickleback
(Gasterosteus aculeatus microcephalus)

Status and Distribution: The partially armored threespine stickleback is a Forest Service Region 5 Sensitive Species. Swift et al. (1993) report that native populations of this subspecies are widespread north of Point Conception but declining rapidly to the south. Recent records (1991 onward) south of the Los

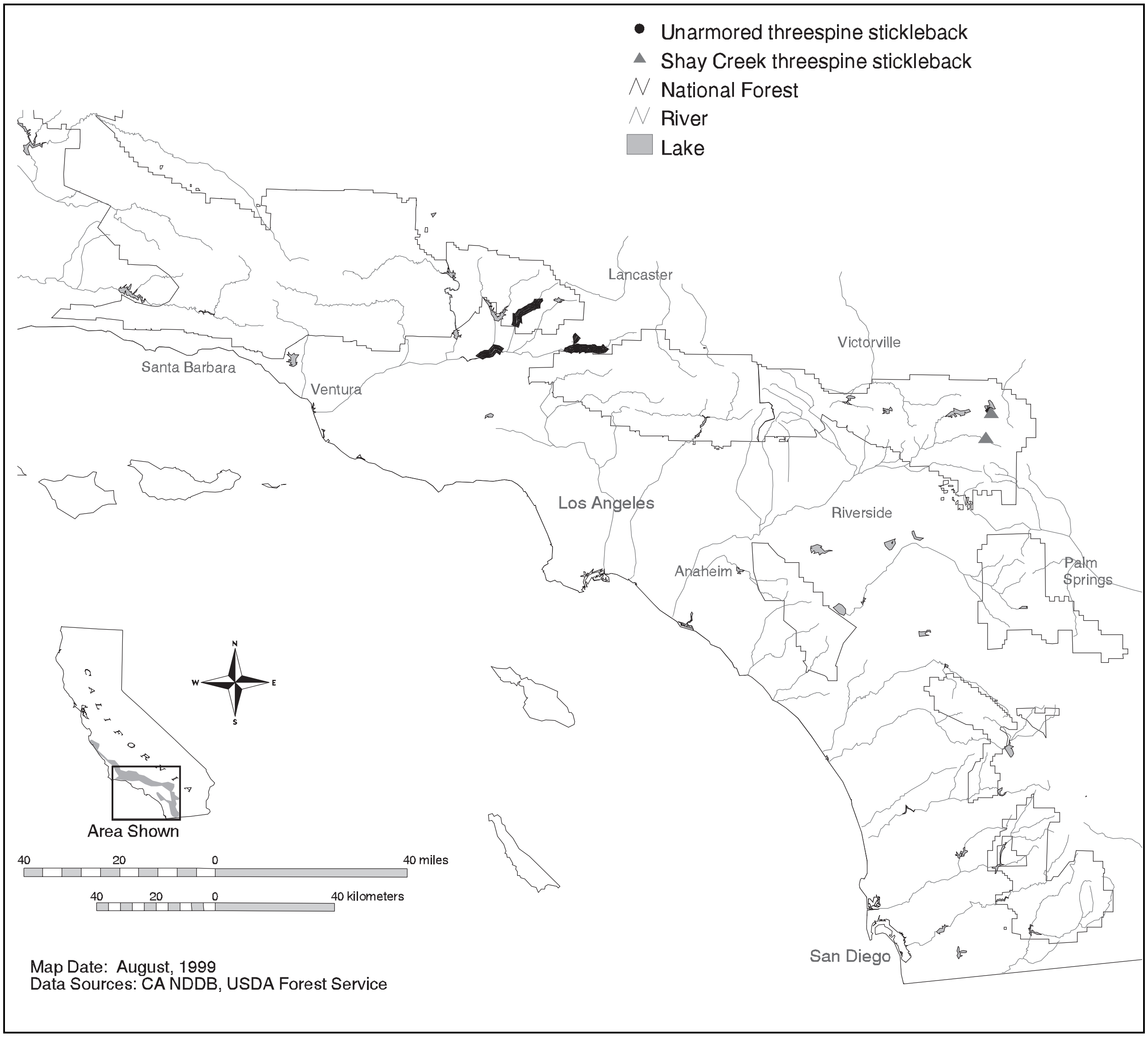


Figure 4.8. Current distribution of the unarmored threespine stickleback.

Angeles Basin are from the Santa Ana Mountains (Trabuco Creek in and below O'Neil Park, upper San Juan Creek near the mouths of Hot Spring and Cold Spring canyons, and upper reaches of Bell Canyon on Starr Ranch) and the South Fork of the San Jacinto River below Lake Hemet (Swift et al. 1993).

To the north, partially armored sticklebacks occur in the Santa Clara, Ventura, and Santa Ynez rivers as well as many coastal streams in Santa Barbara and San Luis Obispo counties. Other southern streams where native populations of partially armored sticklebacks historically occurred (and may still occur) include San Mateo Creek, Santa Margarita River, and the San Luis Rey River (Swift et al. 1993). They were apparently absent from streams in the Los Angeles Basin inhabited by the unarmored threespine stickleback.

Partially armored sticklebacks have been widely introduced into streams in association with trout plants. Established populations that are believed to be the result of such introductions can be found in Big and Little Rock creeks (Angeles National Forest), Holcomb Creek, Lake Arrowhead, and Big Bear Lake (San Bernardino National Forest), and the Sweetwater River and Pine Creek (Cleveland National Forest) (Swift et al. 1993).

Habitat: They inhabit low-gradient, low-elevation streams with characteristics similar to those described for the unarmored threespine stickleback.

Conservation Considerations: Similar to those described for other native fish. Sticklebacks are hardy fish; the primary threat to native populations is maintaining areas of permanent, year-round surface water.

Tidewater goby *(Eucyclogobius newberryi)*

Status and Distribution: The tidewater goby was federally listed as endangered in 1994. The assessment area extends to the coast only for a small stretch in the northern Santa Lucia Range (Monterey District, Los Padres National Forest). None of the coastal streams in this area are known to support populations of the tidewater goby. The coastline is steep in this area and suitable lagoon habitats are absent (Swift et al. 1989).

Habitat: Tidewater gobies are restricted to coastal, brackish-water habitats (Swift et al. 1989).

Conservation Considerations: The tidewater goby is a species whose conservation can be minimally influenced by management of public lands within the assessment area.

Aquatic/Upland Amphibians and Reptiles

Six amphibian and three reptile species (table 4.5) are dependent, to varying degrees, on aquatic habitats for some part of their life cycle. These are collectively referred to as aquatic/upland species, because upland habitats in the vicinity of stream courses or water bodies are also very important to their survival.

Coast Range newt *(Taricha torosa torosa)*

Status and Distribution: The Coast Range newt is a California Species of Special Concern. It occurs along low-elevation streams mostly near the coast. Newts occupy a number of drainages along the southern Monterey coast, many within the Los Padres National Forest. These include the upper Carmel River, Big Sur River, Big Creek, Devil's Canyon, Willow Creek, and San Carpoforo Creek. Many of the occupied streams in San Luis Obispo and Santa Barbara counties are along the immediate coast and off of National Forest System land. However, newts do occur on national forest system land in Lopez Canyon, East Fork of Morro Creek, Rincon Creek, and probably the upper end of several other streams dropping out of the Santa Ynez Mountains (Jennings and Hayes 1994).

South of the Santa Clara River, Coast Range newt populations are scarcer (Jennings and Hayes 1994). Outside the assessment area, they occur in at least eight small, coastal streams coming out of the Santa Monica Mountains (Gamradt and Kats 1996). In the San Gabriel Mountains, they are known to be present in the east and west forks of the San Gabriel River, Bear Creek, San Dimas Creek, Big Dalton and Little Dalton canyons. There are historic records from other streams on the coastal side of the San Gabriels, so they may still be present in additional drainages. Jennings and Hayes (1994) show one mapped newt location in the San Bernardino Mountains, but they do not describe it and we are not aware of any recent sightings in this range.

On the Cleveland National Forest, newts occur in a series of parallel drainages on the coastal side of the Santa Ana Mountains, including Black Star Canyon, Silverado Canyon, Trabuco Creek, San Juan Creek, San Mateo Creek, Devil's Canyon, and Tenaja Creek. Just off the forest in Camp Pendleton they also occur on San Onofre Creek, Santa Margarita River, and DeLuz Creek. In the San Diego ranges, there is a disjunct population of Coast Range newts in three adjacent streams coming out of the Cuyamaca Mountains—Cedar Creek, Boulder Creek, and Conejos Creek.

Habitat: Coast Range newts breed in streams and ponds but spend much of the year away from water. They generally prefer rocky canyons that contain streams with well-developed pools (Fisher and Case 1997).

Conservation Considerations: Better documentation on the full extent of Coast Range newts in the southern California national forests is needed. They may be more widespread than is documented here, particularly on the Los Padres National Forest. Recent genetic studies by Dave Wake and others have shown that newt populations in Orange and San Diego counties (Cleveland National Forest) may represent a distinct species from those north of the Los Angeles Basin (Fisher and Case 1997).

Predatory non-native species, maintenance of adequate stream flows, water quality, and collecting appear to be the biggest factors affecting newt viability on public lands. Adult newts are known to be highly toxic to predators and thus not at risk to introduced predatory animals. However, a recent study found that newt egg masses and larvae in the Santa Monica Mountains were readily consumed by crayfish and mosquitofish (Gamradt and Kats 1996). They documented the disappearance of breeding newts in three drainages after crayfish, mosquitofish, or both were introduced. On one of these drainages, they even observed recovery of successful newt reproduction after crayfish had been washed out of the stream during heavy winter rains (Gamradt and Kats 1996).

Table 4.5. Amphibians and reptiles associated with aquatic and upland habitats that received individual consideration.

Displayed for each species: (1) the level of knowledge about where it occurs in southern California and, in parentheses, the estimated percentage of locations that are on national forest system lands; (2) the mountain subareas occupied (y = occurs in breeding season, h = historically occurred, p = potentially occurs, t = transient, w = winter visitor)—if the species is localized and data are available, the approximate number of occurrences may be displayed; (3) the vulnerability of populations on national forest system lands to existing threat factors; (4) population trends; and (5) the assigned conservation category.

Aquatic/Upland Animals of Concern *federal status*	(1) Knowledge of SoCal Locations (% on NFs)	(2) areas occupied or estimated # of occurrences if spp. localized									(3) Vulner-ability on NFs	(4) Pop. Trend	(5) Conser-vation Category
		Cleveland NF		**San Bern. NF**		**Angeles NF**		**Los Padres NF**					
		San Diego Rngs	Snta Ana Mts	San Jac Mts	San Bern Mts	San Gab Mts	Cas-taic Rngs	So. LP Rngs	So. SL Rng	No. SL Rng			
Amphibians													
Coast Range newt	High (20-50%)	3	6-8	p	p	5-10	p	4-8	2-5	5-10	Mod	Decl[1]	Site specific
Western spadefoot toad	Mod (< 5%)	y	y	p			p	p	y		Mod	Unkn	Landscape level
Arroyo SW toad *endangered*	High (30-50%)	~19	~8	1	3-5	3-6	3	~10	0	1-2	High	Decl[2]	Site specific
CA red-legged frog *threatened*	Mod-High (20-40%)	h/p	1	h	h	h	1-2	~20	~12	~15	Mod	Decl[2]	Site specific
Foothill yellow-legged frog	High (10-30%)					h	h	h	h/p	2-5	High	Decl[1]	Site specific
Mountain yellow-legged frog	Mod (> 80%)	h/p		4-5	1-3	4-5					High	Decl[1]	Site specific
Reptiles													
SW pond turtle	High (30-60%)	~8	~5	h/p	2	~5	h/p	~25	~15	~15	Mod	Decl[1]	Site specific
South coast red-sided garter snake	Low (< 10%)	1	1	0	0	0	0	1-2			Mod	Decl[1]	Site specific
Two-striped garter snake	Mod (40-70%)	>25	>10	5-10	5-10	>10	5-10	>25	>10	5-10	Mod	Decl[1]	Landscape level

[1]Jennings and Hayes (1994)
[2]USFWS determination as described in listing decisions.

On Boulder Creek on the Cleveland National Forest, sudden large releases of water in mid-summer from an upstream reservoir occur occasionally and appear to be negatively affecting newt reproductive success by flushing eggs and larvae downstream. Collecting of newts for the pet trade has historically been a major problem and may continue to be in some areas. Boulder Creek Road has historically been a collecting spot (J. Copp, CA Academy of Sciences, pers. comm.), and today newts can be readily found a half-mile or more above and below the road crossing but are increasingly rare as you approach the road.

Western spadefoot toad *(Spea [Scaphiopus] hammondii)*

Status and Distribution: The western spadefoot is a California Species of Special Concern. Known localities for this species are predominantly outside the assessment area, in low-elevation coastal and inland valleys. It is reportedly abundant on the Camp Pendleton Marine Corps Base along the northern San Diego County coast (Holland and Goodman 1998). Most known locations within or near the assessment area are in the coastal foothills of San Diego County (e.g., Japatul Valley, Otay Lakes, Santa Maria Valley, and Warner Springs) (Ed Ervin and Joe Copp, pers. comm.) and Santa Barbara and San Luis Obispo counties (e.g., Santa Maria Valley, and Cuyama Valley) (Jennings and Hayes 1994). The toads also have been observed in the foothills of the Santa Ana Mountains at Starr Ranch (Fisher and Case 1997) and the Santa Rosa Plateau (Jennings and Hayes 1994).

Habitat: Western spadefoots occur in coastal valley habitats, valley-foothill grasslands, coastal scrub, and chaparral communities up to approximately 3,000 feet in elevation (Ed Ervin, in litt.). Within this range, spadefoots are confined to areas with relatively flat or low-gradient topography that supports the shallow ephemeral-pool habitat they require for breeding. They are adapted for survival in dry, upland habitats. To avoid desiccation, spadefoot toads spend the drier months of the year inactive and hidden underground. The toad uses its spadelike hind foot to excavate its own retreats in loose or sandy soils. In areas where friable soils are not available, small mammal burrows are often used. Following spring rains, western spadefoots congregate where there is pooled water. Breeding takes place in shallow ephemeral pools that form on valley floors, on ridge and mesa tops, or in quiet drainages on low-gradient slopes above first-order streams.

Conservation Considerations: More complete information is needed on the distribution of western spadefoots on public lands in the assessment area. Threats to the spadefoot toad include destruction of breeding pool habitat, obstructions to migratory routes between breeding sites and upland habitats, and high levels of mortality along roads. Changes to the length of time a breeding pool remains full can have significant negative effects on reproductive success. Pool "enhancements" that make them perennial water bodies create habitat for exotic species to invade and become established.

Arroyo southwestern toad *(Bufo californicus)*

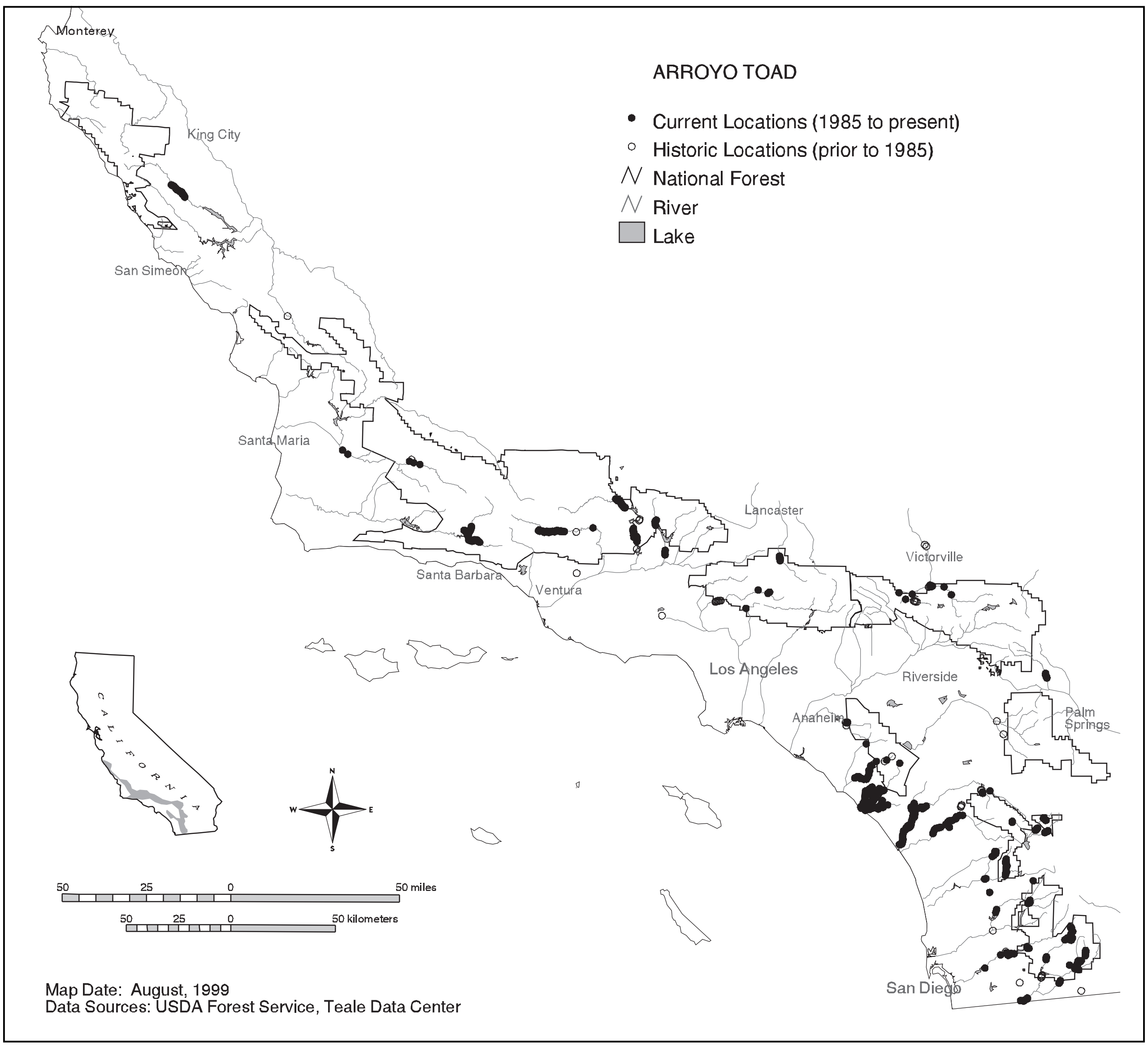
Status and Distribution: The arroyo southwestern toad was federally listed as endangered in 1994 (USFWS 1994). The entire range of the arroyo toad in the United States is within or near the assessment area. The species also extends down into Baja California, Mexico. Based on our GIS database, approximately 36 percent of occupied arroyo toad habitat is on national forest system lands (fig 4.9)—16 percent on the Los Padres National Forest, 12 percent on the Cleveland National Forest, 6 percent on the Angeles National Forest, and 2 percent on the San Bernardino National Forest.

On the Los Padres National Forest, arroyo toads are concentrated in a small number of locations. Substantial populations exist on Piru Creek including lower reaches of Agua Blanca Creek, Sespe Creek, and interconnected reaches of the upper Santa Ynez River, Mono Creek, and Indian Creek. A smaller population occurs along the Sisquoc River. All of these Los Padres populations are predominantly on national forest system land. The northernmost population of arroyo toads, on the San Antonio River in Monterey County, lies just off the forest on the Fort Hunter Liggett Military Reservation.

Arroyo toad populations on the Cleveland National Forest and surrounding lands are more numerous, but many appear to be small in size. Most of the populations occur right along the forest boundary with the bulk of prime breeding habitat often lying just off national forest system land. This is the case at Cottonwood Creek which includes lower reaches of Kitchen and Morena creeks, Potrero Creek, the Sweetwater River, the upper San Diego River, Santa Ysabel Creek and associated lower reaches of Temescal Creek (Pamo Valley), the upper forks of the San Luis Rey River (above Lake Henshaw) including Agua Caliente Creek, Temecula Creek including lower reaches of Arroyo Seco Creek, San Mateo Creek, San Juan Creek, and Trabuco Creek. One population that is predominantly on national forest system land occurs along Pine Valley Creek and several of its tributaries.

On the Angeles National Forest, arroyo toad populations exist along Castaic Creek,

Figure 4.9. Current and historic locations of the arroyo toad within and adjacent to the assessment area. Approximately 36 percent of existing arroyo toad locations are on national forest system lands.



Big Tujunga Creek including associated lower reaches of Mill and Alder creeks, Arroyo Seco Creek, and on the desert side of the San Gabriel Mountains along Little Rock Creek. These populations lie near the forest boundary and, in some cases, extend beyond it.

On the San Bernardino National Forest, arroyo toad populations exist on tributaries of the Mojave River including lower Deep Creek, the West Fork of the Mojave River, the East Fork of the Mojave River (Miller Canyon), and Little Horsethief Creek. They also occur on lower portions of the Whitewater River and probably still occur on lower reaches of the San Jacinto River and adjacent Bautista Creek.

Habitat: Arroyo toads breed and deposit egg masses in shallow, sandy pools along low-gradient sections of streams. These streams are usually bordered by sand-gravel flood terraces (USFWS 1999a). The flood terraces and other upland streamside habitats are important for foraging and overwintering sites (fig 4.10). Arroyo toads have been detected up to one kilometer from a water course (Holland and Goodman 1998). Many arroyo toad populations occur along streams that do not normally flow year-round. The largest populations tend to occur in broad floodplains along wide, shallow streams. However, arroyo toads do exist in some small ephemeral drainages (e.g., Indian Flats area, Cleveland National Forest). It is a low-elevation species, with known locations extending from sea level to about 4,400 feet.

Conservation Considerations: Arroyo toad populations are localized and face a variety of threats. Many populations lie immediately below major dams. The manner in which water is released from upstream reservoirs can greatly influence arroyo toad reproductive success (Sweet 1992) (see "Effect of Dams" section, chapter 3). Recent coordination between various government agencies resulted in releases from Pyramid Dam that more closely mimic natural flows in lower Piru Creek (Sweet 1992). The modified releases have benefited arroyo toads in that drainage (USFWS 1999a).

Figure 4.10. An arroyo southwestern toad emerging from the sand on a streamside terrace. ROBERT GOODMAN, JR

Predatory, non-native species are a major threat to arroyo toads. Bullfrogs have been observed to eat juvenile and adult arroyo toads (Sweet 1993). A number of warm-water fishes (e.g., green sunfish, bluegill, largemouth bass, and black bullheads) and crayfish have been shown to feed on arroyo toad larvae and can cause high larval mortality in breeding pools (Sweet 1992). These species occur in many of the streams occupied by arroyo toads (see "Invasive, Non-Native Species" section, chapter 3). In areas close to human development, Argentine ants have spread into riparian areas and are reducing the native ant fauna (Ward 1987, Holway 1995). Native ants are a major food source for arroyo toads; thus, they may be negatively affected by the continued spread of Argentine ants.

Introduced plants are also a problem in some areas. Tamarisk and arundo colonize newly created flood terraces and can form dense masses of vegetation. These dense stands have higher rates of evapotranspiration than do native vegetation, thereby decreasing the amount of available surface water. They also stabilize stream terraces, which helps to deepen flood channels, resulting in habitat unsuitable for arroyo toads (USFWS 1999a).

Campgrounds and roads within or in close proximity to arroyo toad breeding pools have resulted in toads and their egg masses being inadvertently crushed by vehicle and foot traffic and disturbed by waterplay. There are a number of national forest campgrounds located near arroyo toad breeding habitat—seven on the Los Padres National Forest, four on the Angeles National Forest, and four on the Cleveland National Forest (USFWS 1999a). Seasonal closures and/or restrictions on vehicle access have recently been instituted at some of these campgrounds to reduce impacts (e.g., Beaver, Lion, and Mono campgrounds on the Los Padres and Joshua Tree Campground on the Angeles). Road crossings in toad habitat are also being evaluated and several on the Los Padres and Cleveland have been relocated or rebuilt to reduce impacts to breeding pools.

Off-highway vehicle (OHV) activity in arroyo toad habitat is a problem in some areas, particularly on desert-side streams (e.g., Little Rock Creek, Mojave River, upper Piru Creek). Most of the OHV-related habitat damage, at least on national forest system lands, is the result of unauthorized travel off of designated routes into areas legally closed to such use; it is the actions of a few irresponsible individuals and represents a challenging law enforcement problem.

Livestock grazing in arroyo toad habitat can cause trampling of toads and their egg masses. It also can result in degradation to sand bars and terrace habitats that are important to arroyo toads (USFWS 1999a). Over the last ten years, most riparian habitat on the southern California national forests has been formally excluded from grazing. However, many areas are intermingled with private lands where riparian grazing still exists. Maintenance of fence lines to prevent cattle movement onto public portions of the riparian corridor is a management problem in some areas occupied by arroyo toads.

Suction dredge mining and streamside prospecting (see descriptions of these activities in "Mining" section, chapter 4) have the potential to cause impacts in several areas. Suction dredging has occurred on Piru Creek on the Los Padres National Forest and Pine Valley Creek on the Cleveland National Forest (USFWS 1999a). Prospecting activities, including the digging of pits in the stream bed and banks, has occurred on Little Horsethief Creek on the San Bernardino National Forest (USFWS 1999a). Drawdown of surface water from wells is also a concern.

California red-legged frog *(Rana aurora draytonii)*

Status and Distribution: The California red-legged frog (fig. 4.11) has declined precipitously over the last thirty to forty years and became federally listed as threatened in 1996. Once widespread in low-elevation streams in southern California, the Central Valley, and the Sierra Nevada foothills, it has been extirpated from 70 percent of its former range (USFWS 1996a). Red-legged frogs historically occurred on all four national forests (fig. 4.12) but now appear to be extirpated from the Cleveland and San Bernardino. They also were thought to be extirpated from the Angeles, until a small population was discovered on San Francisquito Creek in 1999.

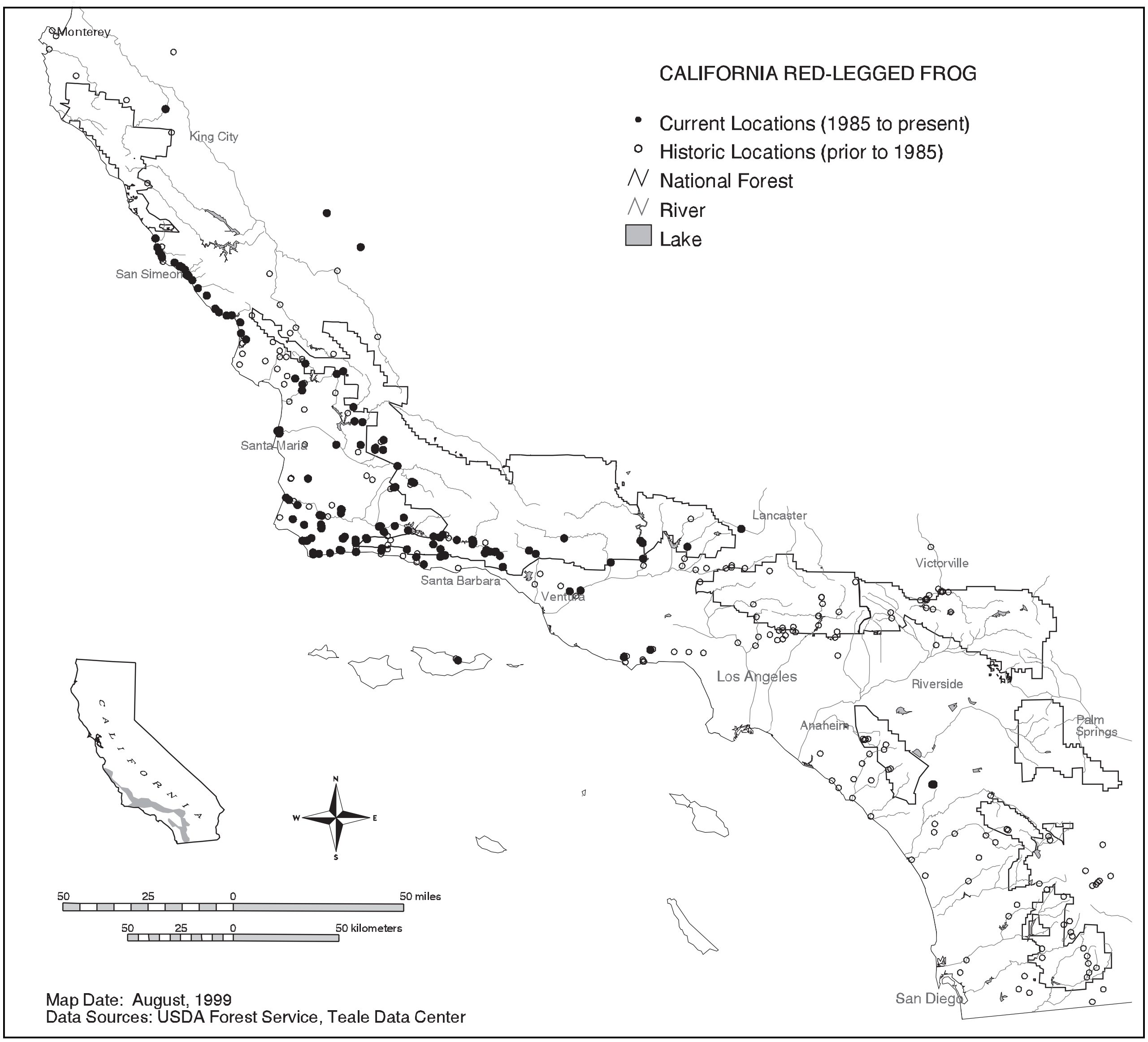
Red-legged frogs extend down into Baja California and there reportedly are still a number of populations in Mexico (Welsh 1988). However, within the United States, there are only three known populations remaining south and east of Ventura County. The southernmost locality is on the Santa Rosa Plateau on the southeastern flank of the Santa Ana Mountains in Riverside County. It is near the Cleveland National Forest but does not extend onto it. This population has been

Figure 4.11. An adult red-legged frog at Cole Creek on the Santa Rosa Plateau. ROBERT GOODMAN, JR.

declining; recent surveys found fewer than four males and no females (D. Holland, pers. comm. 1998; R. Goodman, in litt. 1998). The other populations are both in western Los Angeles County in the Castaic Ranges region, on Amargosa and San Francisquito creeks. The Amargosa Creek population is on private land.

The greatest number of remaining red-legged frog populations are within Monterey (thirty-two occurrences), San Luis Obispo (thirty-six), and Santa Barbara (thirty-six) counties (USFWS 1996a). Approximately 20 to 30 percent of these populations occur on streams within the Los Padres National Forest (fig. 4.12). The remaining are concentrated in small streams along the immediate coastline. Populations occurring within the Los Padres National Forest include Piru Creek, Sespe Creek, Ventura River, Matilija Creek, upper Santa Ynez River, Mono Creek, Indian Creek, Sisquoc River, Manzana Creek, La Brea Creek, Cuyama River, Alamo Creek, Branch Creek, Stone Creek, Trout Creek, Lopez Canyon, San Carpoforo Creek, and the Little Sur and Big Sur rivers. A number of the streams along the Santa Barbara and San Luis Obispo coast contain red-legged frogs and the upper reaches

Figure 4.12. Current and historic locations of the California red-legged frog along California's southern coast. Approximately 30 to 40 percent of red-legged frog populations are on national forest lands, all on the Los Padres National forest.



of some these are within the Los Padres National Forest (e.g., Tajiguas Creek, Toro Creek).

Habitat: Habitat of California red-legged frogs is characterized by dense, shrubby riparian vegetation (e.g., arroyo willow, cattails, and bulrushes) associated with deep (greater than 3 feet), still or slow-moving water (Hayes and Jennings 1988). Red-legged frogs are highly aquatic and need surface water for most, if not all, of the year. They can occur in ephemeral streams, but probably only ones that contain some year-round surface water (Jennings and Hayes 1994). They have been found at elevations up to 5,000 feet (e.g., Doane Pond on Palomar Mountain) but historically were most abundant in low-elevation streams.

Conservation Considerations: The disappearance of red-legged frogs from so much of their former range heightens the importance of remaining populations on the Los Padres and Angeles national forests. Further surveys are needed to determine conclusively if there are any remaining populations on the other two national forests. Historically occupied habitat still exists on those forests and may provide suitable sites for reintroduction into the southern half of the assessment area.

Predatory, non-native fish and amphibians are particularly significant threats to red-legged frogs. With few exceptions, red-legged frogs have disappeared from virtually all sites where bullfrogs have become established (Hayes and Jennings 1988; Fisher and Shaffer 1996; Moyle 1973). The only areas where the two species have managed to coexist for prolonged periods is along the immediate coast, where cool "fogbelt" temperatures appear to provide red-legged frogs some competitive advantages (S. Sweet, UC Santa Barbara, pers. comm.).

Red-legged frogs appear more capable of persisting in the presence of non-native fish; however, there are still strong negative correlations between the abundance of such fish and these frogs (Hayes and Jennings 1988; Fisher and Shaffer 1996). Results of a recent study in artificial ponds showed that mosquitofish and bluegill were significant predators of red-legged frog larvae (Schmieder and Nauman 1994).

Impacts from campgrounds and roads are similar to those described for the arroyo toad, except that the more highly aquatic frogs are less likely to be affected by activities away from the streambed. Livestock grazing that results in a loss of riparian vegetation can be highly detrimental to red-legged frogs. However, such grazing in riparian habitats is not authorized at any of the occupied red-legged frog sites on national forest system lands.

Maintenance of adequate stream flows and high water quality is a key issue for red-legged frogs. Water diversions, groundwater extraction, and stock pond or small reservoir developments can cause degradation or elimination of habitat (USFWS 1996a).

Foothill yellow-legged frog *(Rana boylii)*

Status and Distribution: The foothill yellow-legged frog is a Forest Service Region 5 Sensitive Species and a California Species of Special Concern. While still present on many streams along the northern California coast, it has become extremely rare in the south (Jennings and Hayes 1994). Its range historically extended to the San Gabriel River (North and East forks), and included a number of locations in the Castaic and southern Los Padres ranges, including Elizabeth Lake Canyon, Piru Creek, Sespe Creek, Hopper Creek, Santa Paula Canyon, upper Santa Ynez River (at Juncal Campground), upper Indian Creek, and Santa Cruz Creek (near the Guard Station) (Zweifel 1955; J. Copp, CA Academy of Sciences, in litt.). However, foothill yellow-legged frogs have not been observed in or south of the southern Los Padres ranges since 1978. The last sighting was near Frenchman's Flat along Piru Creek in 1977 (Jennings and Hayes 1994).

Foothill yellow-legged frogs do still occur in several coastal drainages in northern San Luis Obispo and Monterey counties (fig. 4.13). The only occupied drainages on national forest system lands are along the southern Monterey coast; they include the Big Sur River and Willow Creek. Further surveys are needed to determine the full extent of foothill yellow-legged populations in the northern Los Padres. They historically occurred in Lopez Canyon (Zweifel 1955).

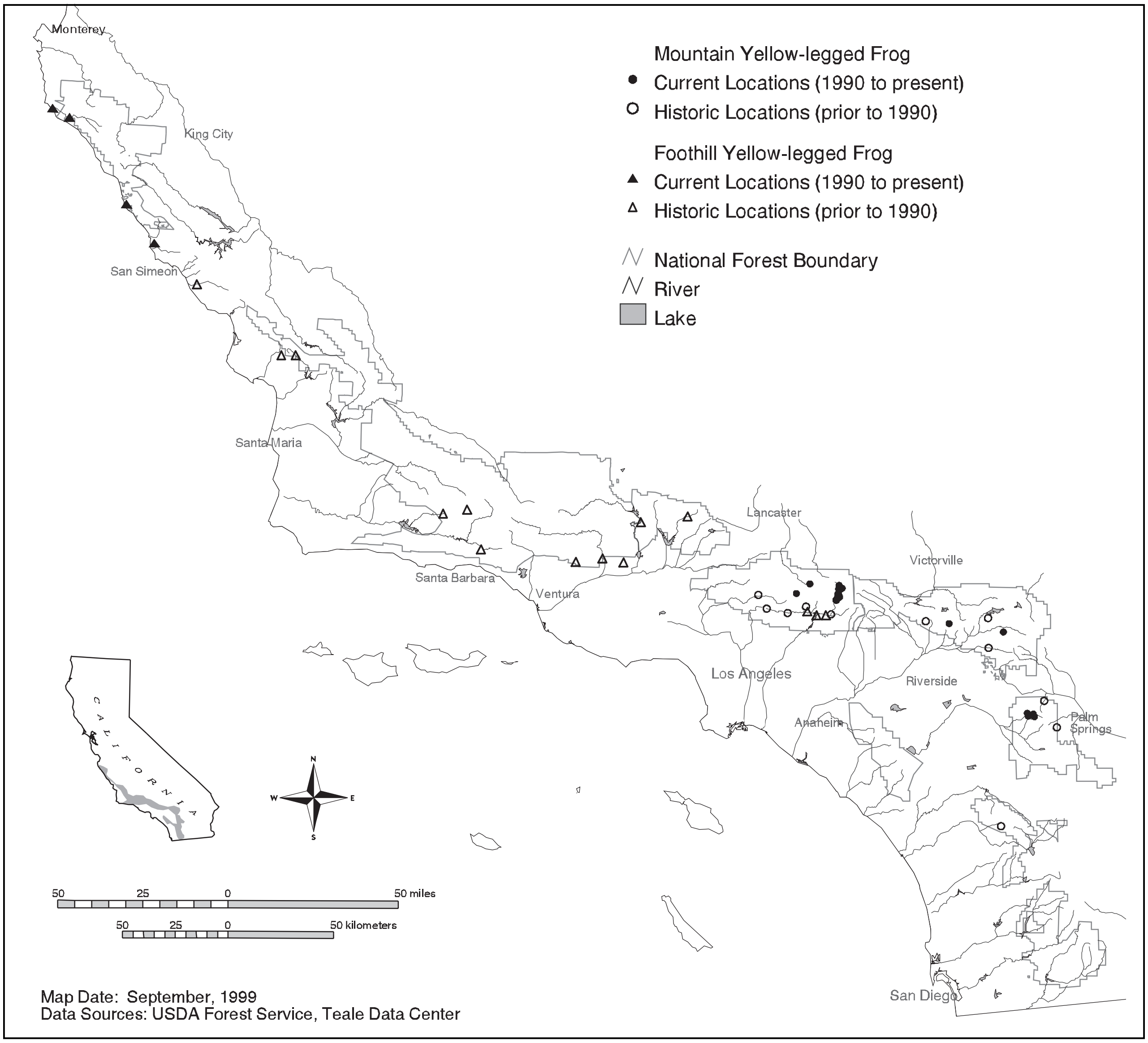


Figure 4.13. Current and historic locations of mountain and foothill yellow-legged frogs.

Habitat: Foothill yellow-legged frogs typically inhabit small- to moderate-sized, perennial streams with at least some cobble-sized substrate (Hayes and Jennings 1988). Most current and historic localities in the assessment area are at elevations below 4,000 feet. It is a highly aquatic frog and seldom found more than one or two leaps from a stream (Zweifel 1955).

Conservation Considerations: The foothill yellow-legged frog is extremely rare in the assessment area and should be given site-specific management attention. Threats to this species are similar to those described for the red-legged frog. Predatory non-native fish and bullfrogs are apparently not present in the southern Monterey and northern San Luis Obispo coast streams still occupied by foothill yellow-legged frogs (D. Holland, pers. comm.). This may explain why the yellow-legged frogs are still there.

Mountain yellow-legged frog *(Rana muscosa)*

Status and Distribution: The mountain yellow-legged frog is a Forest Service Region 5 Sensitive Species and a California Species of Special Concern. Southern California populations are also under consideration for federal listing as endangered. In southern California, these frogs are found in the San Gabriel, San Bernardino and San Jacinto mountains and at least historically on Palomar Mountain (fig. 4.13) (Jennings and Hayes 1994). Small populations of mountain yellow-legged frogs still exist in the San Gabriel Mountains on upper Little Rock Creek and along the upper San Gabriel River and several of its forks (Jennings 1995a, 1998). They also may still be present in Day Canyon (R. McKernan, San Bernardino Nat. History Museum, pers. comm.). In the San Jacinto Mountains, populations are still present in Hall Canyon, Dark Canyon, Fuller Mill Creek, and the North Fork of the San Jacinto River (Jennings 1998). They were historically collected on Snow Creek and reportedly were observed in Andreas Canyon (R. McKernan, pers. comm.), but 1997 surveys at both those locations failed to detect them (D. Holland, pers. comm.).

In the San Bernardino Mountains, mountain yellow-legged frogs were recently rediscovered in City Creek (B. Matibag, pers. comm. 1998). They were reportedly sighted in Barton Creek in the late 1980s (R. McKernan, pers. comm.), but 1997 surveys in this area failed to detected them (D. Holland, pers. comm.). Other historic locations in the San Bernardino Mountains include Siberia Creek, Mill Creek, Plunge Creek, and Waterman Canyon. Focused surveys in 1997 failed to detect mountain yellow-legged frogs on any of these drainages (D. Holland, pers. comm.), although there was an independent report of one such frog on Mill Creek (G. Cardiff, pers. comm.). At the one historic location on Palomar Mountain, a pond on Doane Creek, this species has not been seen since the 1970s and the pond is now overrun with bullfrogs and exotic fishes (Jennings and Hayes 1994).

Mountain yellow-legged frogs have declined precipitously in the southern California mountains; Jennings and Hayes (1994) suggest that they have been extirpated from 99 percent of their historic range in this region. All of the remaining populations appear to be very small, most with less than fifteen adults observed.

Habitat: Mountain yellow-legged frogs inhabit high-elevation streams usually above 4,000 feet. However, in the San Gabriel Mountains and perhaps other areas where the characteristics of mountain streams (i.e., steep, rocky canyons) extend to lower elevations, these frogs historically occurred at elevations down to 2,000 feet (e.g., Bear Creek and Evey Canyon) (G. Stewart, Cal. Poly Pomona, in litt.).

Conservation Considerations: Mountain yellow-legged frog populations within the assessment area are small, localized, and vulnerable to existing threats. They therefore warrant site-specific management attention.

The primary threats to this species are (1) the increasing spread of non-native predatory fish and amphibians (i.e., bullfrogs), (2) loss of breeding pools from siltation or declining surface water, and (3) disturbance of individuals and egg masses from recreation and land use activities. Jennings (1995a, 1998) found potentially impactive recreation activities (e.g., people walking in the creek, swimming, left behind trash, trail crossings) occurring at the mountain yellow-legged frog locations in Dark Canyon, Fuller Mill Creek, Little Rock Creek, and Vincent Gulch. He recommends rerouting trails and campsites to steer recreationists away from these key breeding areas. Jennings (1995) also observed placer mining activity on the upper San Gabriel River (East Fork) within the Sheep Mountain Wilderness Area. Associated with this unauthorized activity were trash and toxic materials such as mercury being dumped into the stream bed.

More survey work is needed to determine if additional populations exist and to better determine the size of known populations. Reintroductions of mountain yellow-legged frogs to historically occupied sites may be an option, particularly in the San Gabriel and San Bernardino mountains where suitable habitat is most widespread. However, the specific habitat conditions necessary for reintroductions first need to be defined. Research done in high mountain lakes in the Sierra Nevada has found mountain yellow-legged frogs to be largely intolerant of introduced predatory fish (i.e. trout), since they rarely persist in lakes where such fishes have been introduced (Bradford 1989; Bradford et al., 1993). The fish apparently consume frog egg masses and larvae. There is uncertainty about whether the effect of introduced trout is as strong in southern California, since the frogs occupy stream habitats rather than lakes. In August 1997 surveys of known mountain yellow-legged frog locations, Jennings (1998) observed rainbow trout and no frogs in pools at two locations—Vincent Gulch (a fork of the upper San Gabriel River), and Fuller Mill Creek. The relationship between introduced trout and yellow-legged frogs in southern California streams needs to be better understood.

Southwestern pond turtle
(Clemmys marmorata pallida)

Status and Distribution: The southwestern pond turtle is a Forest Service Region 5 Sensitive Species and a California Species of Special Concern. Pond turtles are considerably more abundant in the northern half of the assessment area (i.e., northwest of the Santa Clara River). In the Los Padres National Forest there are forty to fifty streams that contain pond turtle populations (USFWS 1993a), with the largest occurring on Piru Creek, Sespe Creek, the Indian Creek/Mono Creek area, the Sisquoc River/Manzana Creek area, Alamo Creek, Nacimiento River and Arroyo Seco Creek (D. Holland pers. comm.; Brattstrom and Messer 1988). Populations also occur along most of the drainages along the immediate coast in Santa Barbara and San Luis Obispo counties.

South of the Santa Clara River, pond turtle populations have declined substantially both in size and number (Holland 1991; Brattstrom and Messer 1988). They still occur at over fifty sites, but most of these contain few turtles. Only six to eight sites contain populations of thirty or more individuals (Holland 1991). There is one large pond turtle population on the Angeles National Forest on the West Fork of the San Gabriel River below Cogswell Reservoir. Small populations on the Angeles also occur on upper Castaic Creek, Aliso Canyon, Pacoima Creek, Little Tujunga Creek, Big Tujunga Creek, the East Fork of the San Gabriel River, and possibly Big Dalton Creek.

On the San Bernardino National Forest, there may still be small pond turtle populations in Cajon Wash, Deep Creek, and probably the West Fork of the Mojave River below Silverwood Lake. Pond turtles historically occurred in Andreas Canyon on the desert side of the San Jacinto Mountains (Jennings and Hayes 1994) and may still be present there.

Two large pond turtle populations occur on the Cleveland National Forest at San Mateo Creek and Pine Valley Creek. Just outside the forest there are also sizable populations on the Santa Margarita River/Temecula Creek (connected drainages), on Aliso Creek in Chino Hills State Park (Goodman 1994), and on Cole Creek within the Santa Rosa Plateau Preserve. Small populations also occur on Tenaja Creek, the upper San Luis Rey River, Santa Ysabel Creek, the upper San Diego River (including Cedar, Boulder and Conejos creeks), the upper Sweetwater River, and Cottonwood Creek above Barrett Lake.

Habitat: Pond turtles inhabit a wide variety of low-elevation aquatic habitats generally below 4,000 feet elevation. In the assessment area, pond turtles are found primarily in rivers and streams that have persistent deep pools (Holland 1991). The pond turtle is a highly aquatic turtle that moves onto land to reproduce and overwinter (Jennings and Hayes 1994). Along the central and southern coast of California, pond turtles may remain active year-round (Holland 1991).

Conservation Considerations: Pond turtle populations south of the Santa Clara River are sufficiently rare to warrant site-specific management attention. The few remaining large populations deserve particular attention and additional surveys are needed to determine the status of the others. Populations on the Los Padres are considerably more abundant and can likely be conserved through general riparian area management.

The primary reason for pond turtle declines has been loss of suitable habitat. This loss has been greatest in the lower foothills and valleys where pond turtles were historically most abundant (Holland 1991). Dams, diversions, and stream channelization have greatly reduced the availability of persistent, pooled water along low-elevation streams. Pond turtles do not do well in large reservoirs; they frequently inhabit stock ponds, but there are indications that reproductive success is poor in these habitats and they may constitute sink habitats (D. Holland, pers. comm.). The reduced availability of water makes pond turtles even more vulnerable to extended droughts. Monitored populations in San Mateo Creek and Pine Valley Creek declined dramatically in the early 1990s at the end of our last prolonged drought (D. Holland, pers. comm.). Some small populations on highly intermittent streams probably disappeared completely during the drought.

Other threats include introduced predatory fish, bullfrogs, and collecting. Predatory fish and bullfrogs impact reproductive success by consuming juvenile turtles. It can be difficult to determine the severity of this impact; pond turtles are long-lived animals and can persist in an area for many years even without successful reproduction. However, a number of pond turtle populations consist primarily of older adults and are considered to be at risk (Holland 1991). Collecting of pond turtles is a significant problem in some easily accessible areas.

South coast red-sided garter snake *(Thamnophis sirtalis* spp.)

Status and Distribution: The south coast red-sided garter snake is believed to be a distinct taxon from red-sided garter snakes north of the Tehachapi Mountains and Carpinteria (Santa Barbara County) (Jennings and Hayes 1994). It is known only from scattered localities along the southern California coastal plain, from the Santa Clara River Valley south to the vicinity of San Pasqual Valley in San Diego County. Historic localities on Camp Pendleton (San Diego County) are dominated by tules, cattail, and willow (Holland and Goodman 1998).

The south coast garter snake has been sighted recently in only a few localities, some of which are near national forest system lands: the lower Santa Clara River, the lower Santa Margarita River, San Mateo Creek, the lower San Luis Rey River and above Lake Henshaw along the upper reaches of the same drainage (Jennings and Hayes 1994; Holland and Goodman 1998; R. Fisher pers. comm.). This species has not been extensively surveyed for and is regarded as difficult to detect. There is potential for it to occur at low elevations (below 3,000 feet) on any or all of the four national forests.

Habitat: The south coast garter snake occurs in marshy, permanent-water habitats along low-elevation streams (Jennings and Hayes 1994).

Conservation Considerations: Surveys need to be conducted for this species along the major low-elevation streams that extend onto national forest system lands. Given its rarity, any occurrences of this species should be give site-specific management attention.

Two-striped garter snake *(Thamnophis hammondii)*

Status and Distribution: The two-striped garter snake is a Forest Service Region 5 Sensitive Species and a California Species of Special Concern. In a reversal of the pattern exhibited by most aquatic species, the two-striped garter snake appears to have declined more in the northern portion of its range (Jennings and Hayes 1994). It is considered to be most common in eastern San Diego County, where it occurs in most foothill and mountain streams that have pools with persistent water (Jennings and Hayes 1994). It still occurs in all the mountain subareas within the assessment area but has disappeared from many historic locations in the coastal basins. The assessment area and the coastal region to the west make up almost the entire range of this species.

Habitat: Two-striped garter snakes inhabit perennial and intermittent streams from sea level to over 7,000 feet (e.g., Tahquitz Valley in the San Jacinto Mountains) (Jennings and Hayes 1994). They also occupy stock ponds and other artificially created aquatic habitats.

Conservation Considerations: Although it is thought to be declining, the two-striped garter snake is considerably more common than the other aquatic amphibians and reptiles described above. For that reason we believe it can be adequately conserved through appropriate landscape-scale management of riparian and aquatic habitats. However, given that national forest system lands are the primary refugia for this species, there is a need to better determine the specific drainages where it occurs. It is a relatively easy species to detect and, once inventoried, it would be easy to at least periodically monitor its presence or absence in specific drainages over time.

Riparian Birds

The importance of riparian habitats to birds has long been recognized and has led to an emphasis on research and monitoring of this group. In southern California, the endangered least Bell's vireo has been the marquee riparian bird over the last two decades. More recently the southwestern willow flycatcher has also become a focal species. To look more broadly at the avian riparian community, in 1988 the four southern California national forests initiated a broad-scale, coarse-filter approach to annually monitor the abundance of birds in riparian habitats. A standardized ten-minute point count technique with three independent observers has been used to sample about two hundred permanent stations each year during the breeding season. These point-count stations are spread across more than twenty drainages (fig 4.14).

Trends in the detection rates of specific bird species have recently been analyzed (Stephenson et al. 1998). Trends from the point-count data were compared with similar trend estimates from the North American Breeding Bird Survey (BBS) (Sauer et al. 1997). For our comparisons we used BBS trends from 1980 to 1996 for all of California, the California foothills physiographic region, and the Los Angeles Ranges physiographic region. Statistically significant trends in abundance were observed for a number of species; however, few of our fine-filter species were detected often enough to reliably determine their trends (table 4.6).

Thirteen riparian bird species were identified as being rare or potentially at risk and received individual consideration (table 4.7). Most of them are associated with low-elevation riparian habitats.

Cooper's hawk *(Accipiter cooperi)*

Status and Distribution: The Cooper's hawk is a California Species of Special Concern. Cooper's hawks are found in all the mountain subareas, but they occur at low-densities and were not effectively monitored in the riparian point-count surveys (i.e., only about two per year were detected) (Stephenson et al. 1998). However, results from the BBS suggest that Cooper's hawks may be declining statewide (table 4.6) (Sauer et al. 1997).

Habitat: Cooper's hawks typically nest in riparian forests, mountain canyons (Garrett and Dunn 1981), and oak woodlands (Unitt 1984). They also utilize eucalyptus groves to some degree and have been observed successfully fledging young in residental areas.

Conservation Considerations: Cooper's hawk breeding habitat is declining on private lands at the lower elevations; thus, public lands in the assessment area are becoming increasingly important to this species. However, this hawk does not seem particularly vulnerable to prevailing agents of change on public lands. Its broad distribution and life history characteristics suggest it can be conserved through landscape-scale, habitat-based management.

Yellow-billed cuckoo *(Coccyzus americanus occidentalis)*

Status and Distribution: The yellow-billed cuckoo is state listed as endangered and

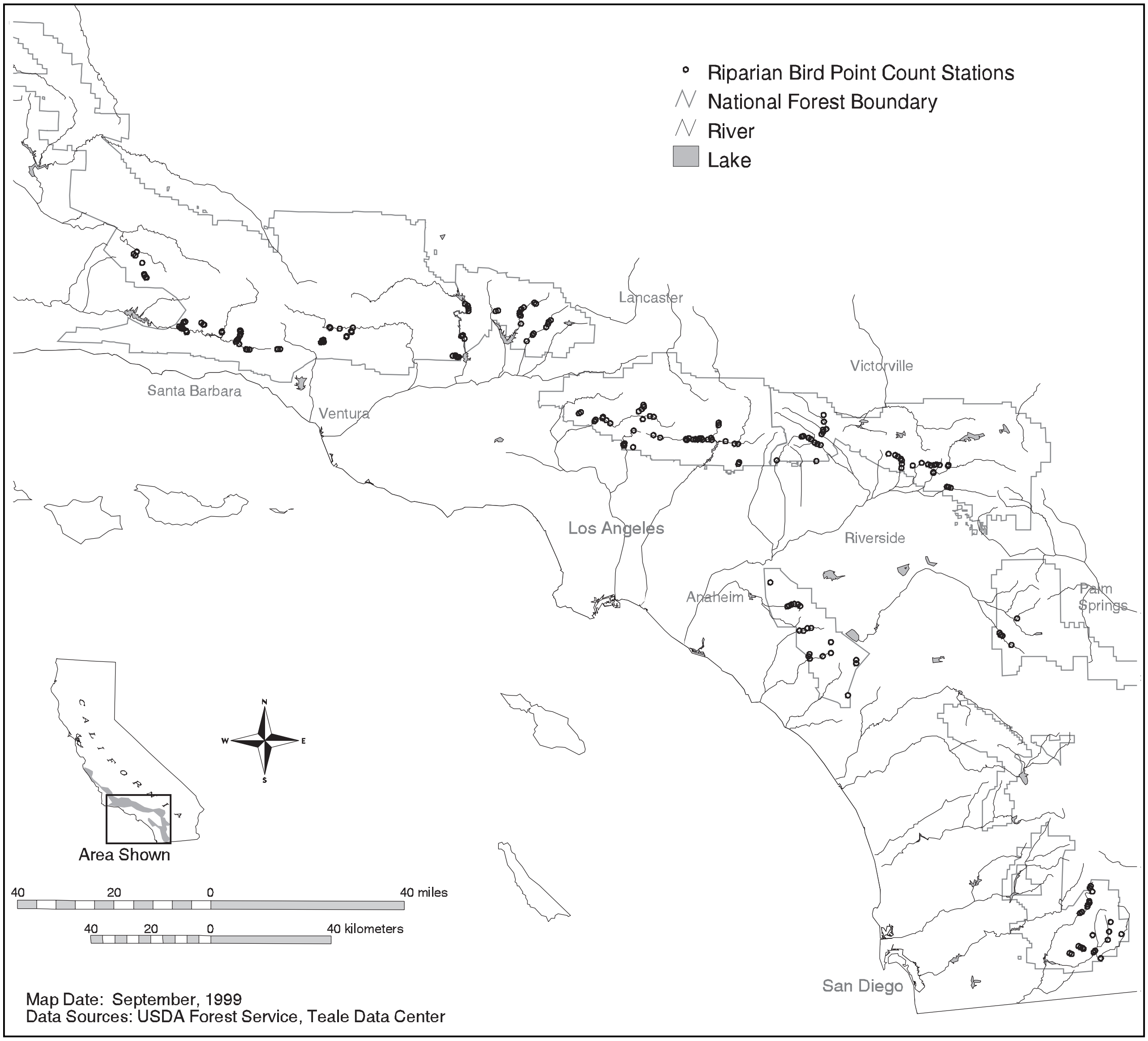


Figure 4.14. Riparian bird point-count monitoring stations across the four southern California national forests. Birds were monitored annually at about two hundred stations from 1988 to 1997.

is a Forest Service Region 5 Sensitive Species. Yellow-billed cuckoos have been observed in the breeding season at various locations along the central and southern California coast (e.g., Prado Basin, lower San Luis Rey River, lower Santa Ysabel Creek above Lake Hodges), but not within the assessment area (Garrett and Dunn 1981). There is very little potential habitat for this species on national forest system lands in southern California.

Habitat: Yellow-billed cuckoos breed in broad, well-developed, low-elevation riparian woodlands.

Conservation Considerations: The yellow-billed cuckoo is not known to occur within the assessment area and the potential to support a population is believed to be very low. Therefore management activities on national forest system lands in the assessment area are believed to have little influence on the conservation of this species.

Black swift *(Cypseloides niger)*

Status and Distribution: The black swift is a local species of concern because (1) it has specialized nesting requirements that are found in very few locations in southern California and (2) most of its breeding localities are within the assessment area. Known nesting localities include Santa Anita Canyon and

Table 4.6. Detection rates and, where possible, trends in abundance for sixteen riparian birds from the national forest riparian point count study (1988 to 1996) and the Breeding Bird Survey (1980 to 1996). The trend value is the mean percent change per year in number of birds detected, based on the slope of a regression line. Statistically significant trend values ($P < 0.10$) are in bold. Detection rates were too low to produce meaningful trends for many of our fine-filter species.

	Avg. #	**Point Counts**		**BBS Routes — 1980 to 1996**					
	observed	1988 to 1996		California		CA Foothills		LA Ranges	
Species	each year	Trend	*P*	Trend	*P*	Trend	*P*	Trend	*P*
Song sparrow	163	**-3.6%**	0.04	0.3%	0.76	1.6%	0.55	-6.1%	0.37
Yellow warbler	104	-0.1%	0.91	**-3.0%**	0.04	**-5.0%**	0.00	**31.5%**	0.00
Warbling vireo	43	**7.6%**	0.09	**-2.0%**	0.03	**-2.9%**	0.02		
Lawrence's goldfinch	21	**-9.6%**	0.04	0.7%	0.78	0.1%	0.97	-11.6%	0.12
Black-chinned hummingbird	19	**-7.1%**	0.04	**-7.0%**	0.03	**-9.5%**	0.01		
Common yellowthroat	10	2.3%	0.66	**5.1%**	0.08				
Swainson's thrush	3	-6.0%	0.56						
Red-shouldered hawk	3	-2.5%	0.75						
Willow flycatcher**	2	Sample too small							
Yellow-breasted chat	2	Sample too small		1.3%	0.25	0.9%	0.62		
Cooper's hawk	2	Sample too small		**-7.5%**	0.02	**-7.0%**	0.03		
American dipper	1	Sample too small							
MacGillivray's warbler**	< 1	Sample too small							
Tree swallow	< 1	Sample too small							
Least Bell's vireo	< 1	Sample too small							
Black swift	< 1	Sample too small							

** Detections of these species were believed to be migrating birds based on time of year.

Wolfskill Canyon in the San Gabriel Mountains, Fallsvale in Mill Creek Canyon in the San Bernardino Mountains, and Tahquitz Creek in the San Jacinto Mountains (Garrett and Dunn 1981).

Habitat: Black swifts nest in rocky cliffs behind waterfalls. They occur in mountain and foothill canyons that contain waterfalls.

Conservation Considerations: Since waterfalls are also popular recreation sites, management attention is needed to ensure that black swift nest sites are not disturbed.

Southwestern willow flycatcher *(Empidonax traillii extimus)*

Status and Distribution: A precipitous decline in the abundance of the southwestern willow flycatcher led to its federal listing as endangered in 1995. Extensive loss of low-elevation riparian habitat across its range and brood parasitism by the brown-headed cowbird were identified as the primary causes of its decline (USFWS 1995c). Its breeding range includes southern California, Arizona, New Mexico, southern portions of Utah and Nevada, and western Texas (USFWS 1995c).

In southern California, the southwestern willow flycatcher is considerably less abundant than the least Bell's vireo (fig. 4.15). It occurs at fewer locations and in smaller numbers. One of the largest remaining populations is on the upper San Luis Rey River, partially within the Cleveland National Forest (Unitt 1987). About eighteen to twenty-five pairs breed along a 3-mile stretch of this river below Lake Henshaw (Griffith and Griffith 1995). A similar size population exists on the Santa Margarita River within

Table 4.7. Riparian-associated birds that received individual consideration.
Displayed for each species: (1) the level of knowledge about where it occurs in southern California and, in parentheses, the estimated percentage of locations that are on national forest system lands; (2) the mountain subareas occupied (y = occurs in breeding season, h = historically occurred, p = potentially occurs, t = transient, w = winter visitor)—if the species is localized and data are available, the approximate number of occurrences may be displayed; (3) the vulnerability of populations on national forest system lands to existing threat factors; (4) population trends; and (5) the assigned conservation category.

Riparian Birds Animals of Concern *federal status*	(1) Knowledge of SoCal Locations (% on NFs)	(2) areas occupied or estimated # of occurrences if spp. localized: Cleveland NF San Diego Rngs	Cleveland NF Snta Ana Mts	San Bern. NF San Jac Mts	San Bern. NF San Bern Mts	Angeles NF San Gab Mts	Angeles NF Cas-taic Rngs	Los Padres NF So. LP Rngs	Los Padres NF So. SL Rng	Los Padres NF No. SL Rng	(3) Vulner-ability on NFs	(4) Pop. Trend	(5) Conser-vation Category
Birds													
Cooper's hawk	Mod (30-60%)	y	y	y	y	y	y	y	y	y	Low	Unkn	Landscape scale
Yellow-billed cuckoo	Mod (0%)							p			Low	Unkn	Minimal influence
Black swift	Mod (>75%)	p		2-3	3-5	3-5	p	p		p	Mod	Unkn	Site specific
SW willow flycatcher *endangered*	High (20-50%)	20+	0	0	1	0	1-2	p	0	0	High	Decl	Site specific
Tree swallow	Low (< 5%)	y	t	y	y	y	p	y	y	y	High	Unkn	Landscape scale
Swainson's thrush	Low (10-30%)	y	y	p/t	p/t	y	y	y	y	y	Mod	Unkn	Landscape scale
American dipper	Low (> 75%)	2-4	0-2	5-15	20-30	20-30	0-2	~15	5-10	5-15	Low	Unkn	Landscape scale
Least Bell's vireo *endangered*	High (< 3%)	15	1-2	0	0	0	1	25	0	0	High	Incr/ Decl[2]	Site specific
Warbling vireo	Mod (30-60%)	y	y	y	y	y	y	y	y	y	Mod	Unkn	Landscape scale
Yellow warbler	Mod (30-60%)	y	y	y	y	y	y	y	y	y	Mod	Stab[1]	Landscape scale
Common yellowthroat	High (< 30%)	y	y	y	y	y	y	y	y	y	Mod	Unkn	Landscape scale
Yellow-breasted chat	Mod (< 20%)	y	y	y	y	y	y	y	y	y	Mod	Unkn	Landscape scale
Lawrence's goldfinch	Mod-Low (30-60%)	y	y	y	y	y	y	y	y	y	Mod	Decl[1]	Landscape scale

[1] based on USFS riparian point count results

[2] Bell's vireo is increasing regionwide, but decreasing on national forest service lands

Camp Pendleton. The only larger population in California occurs on the South Fork of the Kern River, where thirty-eight pairs were documented in 1997 (Whitfield et al. 1997).

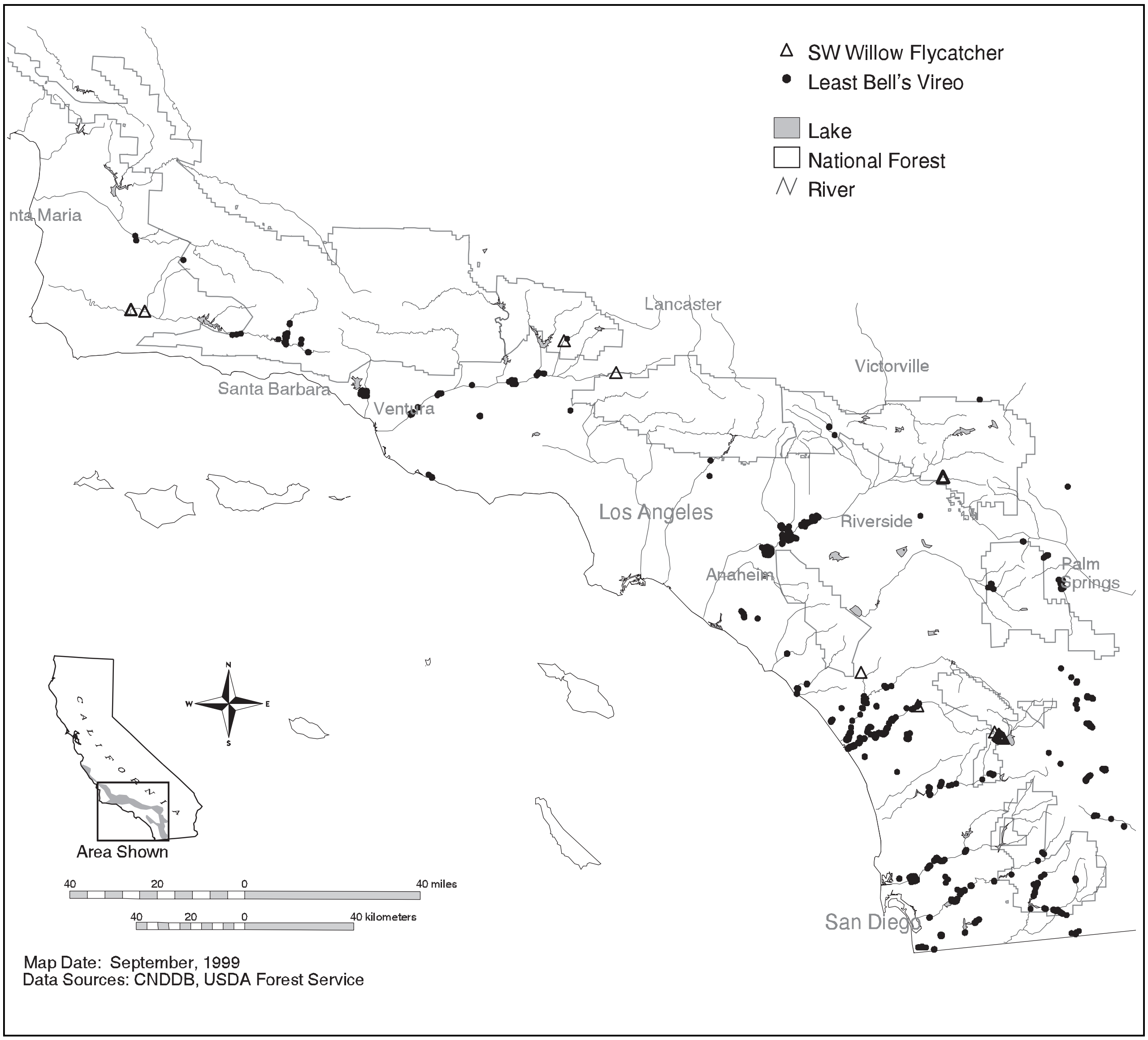
One to three breeding pairs have been observed annually between 1996 and 1998 on Mill Creek near Mountain Home Village on the San Bernardino National Forest. A sizeable number of early-summer detections at point-count stations on San Francisquito Creek in the Angeles National Forest suggest willow flycatchers may breed along that drainage. Also, a willow flycatcher was observed building a nest along the Santa Clara River in Soledad Canyon just north of national forest system lands (D. Cooper, UC Riverside, in litt.). There are currently no known breeding locations on the Los Padres, although several early-summer detections have been made at point-count stations on several drainages. It is unknown if they were residents or migrants.

Recent monitoring of the upper San Luis Rey River population suggests that it is currently stable (B. Haas, Varanus Consulting, pers. comm.). Populations on the Santa Margarita River and Prado Basin also appear stable, but willow flycatchers have not responded to cowbird control with dramatic increases as did the least Bell's vireo at those same locations (L. Hays, USFWS, pers. comm.).

Habitat: The southwestern willow flycatcher is a neotropical migrant that breeds in low-elevation riparian habitats. Occupied sites are highly localized and variable in vegetation structure, making it difficult to readily see what microhabitat features are being selected. One common denominator appears to be the presence of perennial or near-perennial water. Whitfield and Enos (1996) measured the vegetative characteristics of willow flycatcher breeding sites on the Kern River and found that all nesting territories had high vegetative volume in the lower strata and high canopy density.

Conservation Considerations: Southwestern willow flycatcher populations within the assessment area are few and vulnerable to existing threat factors. They therefore warrant

Figure 4.15. Known locations of the southwestern willow flycatcher and least Bell's vireo along the southern California coast.



site-specific management attention. The upper San Luis Rey River population is a particularly significant resource and should be managed accordingly. Threats are similar to those described for the least Bell's vireo, although factors controlling willow flycatcher population growth are not as well understood.

The South Fork, Kern River population is the best studied. In the years prior to cowbird control (1989 to 1992), nest parasitism rates averaged 62.5 percent. With cowbird removal (1994 to 1997), parasitism rates have averaged only 16.5 percent (Whitfield et al. 1997). However, this improvement has not, as of yet, resulted in a significant increase in the number of willow flycatchers (Whitfield et al. 1997). The Cleveland National Forest has trapped cowbirds annually along the upper San Luis Rey River since 1992. Nest parasitism rates prior to cowbird trapping are not known, but nest monitoring since the initiation of trapping has detected very low parasitism rates (less than 5 percent) (Griffith and Griffith 1995; B. Haas, pers. comm.).

More inventory work is needed to determine the full extent of breeding willow flycatcher populations. Determining if breeding is occurring along San Francisquito Creek is a particular priority. In addition, a better understanding is needed of the key factor limiting the growth and expansion of southwestern willow flycatcher populations.

Tree swallow *(Tachycineta bicolor)*

Status and Distribution: The tree swallow is a rare summer resident in southern California. We found no confirmed breeding locations on national forest system lands, although there likely are some. Most of the breeding locations identified by Garrett and Dunn (1981) are near the immediate coast (e.g. Morro Bay, Santa Maria River, and the lower San Luis Rey River). Two breeding locations, Lake Henshaw and Wynola, are within the assessment area and close to the boundaries of the Cleveland National Forest.

Habitat: Tree swallows typically breed in lowland and foothill riparian habitats in the vicinity of slow-moving or standing water (Garrett and Dunn 1981).

Conservation Considerations: More complete information is needed on the distribution of tree swallows on public lands in the assessment area. Ongoing surveys associated with the development of breeding bird atlases in Los Angeles and San Diego counties should provide much needed information. The decline of this species as a breeder in the region is attributed to loss of low-elevation riparian habitat and competition with starlings for nest cavities (Garrett and Dunn 1981).

Swainson's thrush *(Catharus ustulatus)*

Status and Distribution: There seems to be broad consensus that Swainson's thrushes are declining throughout California and have disappeared from many areas (Garrett and Dunn 1981; Unitt 1984; Stefani 1998). Results from the BBS also show a downward trend, although it is not statistically significant. The status of Swainson's thrushes within the assessment area is difficult to determine given the paucity of data on its distribution and abundance.

The Swainson's thrush is a common spring transient and localized summer resident in low-elevation riparian habitats in southern California. Breeding populations are reportedly more abundant from Santa Barbara County north (Garrett and Dunn 1981). Knowledge of its distribution and abundance within the assessment area is poor. The Swainson's thrush's apparent affinity for coastal lowland habitats (Unitt 1984) reduces the amount of potential nesting habitat on national forest system lands. Still, Swainson's thrushes were detected repeatedly along several drainages during the annual riparian point counts conducted from 1988 to 1996 (table 4.8). Some of these were probably transient birds, but the locations provide a place to start when looking for nesting locations.

Habitat: The Swainson's thrush occupies low-elevation riparian habitats, typically in dense thickets of willow and other hardwoods along the primary stream channel (R. Stefani, UC Davis, pers. comm.).

Conservation Considerations: Major threats are loss of lowland riparian habitat and nest parasitism by brown-headed cowbirds (Garrett and Dunn 1981). Better information on the distribution and abundance of the Swainson's thrush within the assessment area is sorely needed. It is clearly not common and appears to be vulnerable to existing threat factors.

American dipper *(Cinclus mexicanus)*

Status and Distribution: The American dipper is a species of local concern because it is rare in southern California and most locations are within the assessment area. Dippers are most common in the San Gabriel and San Bernardino mountains, with scattered occurrences in some of the other mountain ranges. Known dipper nesting localities include Upper Sisquoc Falls, Santa Paula Canyon, Agua Blanca Creek and Sespe Creek (Los Padres National Forest); Santa Anita Canyon and the upper forks of the San Gabriel River (Angeles National Forest); Upper Santa Ana River, Bear Creek and Mill Creek in the San Bernardino Mountains and Tahquitz Creek and the North Fork of the San Jacinto River in the San Jacinto Mountains (San Bernardino National Forest); and Pauma Creek on Palomar Mountain (Cleveland National Forest)(Garrett and Dunn 1981; Unitt 1984; Lane 1985; Lentz 1993).

Habitat: Dippers occupy fast-flowing, clear streams in mountain canyons (Garrett and Dunn 1981).

Conservation Considerations: Dipper habitat is typically in remote canyons and vulnerability to land use impacts is believed to be low. The biggest threat is further impoundment or diversion of streamflows.

Table 4.8. Locations where Swainson's thrushes were detected multiple times in riparian point count surveys from 1988 to 1996. These surveys did not extend north of the Sisquoc River. Most detections were made during the month of May. Further survey work is needed to determine if these represent breeding locations or just birds migrating through the area.

Swainson Thrush Locations

Specific Drainage	Primary Drainage	National Forest	# of Years Detected	# of points where detected
Cachuma Creek	Santa Ynez River	Los Padres	2	1
Santa Ynez River	Santa Ynez River	Los Padres	1	3
Elizabeth Lake Canyon	Elizabeth Lake Canyon	Angeles	2	3
San Francisquito Canyon	San Francisquito Canyon	Angeles	2	2
Little Tujunga Canyon	Little Tujunga Canyon	Angeles	2	2
Lower Big Tujunga Canyon	Big Tujunga Canyon	Angeles	3	4
Upper Big Tujunga Canyon	Big Tujunga Canyon	Angeles	1	3
Mill Creek (Big Tujunga)	Big Tujunga Canyon	Angeles	2	2
Arroyo Seco Creek	Arroyo Seco Creek	Angeles	2	2
Cajon Creek (Lost Lake)	Cajon Creek	San Bern.	2	1
Bautista Canyon	San Jacinto River	San Bern.	4	2
Silverado Canyon	Silverado Canyon	Cleveland	3	4
San Juan Creek	San Juan Creek	Cleveland	3	2
Long Canyon	San Juan Creek	Cleveland	2	1
Pine Valley Creek	Pine Valley Creek	Cleveland	1	2
Kitchen Creek	Cottonwood Creek	Cleveland	1	2
La Posta Creek	Cottonwood Creek	Cleveland	2	2
Morena Creek	Cottonwood Creek	Cleveland	2	1

Least Bell's vireo *(Vireo bellii pusillus)*

Status and Distribution: The least Bell's vireo was federally listed as endangered in 1986. Its breeding range is restricted to southern California and northern Baja California, Mexico (USFWS 1998c). The low-elevation riparian habitats preferred by Bell's vireos are uncommon in the assessment area. Consequently, Bell's vireo numbers are low on national forest system lands and make up a small percentage (less than 3 percent) of the total regional population. The largest population on national forest system lands, currently twenty to thirty pairs, is located on the Los Padres along the upper Santa Ynez River and its tributaries, Mono and Indian Creeks, above Gibraltar Reservoir. This population has been monitored for many years by Jim Greaves and associates (Gray and Greaves 1984; Greaves 1989, 1993, 1997). It appears to be the only area on the Los Padres where Bell's vireos consistently breed (Greaves and Labinger 1997).

The other documented breeding locations within the assessment area are within or near the Cleveland National Forest. Bell's vireo locations on the Cleveland National Forest are along the upper reaches of drainages that have substantially larger populations further downstream. Small breeding populations (one to ten pairs) exist on national forest system lands along Cottonwood Creek (a tributary of the Tijuana River), Pine Valley Creek (a tributary of Cottonwood Creek), Santa Ysabel Creek, and the San Luis Rey River.

Within the Angeles National Forest there have been sporadic sightings of Bell's vireos during the breeding season on San Francisquito Creek, Big Tujunga Creek, and the upper Santa Clara River (USFWS 1998c). Two were also sighted on Cajon Creek within San Bernardino National Forest in 1990. However, breeding has not been documented at any of these locations. There is a need to determine if breeding populations exist in these drainages.

The decline of this species is attributed primarily to extensive loss of low elevation riparian habitat and brood parasitism by the brown-headed cowbird. In recent years, least Bell's vireo numbers in southern California have increased dramatically, from an estimated 300 pairs in 1986 to an estimated 1,346 pairs in 1996 (USFWS 1998c).

Habitat: The least Bell's vireo is a neotropical migrant that breeds in low-elevation riparian habitats, particularly broad cottonwood-willow woodlands and mule fat scrub. A detailed description of habitat characteristics is provided in the draft recovery plan (USFWS 1998c).

Conservation Considerations: Within the assessment area, habitat degradation and nest parasitism by brown-headed cowbirds are the biggest threats to least Bell's vireos (USFWS 1998c). Habitat loss is occurring primarily in urbanizing areas and is not considered to be a major problem on public lands.

Cowbird nest parasitism, where it has not been effectively reduced through control programs, is probably the most chronic and debilitating threat to least Bell's vireo populations. It is considered to be a major problem for all of the Bell's vireo populations on national forest system lands (Greaves 1997; Wells and Turnbull 1998). Cowbird control efforts near vireo breeding areas are cited as being particularly instrumental in the recovery of this species.

On the Santa Margarita River within the Camp Pendleton Marine Corps Base, cowbird parasitism of least Bell's vireo nests was at 47 percent in 1983 when the base began an intensive cowbird trapping program. With annual trapping, by 1990 the brood parasitism rate had dropped to less than 1 percent (Griffith and Griffith, in press). The Santa Margarita River Bell's vireo population rose from 60 pairs in 1983 to 319 pairs in 1993 (Griffith and Griffith, 1995). Since the initiation of annual cowbird removal programs, similarly dramatic population increases have occurred on the Tijuana and San Luis Rey rivers and in the Prado Basin (Kus 1995; Kus 1996; Pike and Hays 1997).

Bell's vireo populations on national forest system lands have not been nearly as successful. The Santa Ynez River population has dropped from fifty-five breeding pairs in 1980 to fewer than thirty pairs in 1994 (Greaves 1997). The population along Pine Valley Creek has dropped from five pairs in 1994 to zero in 1997 and 1998, although in neighboring Cottonwood Creek the population has stayed consistently around four to six pairs (Wells and Turnbull 1998).

Habitat degradation can occur when the structure or composition of riparian vegetation is altered. Dense shrub cover within 3 to 6 feet of the ground is important for Bell's vireos and this cover can be significantly reduced by overgrazing, off-road vehicle activity, concentrated recreation use, channel clearing, and large discharges of water from upstream reservoirs. Invasions of non-native plants, particularly arundo and tamarisk, are also crowding out native plants and degrading habitats for the Bell's vireo in a number of locations.

Warbling vireo *(Vireo gilvus)*

Status and Distribution: The warbling vireo is identified as a high-priority riparian obligate species by California Partners in Flight (Evans 1997). It is a summer resident at low- to mid-elevations across the assessment area, although there are few recent breeding records from the San Jacinto Mountains and the San Diego ranges (Garrett and Dunn 1981; Unitt 1984).

Warbling vireos were detected at 30 percent of the riparian point-count stations annually and they increased significantly in abundance between 1988 and 1996 (table 4.6) (Stephenson et al. 1998). However, the BBS results suggest that warbling vireos may be declining statewide. Garrett and Dunn (1981) indicate that this species has declined in the southern half of the assessment area, particularly at lower elevations.

Habitat: In the northern part of the assessment area, warbling vireos commonly nest in low-elevation riparian and mixed woodland habitats (Garrett and Dunn 1981). In the south they apparently now nest primarily in mixed conifer-oak woodlands in the mountains (Garrett and Dunn 1981; Unitt 1984).

Conservation Considerations: Nest parasitism by brown-headed cowbirds is strongly implicated in the decline of this species as a breeder in coastal lowland and foothill riparian areas (Garrett and Dunn 1981; Unitt 1984).

Yellow warbler
(Dendroica petechia brewsteri)

Status and Distribution: The yellow warbler is a California Species of Special Concern and is identified as a high-priority riparian obligate species by California Partners in Flight (Evans 1997). It is a summer resident at low-elevations across the assessment area.

Yellow warblers were detected at 51 percent of the riparian point-count stations annually and had a very stable trend. This was the only species for which it was possible to conclude, with high statistical power, that they are not declining at an annual rate of 3 percent or more (table 4.6) (Stephenson et. al. 1998). However, results from the BBS suggest that the yellow warbler may be declining statewide and in the California foothills physiographic region (Sauer et al. 1997).

Habitat: Yellow warblers breed in riparian woodlands in the lowlands and foothill canyons (Garrett and Dunn 1981; Unitt 1984; Lehman 1994). They are typically found in riparian forests that contain cottonwoods, sycamores, willows, or alders.

Conservation Considerations: Nest parasitism by brown-headed cowbirds is strongly implicated in the decline of this species as a breeder in coastal lowland and foothill riparian areas (Garrett and Dunn 1981; Unitt 1984).

Common yellowthroat *(Geothlypis trichas)*

Status and Distribution: The common yellowthroat is identified as a high priority riparian obligate species by California Partners in Flight (Evans 1997). It is primarily a species of lowland habitats and occurs in the assessment area only in the low foothills. Common yellowthroats were detected at only 8 percent of the riparian point-count stations annually and no clear trend in abundance could be ascertained (table 4.6). BBS results suggest that yellowthroats may be on the increase statewide (Sauer et al. 1997).

Habitat: Common yellowthroats typically breed in fresh water and brackish marshes of cattails, bulrushes, and other emergent vegetation and also occupy dense brush in damp areas (Garrett and Dunn 1981).

Conservation Considerations: The primary threat to this species is loss or degradation of riparian habitats, particularly areas that support dense emergent vegetation.

Yellow-breasted chat *(Icteria virens)*

Status and Distribution: The yellow-breasted chat is a California Species of Special Concern and is identified as a high-priority riparian obligate species by California Partners in Flight (Evans 1997). It is a localized summer resident in low-elevation foothill canyons across the assessment area and appears to be quite rare. Indications are that this species has declined dramatically in southern California (Garrett and Dunn 1981).

Chats were rarely detected in the riparian point-count survey. All of the stations at which they were detected in multiple years are located on the Los Padres National Forest. Known locations of the yellow-breasted chat include Mono Creek, Santa Ynez River, and Sespe Creek on the Los Padres National Forest; San Francisquito and Elizabeth Lake canyons on the Angeles National Forest; Bautista Canyon on the San Bernardino National Forest; and the upper San Luis Rey River on the Cleveland National Forest (Unitt 1984).

Habitat: Yellow-breasted chats breed in dense riparian thickets and brushy tangles in the vicinity of water courses (Garrett and Dunn 1981). They are found primarily in the coastal lowlands.

Conservation Considerations: Major threats to this species are loss of lowland riparian habitat and nest parasitism by brown-headed cowbirds (Garrett and Dunn 1981). More information is needed on the distribution and abundance of the yellow-breasted chat within the assessment area. The rarity and apparent decline of this species warrants paying increased attention to sites where they still occur.

Lawrence's goldfinch *(Carduelis lawrencei)*

Status and Distribution: The Lawrence's goldfinch has been identified as a "extremely high priority" watch list species by Partners in Flight, although no reason is given for this designation (Carter 1998). It is probably because the breeding range of this species is restricted to California west of the Sierra Nevada and to northern Baja California. Lawrence's goldfinches are found at low- to mid-elevations on both coastal and desert sides of the assessment area, but it is described as an opportunistic, nomadic breeder (D. Cooper, UC Riverside, pers. comm.), and thus its distribution and abundance varies considerably from year to year (Garrett and Dunn 1981).

Lawrence's goldfinches were detected at 12 percent of the riparian point count stations annually and had a declining trend of 9.6 percent per year (table 4.6). However, this species is known for having large and erratic fluctuations in abundance (Garrett and Dunn 1981), so this trend may be misleading. A decline in Lawrence's goldfinches was not apparent in statewide BBS results, but was observed in BBS routes from the Los Angeles Ranges physiographic region (Sauer et al. 1997).

Habitat: Lawrence's goldfinches breed around riparian thickets within arid woodlands and shrublands (e.g., arid oak savanna, pinyon-juniper, chaparral, open coniferous forest) (Garrett and Dunn 1981).

Conservation Considerations: It is difficult to assess the conservation needs of the Lawrence's goldfinch. More information is needed on what areas or microhabitats may be particularly important to this species.

Riparian Invertebrates

Three riparian invertebrates were identified as being rare or potentially at risk and received individual consideration (table 4.9).

California diplectronan caddisfly
(Diplectronan californica)

Status and Distribution: The California diplectronan caddisfly is a former C2 candidate for federal listing. Information is scarce on the range of this species; the type locality is from Claremont and the only other identified location is on Mill Creek at Thurman Flats in the San Bernardino National Forest (Erman and Nagano 1992).

Habitat: Little is known about this particular species, but other species of this genus are known to occur in rapid portions of small, cool streams (Erman and Nagano 1992).

Conservation Considerations: More information is needed on the distribution, abundance, and habitat associations of this caddisfly before a meaningful conservation strategy can be developed.

Greenest tiger beetle
(Cicindela tranquebarica virudissima)

Status and Distribution: The greenest tiger beetle was formerly a C1 candidate species for federal listing. It is known from the upper Santa Ana River wash area at the base of the San Bernardino Mountains (Ballmer 1992) and was observed in Bautista Canyon in the 1970s (M. Nelson, USFWS, pers. comm.). It is unknown if these populations extend onto public lands within the assessment area.

In 1996, the U.S. Fish and Wildlife Service removed this subspecies from the candidate list based on taxonomic studies which indicate that *C. t. virudissima* is synonymous with the more widely distributed *C. t. vibex* (USFWS 1996b).

Habitat: The greenest tiger beetle is usually found near running water where there is fine sand. Larvae live in burrows in the sand at the margin of streams. Adults are active

Table 4.9. Riparian-associated invertebrates and mammals that received individual consideration. Displayed for each species: (1) the level of knowledge about where it occurs in southern California and, in parentheses, the estimated percentage of locations that are on national forest system lands; (2) the mountain subareas occupied (y = occurs in breeding season, h = historically occurred, p = potentially occurs, t = transient, w = winter visitor)—if the species is localized and data are available, the approximate number of occurrences may be displayed; (3) the vulnerability of populations on national forest system lands to existing threat factors; (4) population trends; and (5) the assigned conservation category.

Riparian Mammals and Invertebrates *federal status*	(1) Knowledge of SoCal Locations (% on NFs)	(2) areas occupied or estimated # of occurrences if spp. localized									(3) Vulner-ability on NFs	(4) Pop. Trend	(5) Conser-vation Category
		Cleveland NF		**San Bern. NF**		**Angeles NF**		**Los Padres NF**					
		San Diego Rngs	Snta Ana Mts	San Jac Mts	San Bern Mts	San Gab Mts	Cas-taic Rngs	So. LP Rngs	So. SL Rng	No. SL Rng			
Invertebrates													
CA diplectronan caddisfly	Very Low (?)				y	p	p				Unkn	Unkn	Landscape level
Greenest tiger beetle	Very Low (?)			p	p						Unkn	Unkn	Miinimal Influence
Harbison's dun skipper	Mod (< 20%)	y	y								Mod	Unkn	Landscape level
Mammals													
Western red bat	Low (?)	y	y	y	y	y	y	y	y	y	Mod	Unkn	Landscape level
San Bernardino dusky shrew	Low (> 75%)				y	y					Low	Unkn	Landscape level
Ringtail	Low (30-70%)	y	y	y	y	y	y	y	y	y	Low	Unkn	Landscape level

runners and fliers along stream shores (Ballmer 1992).

Conservation Considerations: Information is needed on the distribution of this beetle along portions of the Santa Ana River and Bautista Creek that lie within the assessment area. However, changes in the species' taxonomy suggest it is no longer a rare taxon.

Harbison's dun skipper *(Euphyes vestris harbisoni)*

Status and Distribution: The Harbison's dun skipper is a former C2 candidate for federal listing. This butterfly occurs in a series of scattered and disjunct colonies throughout western San Diego County, extending as far north as the Santa Ana Mountains in Orange County (Brown 1991). Localities in or near the assessment area include Silverado Canyon (Santa Ana Mountains), San Pasqual Valley, Ramona, Flinn Springs, Old Viejas Grade, Otay Mountain, and Tecate Peak (Murphy 1990; Brown 1991). Some historic populations have declined or been extirpated, primarily due to habitat loss resulting from development.

Habitat: The Harbison's dun skipper typically occurs in partially-shaded, riparian oak woodland habitats in a matrix of chamise chaparral or southern mixed chaparral, where seeps or springs provide adequate water to support the larval host plant, San Diego sedge *(Carex spissa)* (Brown 1991). The butterfly has never been found in the absence of San Diego sedge (Brown 1991).

Conservation Considerations: More information is needed on occurrences of this species on public lands in the Santa Ana Mountains and the San Diego ranges. The presence of San Diego sedge in considerable numbers is a strong indicator of potential habitat for this species (Brown 1991). Water sources associated with occupied or potential habitat should be protected.

Riparian Mammals

Three riparian-associated mammals were identified as being rare or potentially at risk and received individual consideration (table 4.9).

Western red bat *(Lasiurus blossevillii)*

Status and Distribution: The western red bat is a Forest Service Region 5 Sensitive Species and a California Species of Special Concern. There is little information on the distribution and relative abundance of western red bats in southern California. During surveys in the national forests, it was recently detected by mist net capture or Anabat detector in the following locations: upper Salinas River (Los Padres National Forest), Sugarloaf Meadows and Big Bear Dam (San Bernardino National Forest), and Laguna Meadow and Lost Valley (Cleveland National Forest) (Miner and Brown 1996; Simons et al. in prep.).

Habitat: The western red bat is primarily a solitary species that roosts in the foliage of trees and shrubs often, but not exclusively, in riparian habitats (Bolster 1998).

Conservation Considerations: More information is needed on the distribution and abundance of this species before its conservation needs can be adequately assessed. There is a concern about the effect of controlled burns on this species when roosting in leaf litter during cool weather (Bolster 1998).

San Bernardino dusky shrew *(Sorex monticolus parvidens)*

Status and Distribution: The San Bernardino dusky shrew was formerly a California Species of Special Concern. It is reported to occupy riparian habitats from about 4,200 to 7,500 feet elevation in the San Bernardino and San Gabriel mountains (Hennings and Hoffman 1977). However, Williams (1986) reports that these shrews are indistinguishable from ornate shrews captured in the same areas. He concludes that they are probably the same species and that these populations are not threatened.

Habitat: These shrews are solitary, secretive animals that occupy moist soil, stumps, and logs in montane riparian and wet meadow areas (Ingles 1965; Zeiner et al. 1990).

Conservation Considerations: The recommended change in the taxonomic status of the San Bernardino dusky shrew has caused it to be dropped from the California Species of Special Concern list. The ornate shrew is widespread and, given its habitat requirements and life history characteristics, it should not be particularly vulnerable to land use activities currently occurring on national forest system lands.

Ringtail *(Bassariscus astutus)*

Status and Distribution: The ringtail is not on any concern lists and it is believed to be relatively common (P. Collins, Santa Barbara Nat. Hist. Museum, pers. comm.). We include it as a local viability concern because there is little recent, documented information on its distribution or status in the assessment area. Vaughan's (1954) report on mammals in the San Gabriel Mountains says that ringtails were present in San Gabriel Canyon, Dalton Canyon, Palmer Canyon, and San Antonio Canyon. There are more recent reports of sightings in Lytle Creek Canyon (S. Loe, San Bernardino NF, pers. comm.).

Habitat: Ringtails are generally known to occupy brushy and wooded areas along water courses in foothill and lower montane canyons (Jameson and Peeters 1988). Its principal habitat requirements seem to be den sites among boulders or in hollows in trees and sufficient food in the form of rodents and other small animals (Williams 1986). Rocky habitats are apparently preferred. In the San Gabriel Mountains, Vaughan (1954) reports that ringtails occur in canyons in the chaparral belt. Unlike the raccoon, ringtails reportedly avoid urbanized areas (Jameson and Peeters 1988).

Conservation Considerations: Some current, baseline information is needed on the distribution of this species within the assessment area. However, the ringtail's habitat requirements are not likely to make it highly vulnerable to land use activities occurring on national forest system lands.

Lake Species

Two species of concern, both birds, are strongly associated with lake or reservoir habitats (table 4.10). The distribution and abundance of these species has actually increased within the assessment area over the last eighty years as a result of reservoir development.

Bald Eagle *(Haliaeetus leucocephalus)*

Status and Distribution: Bald eagle populations in the continental United States were federally listed as threatened in 1978. However, steady population increases nationwide culminated in a formal proposal on July 4, 1999, to remove bald eagles from the threatened species list. Southern California is primarily wintering habitat for bald eagles. Breeding has been confirmed only in a few locations in the northern part of the assessment area (i.e., Nacimiento Lake, San Antonio Lake, and Cachuma Lake). However, a pair recently attempted to nest near Silverwood Lake in the San Bernardino Mountains.

The largest wintering population in southern California is at Big Bear Lake in the San Bernardino Mountains, where twenty to thirty eagles typically congregate from November to March. Most of the other large reservoirs in the assessment area also support anywhere from two to ten wintering eagles. In the San Bernardino Mountains, bald eagles have been observed moving between lakes during the winter (R. Butler, Mountaintop District, pers. comm.).

Habitat: In the assessment area, bald eagles are usually found close to lakes and reservoirs where they feed on fish, coots, and waterfowl (Garrett and Dunn 1981).

Conservation Considerations: There are high levels of human activity around many of the reservoirs in the assessment area where bald eagles spend the winter months. The eagles are affected by this activity and can alter their

Table 4.10. Rare or potentially at risk species associated primarily with lake habitats.
Displayed for each species: (1) the level of knowledge about where it occurs in southern California and, in parentheses, the estimated percentage of locations that are on national forest system lands; (2) the mountain subareas occupied (y = occurs in breeding season, h = historically occurred, p = potentially occurs, t = transient, w = winter visitor)—if the species is localized and data are available, the approximate number of occurrences may be displayed; (3) the vulnerability of populations on national forest system lands to existing threat factors; (4) population trends; and (5) the assigned conservation category.

Lake Associated Animals of Concern *federal status*	(1) Knowledge of SoCal Locations (% on NFs)	(2) areas occupied or estimated # of occurrences if spp. localized: Cleveland NF San Diego Rngs	Cleveland NF Snta Ana Mts	San Bern. NF San Jac Mts	San Bern. NF San Bern Mts	Angeles NF San Gab Mts	Angeles NF Cas-taic Rngs	Los Padres NF So. LP Rngs	Los Padres NF So. SL Rng	Los Padres NF No. SL Rng	(3) Vulner-ability on NFs	(4) Pop. Trend	(5) Conser-vation Category
Birds													
Bald eagle *threatened**	High (30-60%)	w	t	w	w	w	w	y	y	y	Mod	Stable	Site Specific
Osprey	High (20-50%)	w	t	w	p/w	t	w	y	p/w	y	Mod	Unkn	Minimal Influence

* There is now a formal proposal to remove the bald eagle from the threatened species list.

habitat use patterns because of it (Steidl and Anthony 1996).

Osprey *(Pandion haliaetus)*

Status and Distribution: The osprey is a California Species of Special Concern. It primarily is an uncommon winter visitor in southern California, but nesting has been documented at Lake Casitas near Ventura and Lake San Antonio in Monterey County (Garrett and Dunn 1981) and may occur elsewhere.

Habitat: Ospreys eat fish and thus are found near large coastal estuaries and inland lakes.

Conservation Considerations: The habitat requirements of osprey in the assessment area center on lake resources. Typically, these resources are little affected by management activities occurring on national forest system lands.

Animals of Monterey Coast Habitats

As described in chapter 2, the Monterey coast has habitats that are found nowhere else in the assessment area. Ten animal species associated with these unique habitats are considered individually in this section (table 4.11). Included in this group are two marine mammals and several bird species that are found only along the immediate coast. They require consideration because the Monterey District of the Los Padres National Forest encompasses almost twenty miles of ocean coastline in this area.

Smith's blue butterfly *(Euphilotes enoptes smithi)*

Status and Distribution: The Smith's blue butterfly was federally listed as endangered in 1976. At the time of listing it was thought to occur only in coastal dunes along Monterey Bay and from coastal scrub near Big Sur (Foster 1998). However, focused surveys have revealed additional populations and the Smith's blue is now known to occur along the coastal portions of Monterey, Santa Cruz, and San Mateo counties at about one hundred different locations (R.A. Arnold pers. comm., as cited in Foster 1998). Eleven of these sites are on or close to national forest system land (Foster 1998). Occupied areas include Big Sur Park, Burns Creek, along the Nacimiento-Ferguson Road, Kirk Creek, and Gorda Horse Pasture (fig. 4.16).

Habitat: The Smith's blue butterly occurs in coastal prairie and coastal scrub habitats. Its distribution is limited to a portion of the combined range of two host plants: seacliff buckwheat *(Eriogonum parvifolium)* and coast buckwheat *(Eriogonum latifolium)*. Together these two plants function as the sole larval and primary adult food plants for the butterfly (Arnold 1983). Norman (1994) surveyed the west slope of the northern Santa Lucia Range and, based on the presence of seacliff buckwheat, estimated that there are several thousand acres of potentially suitable Smith's blue butterly habitat on the Monterey Ranger District. The elevation range of seacliff buckwheat is from sea level to approximately 2,600 feet (Foster 1998).

Conservation Considerations: The Smith's blue butterfly is a rare and highly localized species that warrants site-specific management attention. Foster (1998) provides a detailed evaluation of factors potentially affecting Smith's blue butterfly populations within the assessment area; the following synopsis is based on that report. Small amounts of suitable habitat may be affected by existing roads, trails, and developed recreation sites.

Table 4.11. Animals associated with Monterey Coast habitats that received individual consideration. Displayed for each species: (1) the level of knowledge about where it occurs in southern California and, in parentheses, the estimated percentage of locations that are on national forest system lands; (2) the mountain subareas occupied (y = occurs in breeding season, h = historically occurred, p = potentially occurs, t = transient, w = winter visitor)—if the species is localized and data are available, the approximate number of occurrences may be displayed; (3) the vulnerability of populations on national forest system lands to existing threat factors; (4) population trends; and (5) the assigned conservation category.

Monterey Coast Animals of Concern *federal status*	(1) Knowledge of SoCal Locations (% on NFs)	(2) areas occupied or estimated # of occurrences if spp. localized **Cleveland NF** San Diego Rngs	**Cleveland NF** Snta Ana Mts	**San Bern. NF** San Jac Mts	**San Bern. NF** San Bern Mts	**Angeles NF** San Gab Mts	**Angeles NF** Cas-taic Rngs	**Los Padres NF** So. LP Rngs	**Los Padres NF** So. SL Rng	**Los Padres NF** No. SL Rng	(3) Vulner-ability on NFs	(4) Pop. Trend	(5) Conser-vation Category
Invertebrates													
Smith's blue butterfly *endangered*	High (10-50%)									y	Mod	Unkn	Site specific
Doudoroff's elfin	Low (40-80%)									y	Low	Unkn	Landscape level
Clemence's silverspot	Mod (40-80%)								y	y	Low	Unkn	Landscape level
Amphibians													
Pacific giant salamander	Low (40-80%)									y	Low	Unkn	Landscape level
Birds													
CA brown pelican *endangered*	High (<2%)									y	Low	Incr	Minimal Influence
Western snowy plover *threatened*	Mod (< 2%)									p	Mod	Unkn	Site specific
Marbled murrelet *endangered*	Mod (< 5%)									y	Low	Unkn	Site specific
Mammals													
Monterey dusky-footed woodrat	Low (?)									y	Low	Unkn	Landscape level
Southern sea otter *threatened*	High (< 1%)									y	Low	Stable	Minimal Influence
Steller sea lion *threatened*	High (< 5%)									y	Low	Decl	Minimal Influence

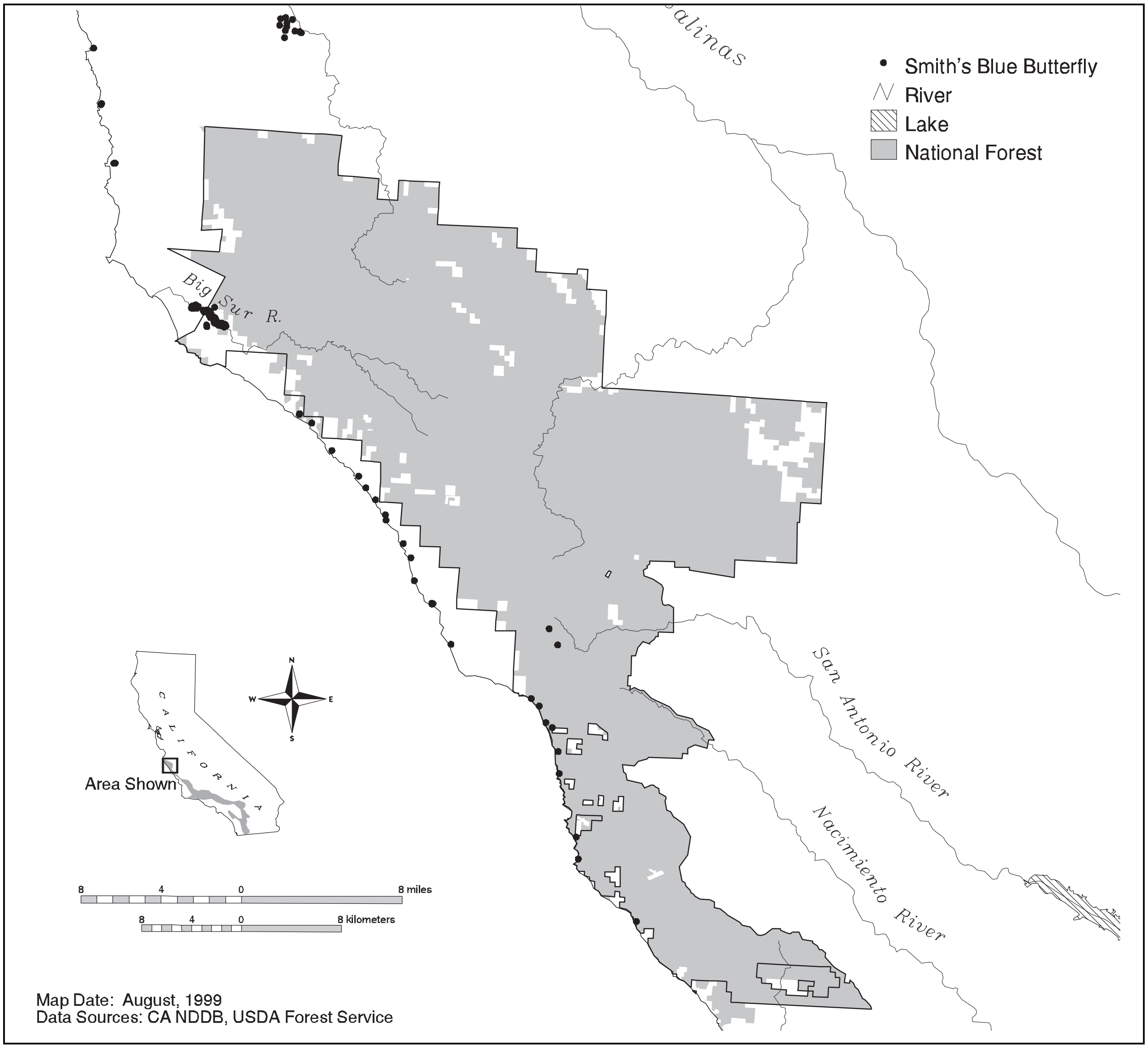


Figure 4.16. Documented locations of the Smith's blue butterfly along the Monterey coast (this map may not show all known localities).

Livestock grazing is permitted in areas of suitable and occupied Smith's blue habitat and may be causing habitat degradation. Invasive, non-native plants may be causing a reduction in the abundance of seacliff buckwheat. Particular problem species are kikuyu grass *(Pennisetum clandestinum)*, Pampas grass, and French broom.

Doudoroff's elfin butterfly *(Incisalia mossii doudoroffi)*

Status and Distribution: The Doudoroff's elfin butterfly is known primarily from Partington Canyon near Big Sur (Murphy 1990). Potential habitat occurs elsewhere along the southern Monterey coast, primarily on the Los Padres National Forest east of Highway 1 and largely within the Ventana Wilderness Area. The lack of observations of this species from other areas is attributed to the inaccessibility of its habitat and its short, early flight period (February to early March) (Murphy 1990).

Habitat: The host plant for Doudoroff's elfin is a *Sedum* species (Murphy 1990).

Conservation Considerations: Additional information is needed on the distribution and abundance of this species and its host plant. In Murphy's (1990) status review, the

Doudoroff's elfin is listed as a category C taxon, that is, a taxon for which specific protective measures are not presently necessary. However, it appears this determination is based upon very little specific information.

Clemence's silverspot butterfly
(Speyeria adiaste clemencei)

Status and Distribution: The Clemence's silverspot butterfly occurs in both the northern and southern Santa Lucia Ranges, from the vicinity of Carmel on the north, to the area of Pozo on the south (Murphy 1990). It is also found on the north end of Garcia Mountain. Much of its distribution is believed to be on the Los Padres National Forest (Murphy 1990).

Habitat: The suspected food plant of this butterfly is *Viola quercetorum* (Murphy 1990).

Conservation Considerations: Additional information is needed on the distribution and abundance of this species. Murphy (1990) considers the Clemence's silverspot to be a category D taxon, that is, a taxon that is neither in danger of extinction nor likely to be. However, it is unclear what specific information is being used to make this determination.

Pacific giant salamander
(Dicamptodon ensatus)

Status and Distribution: The northern Santa Lucia Range contains the southernmost populations of this salmander (Anderson 1969). This disjunct population is concentrated along the Little Sur River (J. Copp, CA Academy of Sciences, pers. comm.). We did not find any information on the abundance or status of the Pacific giant salamander in this area. It is not considered to be a sensitive species.

Habitat: The Pacific giant salamander is associated with streams and other mesic habitats in humid, coastal forests (particularly redwood).

Conservation Considerations: Water quality and the sustainability of mesic conditions appear to be important factors for the Pacific giant salamander. Along the Monterey coast, much of the habitat for this species is within a designated wilderness area.

California brown pelican
(Pelecanus occidentalis californicus)

Status and Distribution: The federally endangered California brown pelican is found only near the ocean, along the entire central and southern California coast and in Baja California, Mexico (Garrett and Dunn 1981). It is addressed as a Monterey coast species because that is the only place where the assessment area reaches the ocean's edge. Approximately twenty miles of coastline are within the Monterey District of the Los Padres National Forest. Brown pelicans are not believed to breed along this stretch, but they can be found there during the summer months.

Habitat: The California brown pelican is almost exclusively a bird of marine habitats and thus is found only along the immediate coastline. Birds currently nest in several large colonies on the Channel Islands (Garrett and Dunn 1981).

Conservation Considerations: The primary threats to brown pelicans are (1) the continued, although dwindling, presence of organochlorine pesticides (e.g., DDT) in the marine food chain, and (2) depleted food resources due to commercial harvesting of fish such as anchovies (Garrett and Dunn 1981). However, brown pelican numbers have increased substantially in the last twenty years. This increase has largely been attributed to a decline in near-shore DDT levels.

Although the brown pelican does occur on public lands within the assessment area, the management of those lands has little effect on the conservation of this species. Brown pelicans are dependent on resources that come from the marine environment and on the key locations where they nest.

Western snowy plover
(Charadrius alexandrinus nivosus)

Status and Distribution: The western snowy plover is primarily an inhabitant of sandy coastal beaches. It was federally listed as threatened in 1993 because of population declines and disturbance to coastal nesting sites (USFWS 1993d). The preference of snowy plovers for sandy beaches has led to its decline as a nesting bird along the coast; such areas suffer from much human disturbance during the nesting season (Garrett and Dunn 1981). Snowy plovers reportedly nest on the beach near Point Sur Lighthouse just north of the assessment area (California Coastal Commission 1987). Most of the coastline within the assessment area is steep and devoid of sandy beaches; however, there are several small beaches (e.g., Pfeiffer and Sand Dollar) that potentially could support this species.

Habitat: Snowy plovers nest, feed, and take cover on sandy or gravelly beaches along the coast, on estuarine salt ponds, and on alkali lakes (Zeiner et al. 1990a).

Conservation Considerations: More information is needed on the nesting status of snowy plovers in this area and the potential for beaches within the assessment area to support nesting.

Marbled murrelet
(Brachyramphus marmoratus)

Status and Distribution: The marbled murrelet was federally listed as threatened in 1992 because of population declines and concerns that logging in coastal forests of the Pacific Northwest was eliminating its nesting habitat (USFWS 1992b). The Monterey coast is at the extreme southern periphery of the marbled murrelet's breeding range (Ralph et al. 1995).

Reported sitings of marbled murrelets along the central California coast have been concentrated within a 6-mile (10 kilometer) radius of Point Año Nuevo in Santa Cruz County (Ainley et al. 1995). It is unclear if they actually do nest as far south as the coastal forests in the northern Santa Lucia Range. The habitat appears suitable, but we could find no documentation of sitings in this area.

Habitat: Marbled murrelets spend most of their lives at sea but come onshore to nest in large, old trees. They are highly secretive on land and it is difficult to locate their nest sites (Ralph et al. 1995).

Conservation Considerations: It is important to determine if marbled murrelets do nest in the northern Santa Lucia Range. However, even if they do, threats to suitable breeding habitats are likely to be low. No logging is done in this area and most of the forested area along the immediate coast is within state parks or Forest Service wilderness areas.

Monterey dusky-footed woodrat
(Neotoma fuscipes luciana)

Status and Distribution: The Monterey dusky-footed woodrat is listed as a California Species of Concern although it was not discussed in Williams' (1986) report on mammalian species of concern in California. We could find very little information on this specific subspecies, other than it is reported to occur in a variety of areas on Fort Ord near Monterey. Woodrats are common in the northern Santa Lucia Range (e.g., the Hastings Reserve) (Williams et al. 1992), but it is unclear if they are this particular subspecies.

Habitat: Dusky-footed woodrats are generally found in dense chaparral, oak and riparian woodland, and in mixed conifer forest that has a well-developed understory. They seem to favor brushy habitat or woodland that has a live oak component. They are highly arboreal, and thick-leaved trees and shrubs are important habitat components for this species (Williams et al. 1992).

Conservation Considerations: Clarification is needed on whether woodrats occurring in the northern Santa Lucia Range are *N. f. luciana*. There is a large amount of suitable woodrat habitat in these mountains and it is not considered to be threatened by existing land uses or ecological changes.

Southern sea otter *(Enhydra lutris nereis)*

Status and Distribution: Coastal waters from the Carmel River south to Santa Rosa Creek have been designated as the California

Sea Otter State Game Refuge. Sea otters are common along this stretch of coastline.

Habitat: Sea otters spend essentially their entire life in shallow ocean waters, particularly in the vicinity of kelp beds. They occur near land in protected coves and shallow intertidal waters but rarely, if ever, venture onshore. Abalone and urchins are their preferred food.

Conservation Considerations: Activities occurring on the Los Padres National Forest and other public lands within the assessment area are unlikely to have any effect on sea otters. The primary threats to this species, as identified on the Friends of the Sea Otter web page, are offshore oil spills and competition from humans for abalone.

Steller sea lion *(Eumetopias jubatus)*

Status and Distribution: The central California coast is the southern limit of the Steller or northern sea lion's range. Historically there was a rookery on San Miguel Island, one of the Channel Islands, but the last pups were born there in 1982 (Marine Mammal Center 1997). The southernmost active rookery is on Año Nuevo Island in San Mateo County. Steller sea lions are declining precipitously and are now rare along the Monterey coast.

Habitat: The Steller sea lion is a marine mammal that forages near shore. It does haul out on mainland coastlines but more commonly utilizes offshore rocks (Marine Mammal Center 1997).

Conservation Considerations: Activities occurring on the Los Padres National Forest and other public lands within the assessment area are unlikely to have any significant effect on the status of this species.

Animals of Low-Elevation Valley Habitats

Sixteen of the animal species that received individual consideration are associated with low-elevation valley habitats (table 4.12). Six species are either restricted to or primarily found in the vicinity of the San Joaquin Valley, six are found strictly in valleys on the coastal side of the mountains, and four occur on both sides of the mountains. Low-elevation valley habitats are primarily outside the assessment area and poorly represented on national forest system lands. Consequently, the ability to influence the conservation of these species through management of national forest system lands is often small. However, they have the potential to occur within the assessment area in a few localized areas so they need to be considered.

Western San Joaquin Valley Inhabitants

Longhorn fairy shrimp *(Branchinecta longiantenna)*

Status and Distribution: The longhorn fairy shrimp was federally listed as endangered in 1994. It occurs primarily along the west side of the San Joaquin Valley from Altamont Pass south to the Carrizo Plain (Eng et al. 1990). There are no known localities within the assessment area; the closest is at Soda Lake. There is some potential for the species to occur in potrero habitats in the Sierra Madre Mountains.

Habitat: These small crustaceans inhabit rain-filled, ephemeral pools (i.e., vernal pools) that form in depressions usually in grassland habitats (Eng et al. 1990). These pools must fill frequently enough and persist long enough for the fairy shrimp to complete their life cycle.

Conservation Considerations: Surveys are needed to determine if this species occurs on public lands within the assessment area.

Blunt-nosed leopard lizard *(Gambelia silus)*

Status and Distribution: The blunt-nosed leopard lizard was federally listed as endangered in 1967. It is endemic to the San Joaquin Valley and surrounding foothills. Its distribution overlaps the assessment area only in the upper Cuyama Valley, where it approaches the Los Padres National Forest. This region is significant from an evolutionary perspective because it is a contact zone between the blunt-nosed leopard lizard and the long-nosed leopard lizard (*Gambelia wislizenii*), a species common in the Mojave Desert (Montanucci

Table 4.12. Animals associated with low-elevation valley habitats that received individual consideration. Displayed for each species: (1) the level of knowledge about where it occurs in southern California and, in parentheses, the estimated percentage of locations that are on national forest system lands; (2) the mountain subareas occupied (y = occurs in breeding season, h = historically occurred, p = potentially occurs, t = transient, w = winter visitor)—if the species is localized and data are available, the approximate number of occurrences may be displayed; (3) the vulnerability of populations on national forest system lands to existing threat factors; (4) population trends; and (5) the assigned conservation category.

Low-Elevation Valley Animals of Concern *federal status*	(1) Knowledge of SoCal Locations (% on NFs)	(2) areas occupied or estimated # of occurrences if spp. localized									(3) Vulner-ability on NFs	(4) Pop. Trend	(5) Conser-vation Category
		Cleveland NF		**San Bern. NF**		**Angeles NF**		**Los Padres NF**					
		San Diego Rngs	Snta Ana Mts	San Jac Mts	San Bern Mts	San Gab Mts	Cas-taic Rngs	So. LP Rngs	So. SL Rng	No. SL Rng			
West. San Joaquin Val.													
Longhorn fairy shrimp *endangered*	Mod (0%)								p		Unkn	Unkn	Minimal influence
Blunt-nosed leopard lizard *endangered*	High (< 1%)							h/p[hy]			Low	Decl[1]	Minimal influence
Mountain plover *C1 candidate*	Mod (0%)							w	w			Decl[2]	Minimal influence
Giant kangaroo rat *endangered*	Mod (0%)							p	p		Low	Decl[1]	Minimal influence
San Joaquin antelope squirrel	High (< 1%)							p	p		Low	Unkn	Minimal influence
San Joaquin kit fox *endangered*	High (< 2%)							p	p		Low	Decl[1]	Minimal Influence
Coastal Valleys													
CA tiger salamander	Mod (< 5%)							p	p	y	Mod	Decl[3]	Site Specific
L.A. pocket mouse	Low (< 2%)	p	p	h/p	p						Low		Minimal Influence
Pacific pocket mouse *endangered*	Mod (0%)	p	p								Low	Decl[1]	Minimal influence
San Bern. kangaroo rat *endangered*	Mod (< 3%)			y	p						Low	Decl[1]	Site specific
Stephens' kangaroo rat *endangered*	High (< 1%)	y	p	p							Low	Decl[1]	Landscape level
San Diego black-tailed jackrabbit	Mod (< 5%)	y	p	p	y	h/p					Low	Unkn	Landscape level
Both													
Vernal pool fairy shrimp *threatened*	High (< 5%)		y					y	p		Mod	Unkn	Landscape level
Burrowing owl	Mod (< 1%)	p	p	p				h/p	p		Mod	Decl[2]	Minimal Influence
Swainson's hawk	Mod (< 5%)	t	t	t	t	t	p	p	p	t	Low	Decl[2]	Minimal influence
Loggerhead shrike	Mod (< 5%)	y	y	y	y	p	y	y	y	p	Low	Unkn	Landscape level

[hy] Hybrid population *(Gambelia silus* x *G. wislizenii)*

[1] USFWS determination as described in Final Rule to list as endangered.

[2] Garrett and Dunn (1981); Zeiner et al. (1990); Lehman (1994)

[3] Jennings and Hayes (1994)

1978). Patterns of hybridization in this area are of scientific interest and have provided insights into the selective factors that maintain two distinct species (Montanucci 1970; Montanucci 1978). There are no known occurrences of the full species *G. silus* on the Los Padres; however, the narrow zone where *G. silus* x *G. wislizenii* hybrids have been found is partially on national forest system lands in the lower parts of Ballinger and Quatal canyons.

Habitat: The blunt-nosed leopard lizard inhabits semi-arid, sparsely vegetated grasslands and dry washes (Montanucci 1970).

Conservation Considerations: Jennings (1995) reports that habitat loss in the zone of hybridization may have eliminated the hybrid populations studied by Montanucci. Survey work is needed to conclusively determine if hybrid blunt-nosed leopard lizards still occur on the Los Padres. If they do still occur, efforts should be made to protect these populations because of their significance. However, conservation of the full species *G. silus* will be minimally influenced by management of public lands within the assessment area.

Mountain plover *(Charadrius montanus)*

Status and Distribution: The mountain plover is proposed for federal listing as threatened and is a California Species of Special Concern. It winters in sparsely vegetated fields and grasslands at low elevations in southern California. Mountain plovers have become very rare on the coastal side of the mountains, although small wintering populations may still occur just west of Santa Maria (Lehman 1994) and in the Tijuana River Valley (Unitt 1984). The primary wintering ground near the assessment area is on the Carrizo Plain in southeastern San Luis Obispo County (Knopf and Rupert 1995).

Habitat: Wintering mountain plovers apparently prefer alkaline flats, cultivated and plowed fields, and sparse grasslands.

Conservation Considerations: The study by Knopf and Rupert (1995) suggests that wintering mountain plovers do not utilize habitats in the Los Padres National Forest to any significant extent. Thus, it appears there is little potential to influence the conservation of mountain plovers through management of national forest system lands within the assessment area.

Giant kangaroo rat *(Dipodomys ingens)*

Status and Distribution: The giant kangaroo rat was federally listed as endangered in 1987. It inhabits the arid southwestern edge of the San Joaquin Valley, the Carrizo and Elkhorn plains, and the Cuyama Valley (Williams 1992). It occurs at elevations ranging from approximately 280 to 2,800 feet but is rare above 2,400 feet (Williams 1996). The giant kangaroo rat's range approaches, and potentially extends onto, the Los Padres National Forest at the lower end of the Cuyama Valley (fig. 4.17). We did not find any documented sightings of this species on national forest system lands.

Habitat: Giant kangaroo rats mainly inhabit sandy-loam soils located on level and gently sloping ground vegetated with annual grasses and forbs and widely scattered desert shrubs. Long-term occupancy of a site by giant kangaroo rats results in a mima-mound topography, with burrow systems located on mounds a few to several centimeters above the intervening ground (Williams 1996).

Conservation Considerations: Additional survey work is needed to conclusively determine if the giant kangaroo rat extends onto the Los Padres. If found, those areas should receive site-specific management attention. However, it is likely that any occurrences on national forest system lands will be at the fringe of suitable habitat which is concentrated in the valley below. Thus management of public lands within the assessment area will likely have minimal influence on the conservation of giant kangaroo rats.

San Joaquin antelope squirrel *(Ammospermophilus nelsoni)*

Status and Distribution: The San Joaquin antelope squirrel is state listed as threatened.

It occurs in the San Joaquin Valley and on slopes and ridgetops in the foothills along the western edge of the valley, in the Cuyama and Panoche valleys, and on the Carrizo and Elkhorn plains (Best et al. 1990). The antelope squirrel's range approaches, and potentially extends onto, the Los Padres National Forest along the upper margins of the Cuyama Valley (fig. 4.17). We did not find any documented sightings of this species on national forest system lands.

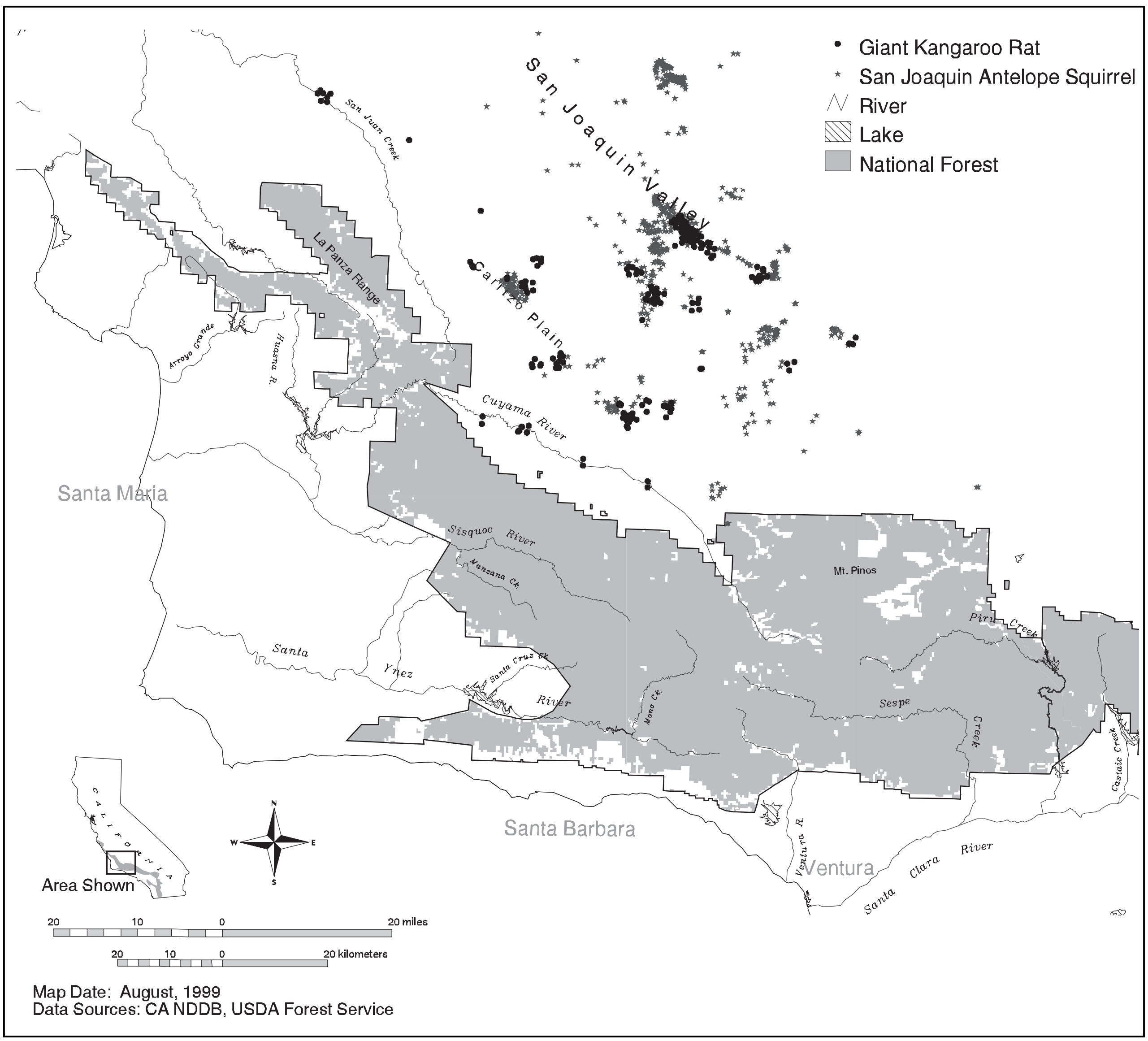
Habitat: San Joaquin antelope squirrels inhabit arid grassland, shrubland, and alkali sink habitats and are often found in association with saltbush *(Atriplex)* and Mormon tea *(Ephedra)* (Best et al. 1990). Present populations range in elevation from approximately 100 feet to 3,600 feet (Brown and Williams 1996).

Conservation Considerations: Same as those described for the giant kangaroo rat.

San Joaquin kit fox
(Ammospermophilus nelsoni)

Status and Distribution: The San Joaquin kit fox was federally listed as endangered in 1967. It formerly occupied most of the San Joaquin Valley as well as low-elevation basins and ranges along the eastern side of the central Coast Ranges (Brown et al. 1997). Kit

Figure 4.17. The documented locations of the giant kangaroo rat and San Joaquin antelope squirrel..



foxes potentially occur within the Los Padres National Forest in the upper Cuyama Valley watershed and along the eastern slope of the La Panza Range. The species is most likely a transitory visitor on national forest system lands, since there is little high-quality habitat.

Habitat: The San Joaquin kit fox primarily inhabits arid grasslands and open scrublands. It also will utilize oak savanna and alkali sink habitats (McGrew 1979).

Conservation Considerations: Additional survey work is needed to determine the extent to which kit foxes utilize areas within the Los Padres National Forest. Occupied areas should receive site-specific management attention. However, it seems apparent that national forest system lands are on the fringe of suitable habitat; thus, management of public lands within the assessment area will likely have minimal influence on the conservation of this species.

Coastal Valley Inhabitants

California tiger salamander *(Ambystoma californiense)*

Status and Distribution: The California tiger salamander is a California Species of Special Concern. The known range of this species extends into the assessment area from the northern Santa Lucia Range south to the Santa Ynez River. Based on the distribution map in Jennings and Hayes (1994), tiger salamanders occur in upper portions of the Carmel River and Little Sur River watersheds where they are either on or near the Los Padres National Forest.

No localities are shown in the southern Santa Lucia Mountains, but they do occur in the lower Sisquoc River and Santa Ynez River watersheds. These southernmost localities appear to correspond with the Solomon Hills and Santa Rita Hills, respectively, where Sam Sweet (pers. comm.) has found tiger salamanders. Both of these locations are west of the Los Padres National Forest by at least 5 miles. It is uncertain to what extent potential habitat is available on national forest system lands.

Habitat: The California tiger salamander is a lowland species restricted to grasslands and low foothill regions where its breeding habitat (long-lasting rain pools) occurs. Permanent aquatic sites are unlikely to be used for breeding unless they lack fish predators (Shaffer et al. 1993; Jennings and Hayes 1994). Tiger salamanders also appear to require dry-season refuge sites (typically small mammal burrows) in the vicinity of breeding sites (up to one mile away) (Jennings and Hayes 1994). The known elevational range of this species extends from near sea level to 3,400 feet (Shaffer et al. 1993).

Conservation Considerations: California tiger salamanders are dependent on the integrity of large rain pool complexes. Efforts should be made to identify such potential breeding sites on the Los Padres National Forest, beginning with the upper Carmel River and Little Sur River watersheds where this species is known to occur. Efforts should be made to keep tiger salamander breeding sites free of non-native predators (e.g., fish, bullfrogs, and crayfish). This may require coordination with agencies in charge of mosquito abatement to avoid the stocking of mosquitofish in these areas (Jennings and Hayes 1994).

Los Angeles pocket mouse *(Perognathus longimembris brevinasus)*

Status and Distribution: The Los Angeles pocket mouse is a Forest Service Region 5 Sensitive Species and a California Species of Concern. The known range of this subspecies extends from the cities of Burbank and San Fernando on the northwest, to the city of San Bernardino on the northeast, to the vicinity of Cabazon, Hemet, and Aguanga on the east and southeast. Its geographic limits on the southwest are unclear but probably lie somewhere near the Hollywood Hills (Williams 1986). Bond (1977) identifies specimens from Ranchita and Warner Pass in San Diego County as this subspecies, but Williams (1986) believes they are probably *P. l. internationalis.*

The geographic range just described is almost entirely outside our assessment area.

However, one historic Los Angeles pocket mouse locality listed in Williams (1986) is at Dos Palmas Spring at the base of the Santa Rosa Mountains, well to the east of the described range and within the San Jacinto District of the San Bernardino National Forest. Historic localities near Cabazon, Banning, Valle Vista, and Cajon Wash are close to national forest system lands, although the transition to steep, low-quality habitat occurs rapidly in these areas.

Habitat: The Los Angeles pocket mouse occupies areas with fine, sandy soils, typically in arid grassland or coastal sage scrub habitats (Genoways and Brown 1993). The upper elevation limit of distributional records listed in Williams (1986) is 3,500 feet (at Dos Palmas Spring), but most locations (all but two) are below 2,200 feet.

Conservation Considerations: Although the potential for major populations is low, surveys are needed to determine if the Los Angeles pocket mouse occurs on public lands within the assessment area. At a minimum the Dos Palmas Spring location should be resurveyed to see if this subspecies is present. National forest system lands in Cajon Wash may also contain potential habitat. However, given its known distribution and habitat requirements, this is a species whose conservation is not likely to be significantly influenced by management of national forest system lands within the assessment area.

Pacific pocket mouse
(Perognathus longimembris pacificus)

Status and Distribution: The Pacific pocket mouse was federally listed as endangered in 1994. This taxon is endemic to the immediate coast of southern California from Marina del Rey and El Segundo in Los Angeles County south to the vicinity of the Mexican border in San Diego County (Williams 1986). All known locations have been within 2.5 miles of the coast and below 600 feet in elevation (USFWS 1994c). Given this geographic range, it is highly unlikely that the Pacific pocket mouse occurs within the assessment area.

Habitat: The habitat requirements of this species are not well understood, but it is known to occur in sparsely vegetated areas on fine-grain, sandy substrates in the immediate vicinity of the Pacific Ocean (USFWS 1994c).

Conservation Considerations: All indications are that the Pacific pocket mouse is a species whose conservation cannot be influenced by management of national forest system lands within the assessment area.

San Bernardino kangaroo rat
(Dipodomys merriami parvus)

Status and Distribution: The San Bernardino kangaroo rat was federally listed as endangered in 1998. The historical range of this subspecies extends from the San Bernardino Valley in San Bernardino County to Menifee Valley in Riverside County (USFWS 1998e). Extant populations along lower Lytle Creek and Cajon Wash extend into the assessment area and may extend into the San Bernardino National Forest (fig. 4.18). A large population along the Santa Ana River extends upstream to Greenspot Road bridge (McKernan 1997), which is less than a mile below the San Bernardino National Forest boundary.

Habitat: San Bernardino kangaroo rats are found primarily on sandy loam substrates, characteristic of alluvial fans and flood plains, where they are able to dig simple, shallow burrows (McKernan 1997). Vegetation in these areas is typically alluvial sage scrub or chaparral.

Conservation Considerations: Additional information is needed on the distribution of San Bernardino kangaroo rats on public lands within the assessment area. Threats to its habitat include disruption of the natural hydrologic regime and habitat degradation due to a variety of factors (e.g., sand and gravel mining, stream channelization, and vehicular traffic).

Stephens' kangaroo rat
(Dipodomys stephensi)

Status and Distribution: The Stephens' kangaroo rat was federally listed as endangered in 1988. It is known only from arid grassland

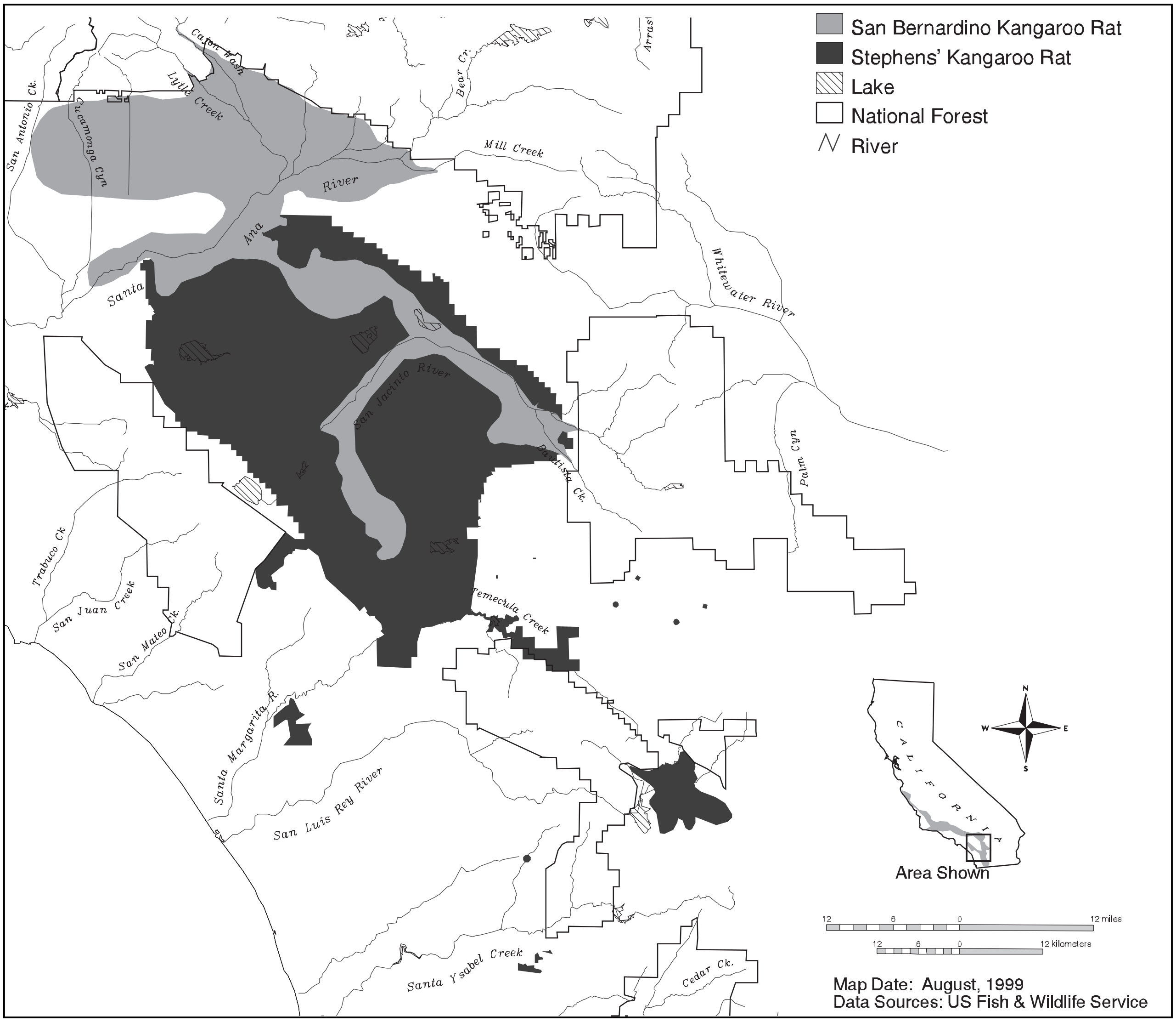


Figure 4.18. The approximate geographic ranges of the San Bernardino and Stephens kangaroo rats.

habitats in northern San Diego County, western Riverside County, and the southwestern edge of San Bernardino County (fig. 4.18) (Bleich 1977). Known locations within the assessment area are all in San Diego County and include the Warner Springs/Lake Henshaw area (O'Farrell 1986), the Guejito Valley, and Santa Maria Valley. The only location where the Stephens' kangaroo rat may actually occur on national forest system lands is along the northern edge of the Warner Springs/Lake Henshaw area, where suitable habitat extends onto the Cleveland National Forest.

Habitat: Stephens' kangaroo rats inhabit sparse grassland habitats, in areas with penetrable soils and flat to moderately sloping topography. These areas include the base of hillsides, flat areas along ridgetops, sandy washes, and open fields (O'Farrell and Uptain 1989). In addition, Stephens' kangaroo rats almost always occupy habitats in which at least half of the soil is bare during the summer and fall.

Conservation Considerations: This is a species whose conservation is not significantly influenced by management of national forest system lands within the assessment area. The small amount of Stephens' kangaroo rat habitat that extends onto the Cleveland National Forest is not threatened by existing activities. The area is grazed by livestock, but this activity is widely believed to be conducive to maintaining suitable habitat for this species.

San Diego black-tailed jackrabbit
(Lepus californicus bennettii)

Status and Distribution: The San Diego or coastal black-tailed jackrabbit is a California Species of Special Concern. Black-tailed jackrabbits are abundant in the deserts, but *L. c. bennettii* occurs only on the coastal side of the southern California mountains where suitable jackrabbit habitat is less common. Most of the historic habitat for this subspecies has either been developed or converted to agriculture. Vaughan (1954) found black-tailed jackrabbits to be "plentiful" in the coastal sage belt along the base of the San Gabriel Mountains from Cajon Wash west to San Gabriel Canyon. However, the landscape in that area has changed dramatically since the early 1950s and the status of jackrabbit populations there today is unknown. In recent years, Steve Loe (San Bernardino NF, pers. comm.) has observed jackrabbits near the Del Rosa Fire Station at the base of the San Bernardino Mountains.

Bond (1977) provides locality information for a number of museum specimens collected in San Diego County. Specimens were collected at elevations ranging from sea level to 6,000 feet. Most San Diego County localities were west of the assessment area, but specimens were reported from Santa Ysabel and the Laguna and Cuyamaca mountains. The mountain localities are curious since they seem to be outside of traditional habitat and jackrabbits are not seen in these areas today.

Habitat: Black-tailed jackrabbits are found only in open or semi-open country, typically in grasslands or sparse coastal scrub (Bond 1977). They are not generally found in chaparral or woodland habitats. Vaughan (1954) found them in "thin stands" of coastal sage scrub and on the margins of citrus groves in the lower foothills of the San Gabriel Mountains.

Conservation Considerations: Information is needed on the current distribution of San Diego black-tailed jackrabbits on public lands along the coastal slopes of the San Gabriel, San Bernardino, and San Jacinto mountains and the mountains of San Diego County. Activities currently occurring on public lands within the assessment area probably are not a substantial threat to jackrabbits, but it is not clear if viable populations exist in these areas which are on the edge of this species' historic range.

Inhabitants of Both Coastal and San Joaquin Valleys

Vernal pool fairy shrimp
(Branchinecta lynchi)

Status and Distribution: The vernal pool fairy shrimp was federally listed as threatened in 1994. Most known locations are in the Sacramento and San Joaquin valleys, and along the eastern margin of the central Coast Ranges (e.g., Soda Lake). However, vernal pool fairy shrimp also occur inside the assessment area in two locations: (1) several small potreros in the mountains north of Santa Barbara and (2) on the Santa Rosa Plateau along the southeastern flank of the Santa Ana Mountains (Eng et al. 1990).

Habitat: These small crustaceans inhabit rain-filled, ephemeral pools (i.e., vernal pools) that form in depressions usually in grassland habitats (Eng et al. 1990). These pools must fill frequently enough and persist long enough for the fairy shrimp to complete their life cycle.

Conservation Considerations: Reported occurrences of vernal pool fairy shrimp in the mountains north of Santa Barbara appear to be within the Los Padres National Forest. The vernal pools which support these populations should be identified and managed to maintain their integrity and natural hydrologic regime. Pools on the Santa Rosa Plateau are protected within an ecological reserve that is managed by The Nature Conservancy and Riverside County. There is little potential habitat for fairy shrimp on national forest system lands in the Santa Ana Mountains.

Burrowing owl
(Athene cunicularia hypogaeae)

Status and Distribution: The burrowing owl is a California Species of Special Concern. Burrowing owl populations are declining across much of their range (Haug et al. 1993) as habitat destruction and improper use of pesticides affect chick survivorship and dispersal (Winchell 1994). Once widespread, their distribution on the coastal side of the mountains is now highly localized and fragmented.

Although recorded at elevations up to 5,300 feet (Zeiner et al. 1990), burrowing owls are primarily found in low elevation valleys. On the Los Padres National Forest, these owls historically occurred in the Santa Ynez Mountains but now appear to be absent. They do still nest in the Carrizo Plain and possibly in the Cuyama Valley (Lehman 1994). A few burrowing owls may still occur along lower desert slopes and inland valleys in the other assessment area mountain ranges, but there are no documented populations in any of them.

Habitat: Burrowing owls inhabit dry, sparse grasslands, desert scrub, and agricultural areas. Rodent burrows, usually those of California ground squirrels, are utilized for roosting and nesting (Unitt 1984; Lehman 1994).

Conservation Considerations: Burrowing owls have been adversely affected by loss of lowland habitats and by the widespread use of pesticides to control ground squirrel populations. Given its distribution and habitat requirements, the burrowing owl is a species whose conservation cannot be significantly influenced by management of national forest system lands within the assessment area.

Swainson's hawk *(Buteo swainsoni)*

Status and Distribution: The Swainson's hawk is a Forest Service Region 5 Sensitive Species and is listed as threatened by the state of California. Historically (i.e., prior to the 1930s), this species commonly nested in the coastal lowlands of southern California in places like Santa Monica, Temecula, Corona, and Santee (Garrett and Dunn 1981; Unitt 1984). However, breeding populations in the coastal valleys have long been extirpated and Swainson's hawks are not likely to recolonize the area (SDNHM 1998).

The only localities close to the assessment area where Swainson's hawks may still nest are in the Antelope Valley north of the Castaic Ranges and in eastern San Luis Obispo County (Garrett and Dunn 1981).

Habitat: During the breeding season, Swainson's hawks are closely associated with open grassland or agricultural lands (particularly alfalfa fields) that contain scattered trees which can be used for nesting. Migrants may be noted over any habitat, but spring concentrations are usually found over desert grasslands (Garrett and Dunn 1981).

Conservation Considerations: Given the known distribution and habitat requirements of Swainson's hawks, their conservation is not likely to be significantly influenced by management of national forest system lands within the assessment area.

Loggerhead shrike *(Lanius ludovicianus)*

Status and Distribution: The loggerhead shrike is a California Species of Special Concern. It is widely distributed at low elevations (below approximately 5,000 feet) across the assessment area but is limited by the availability of suitable open habitat. It has been found nesting at Garner Valley in the San Jacinto Mountains (D. Freeman, unpub. notes). Arid, open country on the eastern side of the southern Santa Lucia Range and southern Los Padres ranges are probably the largest areas of suitable habitat for this species.

Habitat: Loggerhead shrikes are typically found in dry, open habitats with sparse shrubs and trees (Zeiner et al. 1990b). They commonly utilize posts, fences, and utility lines as perches.

Conservation Considerations: Suitable shrike habitat occurs on public lands in the assessment area but is not extensive. The habitat requirements of this species generally indicate low vulnerability to existing land use activities on public lands.

Animals of Coastal Scrub and Chaparral Habitats

Thirteen of the animal species that received individual consideration are associated with scrub or chaparral habitats (table 4.13).

Table 4.13. Animals associated with coastal scrub or chaparral habitats that received individual consideration. Displayed for each species: (1) the level of knowledge about where it occurs in southern California and, in parentheses, the estimated percentage of locations that are on national forest system lands; (2) the mountain subareas occupied (y = occurs in breeding season, h = historically occurred, p = potentially occurs, t = transient, w = winter visitor)—if the species is localized and data are available, the approximate number of occurrences may be displayed; (3) the vulnerability of populations on national forest system lands to existing threat factors; (4) population trends; and (5) the assigned conservation category.

Scrub and Chaparral Animals of Concern *federal status*	(1) Knowledge of SoCal Locations (% on NFs)	(2) areas occupied or estimated # of occurrences if spp. localized									(3) Vulner-ability on NFs	(4) Pop. Trend	(5) Conser-vation Category
		Cleveland NF		San Bern. NF		Angeles NF		Los Padres NF					
		San Diego Rngs	Snta Ana Mts	San Jac Mts	San Bern Mts	San Gab Mts	Cas-taic Rngs	So. LP Rngs	So. SL Rng	No. SL Rng			
Primarily Coastal Sage Scrub or <3,000 ft													
Quino checkerspot *endangered*	Mod (< 5%)	h/p	p	p	p	p					Mod	Decl[1]	Site specific
Orange-throated whiptail	Mod (< 2%)	y	y	y							Low	Unkn	Landscape level
California gnatcatcher *threatened*	High (< 2%)	30-50 pairs	10-20 pairs	p	p	p					High	Decl[2]	Site specific
Coastal cactus wren	High (< 1%)	y	y	p	p	y	p				Mod	Unkn	Landscape level
Rufous-crowned sparrow	Mod-High (< 10%)	y	y	y	y	y	y	y			Mod	Unkn	Landscape level
Primarily Cismontane Chaparral & Scrub													
Hermes copper butterfly	Mod (10-40%)	y									Low	Unkn	Landscape level
Coast patch-nosed snake	Low (30-50%)	y	y	y	y	y	y	y	p		Low	Unkn	Landscape level
Bell's sage sparrow	Mod (30-60%)	y	y	y	y	y	y	y	y	y	Mod	Unkn	Landscape level
In Both Cismontane & Desert Scrub/Chap.													
Pratt's blue butterfly	Low (?)			2-4 pops.							Unkn	Unkn	Landscape level
Coast horned lizard	High (> 50%)	y	y	y	y	y	y	y	y	y	Mod	Decl[3]	Landscape level
Coastal rosy boa	Mod-Low (10-40%)	y	y	y	y	y					Mod	Decl[3]	Landscape level
Red diamond rattlesnake	Mod (30-50%)	y	y	y							Low	Unkn	Landscape level
San Diego pocket mouse	Mod (20-60%)	y	p	y	y	y					Low	Unkn	Landscape level

[1] U.S. Fish and Wildlife Service (1997d)
[2] U.S. Fish and Wildlife Service (1993b)
[3] Jennings and Hayes (1994)

This group is further subdivided into the following categories: (1) species restricted to coastal sage scrub and other habitats found only at elevations below 3,000 feet; (2) inhabitants of both coastal scrub and chaparral habitats, but only on the coastal (cismontane) side of the mountains; and (3) inhabitants of shrublands on both coastal and desert sides of the mountains.

Inhabitants of Coastal Sage Scrub and Other Habitats Below 3,000 Feet

Five of the species that received individual consideration are associated with coastal sage scrub or other predominately shrubland habitats that occur below 3,000 feet elevation on the coastal side of the mountains. These habitats are not well represented in the assessment area.

Quino checkerspot butterfly *(Euphydryas editha quino)*

Status and Distribution: The quino checkerspot butterfly was federally listed as endangered in 1997. Once considered abundant in Orange, San Diego, and western Riverside counties, it has declined dramatically, due probably to the combined effects of habitat loss and population fragmentation (Murphy 1990; USFWS 1997d). The quino's historic range along the southern California coast and inland valleys includes northernmost occurrences in Los Angeles and San Bernardino counties and southernmost localities in the Sierra Juarez of Baja California, Mexico (Mattoni et al. 1997). Currently, it is documented only from several areas in southwestern Riverside County, southern San Diego County, and Baja (Mattoni et al. 1997).

Nearly all of the historic and current locations of this butterfly are outside the assessment area, in more coastal areas of San Diego and Orange counties and in the low elevation valleys of western Riverside County (fig. 4.19). However, there is a 1975 museum specimen from "Mount Palomar" and some of the remaining populations in Riverside County are near the north slope of Palomar (i.e., near Vail Lake and Aguanga) (Mattoni et al. 1997; Hawks, Ballmer, and Pratt, unpubl. notes 1997). The Oak Mountain colony near Vail Lake is considered to be a "source population"; thus, potential habitat along the north side of Palomar Mountain has an increased likelihood of being occupied. There is a confirmed sighting at Oak Grove just outside the Cleveland National Forest boundary and an unconfirmed sighting near Dripping Springs campground, which is on national forest system lands (G. Ballmer, pers. comm.).

Extant occurrences on the slopes of Otay Mountain, Tecate Peak, and several other locations in southern San Diego County suggest there may be remaining populations on the southern end of the Cleveland National Forest. Potential habitat exists in that area on the slopes of Lawson and Lyons peaks and Poser and Viejas mountains. Seemingly suitable habitat also remains on the west side of the Santa Ana Mountains (e.g., Black Star Canyon), but the fact that quino has not been located in Orange County since the 1960s (Mattoni et al. 1997) lowers the likelihood of populations in that area. There may be higher potential on the east side of the range (e.g., Elsinore Peak), which is relatively close to extant populations in the Murrieta area. Suitable habitat within the historic range of the quino may also be present along the base of the San Gabriel, San Bernardino, and San Jacinto mountains, but there are no known populations near those areas.

Habitat: The primary larval food plant for quino checkerspot is *Plantago erecta,* but it also utilizes other *Plantago* species as well as *Castilleja exserta* and *Keckiella antirrinoides* (Mattoni et al. 1997). The primary food plant, and thus the butterfly, is not strongly associated with a single plant community; rather, it is found in sparsely vegetated openings embedded in a variety of vegetation types but most commonly within coastal sage scrub, chaparral, or oak woodlands.

Where *Plantago erecta* is present, optimum stand structure for quino reportedly consists of patchy shrub or small tree landscapes with openings of several meters between large plants (Mattoni et al. 1997). The butterfly typically does not occur in extensive open grasslands, even where *Plantago erecta* is abundant, although apparently there are exceptions (e.g., in the Murrieta area).

There are indications that the distribution of *Plantago erecta* and other native annuals may often be associated with the presence of cryptobiotic crusts on the soil surface (Mattoni et al. 1997). These crusts appear to inhibit invasions of non-native grasses and forbs, providing a competitive advantage for the native annuals. Other edaphic factors (e.g., high clay

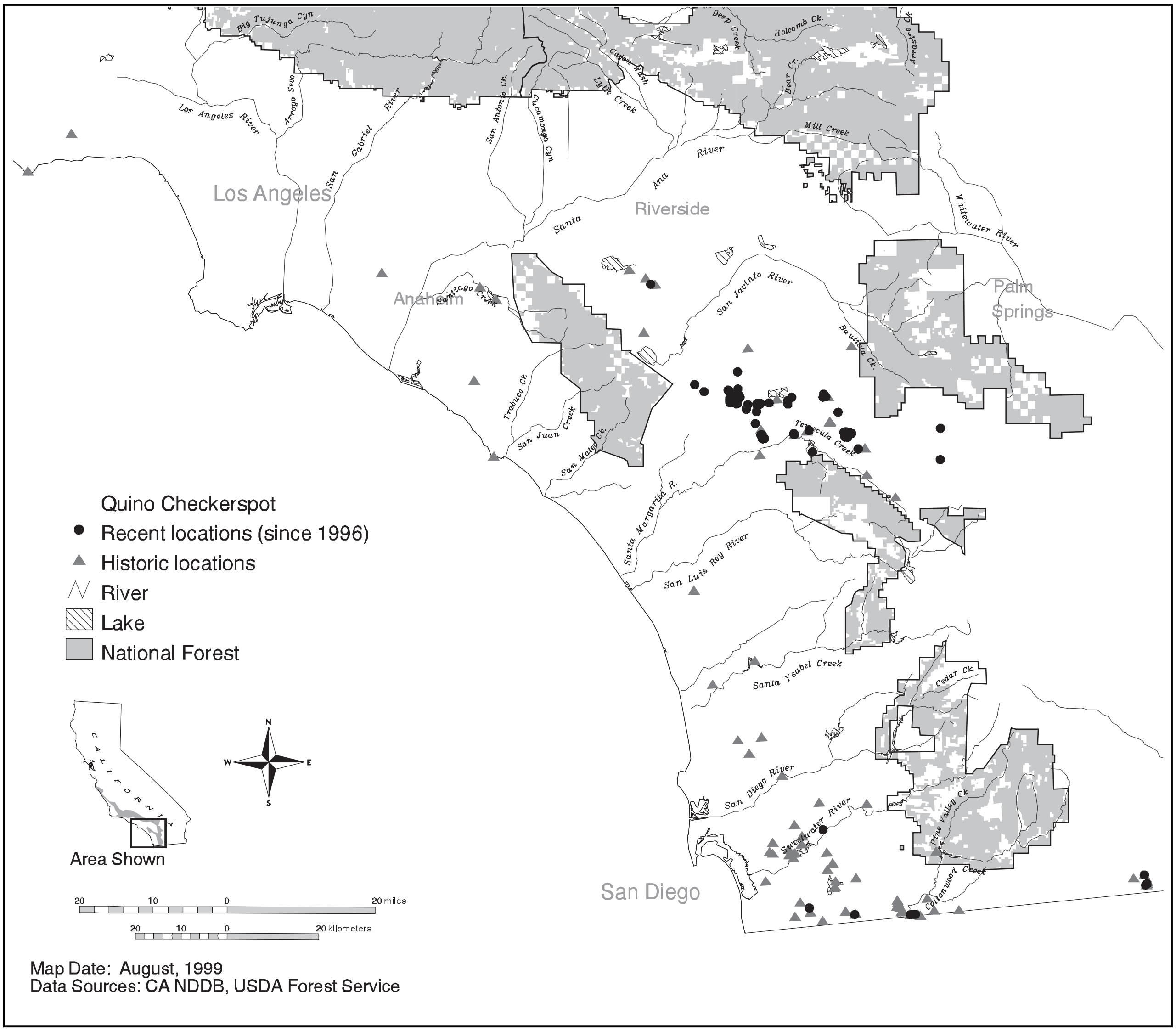


Figure 4.19. Current and historic locations of the quino checkerspot butterfly in relation to the assessment area and national forest system lands (this map may not show all known localities).

content) may similarly inhibit non-natives and might serve as indicators of potential habitat.

Topographic relief such as raised mounds, hills, slopes, or ridges may be an important habitat component (Mattoni et al. 1997). The phenomenon of hilltopping, where butterflies congregate on ridges or hilltops to mate, has been observed at a number of quino locations. All of the known extant quino populations are at elevations below 3,500 feet.

Conservation Considerations: Surveys are needed to determine the distribution of quino checkerspot butterflies on public lands within the assessment area. Particular emphasis should be given to potential habitat areas on the Cleveland National Forest that are near extant populations.

If colonies are found, habitat management for quino will likely center on maintaining ample populations of the larval food plants. Although *Plantago erecta* still occurs in many areas, there are indications that it has become less abundant as non-native annual grasses and forbs have spread. Soil disturbance, particularly degradation of cryptobiotic crusts, can substantially hamper the ability of *Plantago* and other native annuals to hold their own on a site (J. Byers, Riverside Fire Lab, pers. comm.). Thus ground-disturbing activities, such as intensive livestock grazing or off-road vehicle traffic, can contribute to the decline of quino food plants.

Plantago erecta and other native annuals often become abundant in coastal scrub and chaparral for several years immediately after a fire, until the canopy is closed by the regenerating shrub layer. Thus, a shifting age-class mosaic is desirable in these shrublands to maintain a steady supply of early successional patches for native annuals. However, this should not trigger calls for shorter fire-return intervals, particularly in coastal scrub, since frequent fires in these shrublands usually increases the abundance of non-native annual grasses (Zedler et al. 1983).

Orange-throated whiptail *(Cnemidophorus hyperythrus beldingi)*

Status and Distribution: The orange-throated whiptail is a California Species of Special Concern. Its geographic range extends from Orange and the southern edge of San Bernardino counties south to around Loreto in Baja California, Mexico (Jennings and Hayes 1994). Its reported elevation range in California is from near sea level to about 3,400 feet (Jennings and Hayes 1994), but it is most commonly found at elevations below 2,300 feet (Fisher and Case 1997).

Orange-throated whiptails occur at low elevations on the coastal side of the San Diego Ranges, the Santa Ana Mountains, and San Jacinto Mountains. They are common on streamside terraces along the upper San Diego River in the Cleveland National Forest and also were found on Starr Ranch at the base of the Santa Ana Mountains (Fisher and Case 1997). They likely occur in Bautista Canyon in the San Jacinto Mountains.

Habitat: The orange-throated whiptail occurs in coastal sage scrub and, to a lesser extent, chaparral. It appears to reach peak densities on floodplains and streamside terraces (Jennings and Hayes 1994).

Conservation Considerations: Orange-throated whiptails occur in some of the lowest elevation areas within the southern part of the assessment area. The proximity to urbanizing areas increases the potential for whiptail populations to become fragmented and isolated. The food base of orange-throated whiptails (principally termites), may be adversely affected by invasions of Argentine ants from irrigated areas (Jennings and Hayes 1994).

California gnatcatcher *(Polioptila californica)*

Status and Distribution: The California gnatcatcher was federally listed as threatened in 1993 (USFWS 1993b). The current known distribution of California gnatcatchers is concentrated along the coast in maritime-influenced areas of Orange and San Diego counties (Mock 1998). There are also sizable populations in the inland valleys of southwestern Riverside County and on the Palos Verdes Peninsula (Atwood 1993). Within the assessment area, the only known California gnatcatcher population on national forest system lands is on the Cleveland National Forest (fig 4.20). However, recent sightings at Sycamore Flat (near Lytle Creek), at the confluence of Lytle Creek and Cajon Wash, and on the Etiwanda Fan (Davis et al. 1998) indicate a possible population along the lower foothills of the eastern San Gabriel Mountains that may extend onto the San Bernardino and Angeles national forests. There is also a slight possibility that gnatcatchers may also occur on the lower western slopes of the San Jacinto Mountains.

On the Cleveland, the largest population (thirty-plus pairs) is along the upper San Diego River above El Capitan Reservoir. Small clusters have also been observed in the vicinity of Pamo Valley near Ramona and on the lower slopes of the Santa Ana Mountains on the east side near Lake Elsinore and on the west side near San Juan Creek.

Habitat: California gnatcatchers are nonmigratory and strongly associated with Diegan and Riversidian coastal sage scrub (Atwood 1993). These types of sage scrub occur in Los Angeles, Orange, Riverside, San Bernardino, and San Diego counties at elevations below 3,000 feet on the coastal side of the mountains. However, gnatcatcher densities seem

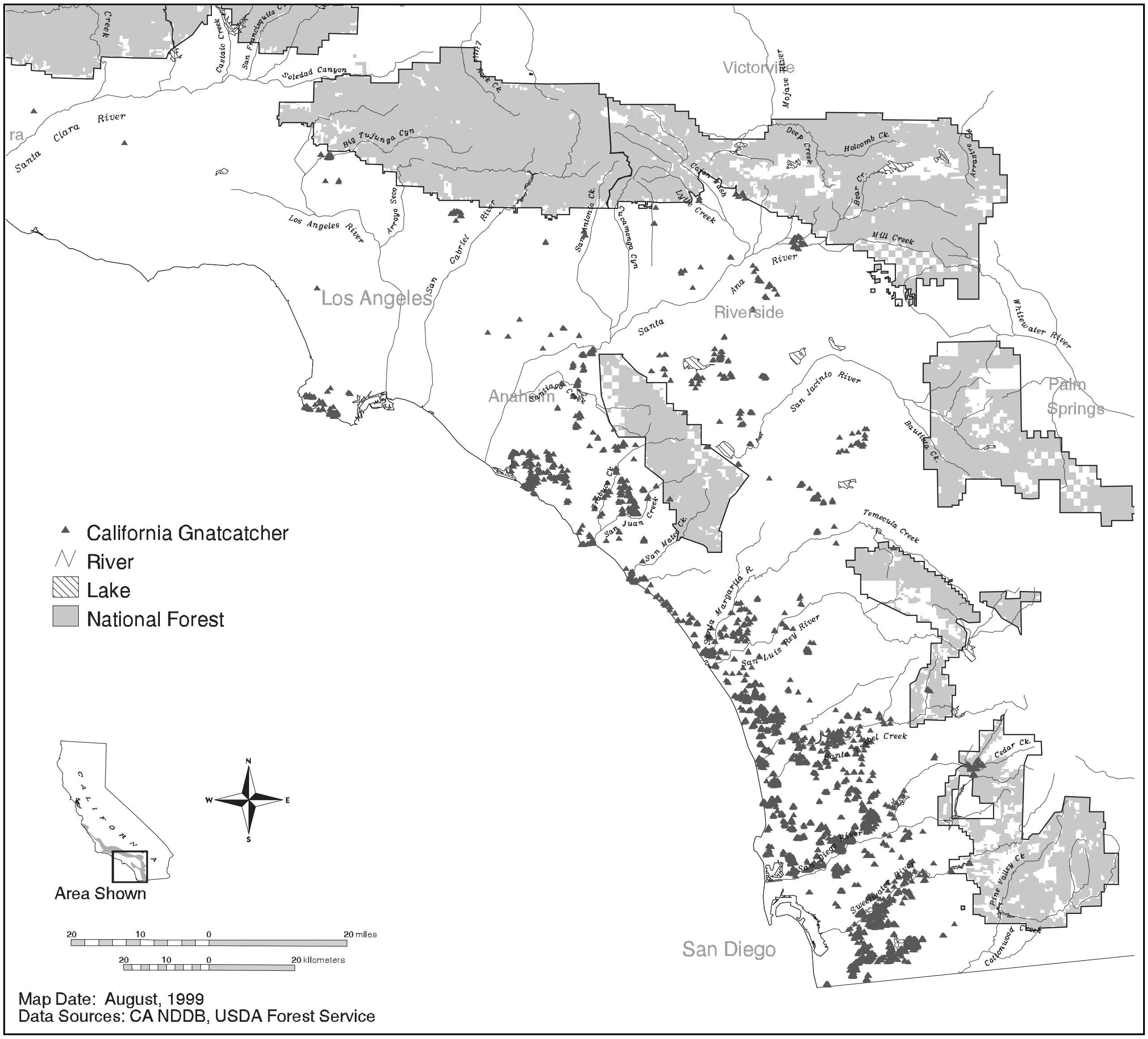


Figure 4.20. Known locations of the California gnatcatcher within or near the assessment area (this map does not show all known localities outside the assessment area).

to decline substantially at elevations above about 2,200 feet and at increasing distances from the coast (Mock 1998).

Total shrub cover appears to be more important than shrub height in determining habitat suitability (Beyers and Wirtz 1997). California gnatcatchers are most abundant in mature stands, where shrub canopy cover is typically greater than 50 percent and often exceeds 60 percent (Atwood 1993; Beyers and Wirtz 1997). However, they will forage in recently burned sites and pairs have been observed establishing territories in burned areas within three years postfire at coastal sites (Wirtz et al. 1997). The rapidity of shrub regrowth appears to affect the rate at which gnatcatchers reoccupy burned areas, and inland sites (particularly Riversidian sage scrub) are slower to recover than coastal sites (Wirtz et al. 1997).

Conservation Considerations: Although the potential for major new populations is low, surveys are needed to more fully determine the distribution of California gnatcatchers in the Cleveland, San Bernardino, and Angeles national forests. Information on occurrences at low elevations in the eastern San Gabriel Mountains would be particularly useful.

Conservation of coastal sage scrub where it does occur within the assessment area is important for the gnatcatcher.

The gnatcatcher population on the upper San Diego River has been negatively affected by recurring fires in the early 1990s. High fire frequencies and invasions of exotic grasses are serious problems in gnatcatcher habitat (Minnich and Dezzani 1998). Coastal sage scrub is a highly flammable vegetation type and maintaining mature stands in fire-prone areas near the urban interface is a significant management challenge (Beyers and Wirtz 1997). Cowbird nest parasitism is also a problem for gnatcatchers in some areas Braden et al. 1997) and has been documented in the upper San Diego River population.

Coastal cactus wren *(Campylorhynchus brunneicapillus* ssp.)

Status and Distribution: The San Diego coastal cactus wren *(C. b. sandiegoense)* is a Forest Service Region 5 Sensitive Species and a California Species of Special Concern. Rea and Weaver (1990) define the range of this subspecies as coastal portions (i.e., west of the mountain crest) of San Diego and southern Orange counties (Trabuco Canyon is the northern boundary). There are no known locations of coastal cactus wrens within the Cleveland National Forest, although they have been observed close by. On the coastal slopes of the Santa Ana Mountains, they have been observed at Starr Ranch, Live Oak Canyon Park, and Caspers Wilderness Regional Park. In San Diego County, they have been found above El Capitan Reservoir on the San Diego River and in Pamo Valley.

Coastal-slope populations of cactus wrens in Riverside, San Bernardino, Los Angeles, Ventura, and northern Orange counties are classified as *C. b. anthonyi,* which is the same subspecies that occurs in the deserts of California and western Arizona (Rea and Weaver 1990). Given its abundance in the desert, this subspecies is not considered to be rare or sensitive. However, coastal-slope populations of cactus wrens are rare and we regard them as a local viability concern. Cactus wrens are scattered across the lower slopes of the San Gabriel Mountains (e.g., Fish Canyon, Duarte, and Claremont) (D. Cooper, UC Riverside, pers. comm.) and may also extend into the foothills of the San Bernardino and San Jacinto mountains.

Habitat: Coastal cactus wrens are closely associated with coastal sage scrub vegetation that contains patches of cholla or prickly pear (*Opuntia* spp.) cactus (Rea and Weaver 1990). The wren's chief requisite is tall *Opuntia* cacti. The wrens construct their nests in these cacti and supplement their insect diet in fall and winter by feeding on cactus fruit (Rea and Weaver 1990).

Conservation Considerations: Although the potential for major populations is low, surveys are needed to more fully determine the distribution of cactus wrens in the low coastal foothills that lie within the Cleveland, San Bernardino, and Angeles national forests.

Rufous-crowned sparrow *(Aimophila ruficeps canescens)*

Status and Distribution: The southern California rufous-crowned sparrow, *A. r. canescens,* is a California Species of Special Concern. It occurs from Santa Barbara County south to northwestern Baja California at low elevations on the coastal side of the mountains (Garrett and Dunn 1981; Unitt 1984). This sparrow is occasionally found on the desert side of the mountains, particularly on the northern end of the San Jacinto Mountains (e.g., near Cabazon) and in southern San Diego County. It is described as being rather scarce on the lower coastal slopes of the San Bernardino Mountains (Garrett and Dunn 1981).

Habitat: Preferred habitat for this sparrow consists of slopes, typically south facing, with sparse brush intermixed with bunch grasses and large rocks. These slopes are often quite steep and rocky (Garrett and Dunn 1981; Unitt 1984). The range of this subspecies is virtually coincident with extensive stands of coastal sage scrub, although it does appear to be more adaptable than the California gnatcatcher and cactus wren in that it extends further up into the foothill scrub-chaparral transition zone (Unitt 1984). Rufous-crowned sparrows do not occupy dense chaparral but can be found in recently burned chaparral or along firebreaks as long as other key habitat elements (e.g., grasses and rocks) are present.

Conservation Considerations: Coastal sage scrub is a declining habitat type and one that is poorly represented on public lands in the assessment area. Conservation of this type where it does occur is important for the rufous-crowned sparrow. Additional information is needed on the distribution and abundance of this species in the foothill scrub-chaparral transition zone, since that type of habitat is much more extensive on public lands. Surveys associated with the development of breeding bird atlases in Los Angeles (LACBBA 1999) and San Diego (SDNHM 1999) counties should help in this regard.

Inhabitants of Coastal-side Chaparral and Scrub

Three of the species that received individual consideration can occur in either chaparral or scrub habitats. The ability of these species to occur in higher elevation chaparral habitats increases the potential to conserve them on public lands within the assessment area.

Hermes copper butterfly *(Lycaena hermes)*

Status and Distribution: The Hermes copper is a former federal C2 Candidate Species and now is on the federal special concern list. It is known only from western San Diego County and a small portion of adjacent northwestern Baja California, Mexico (Brown 1991). Initial collections of this species were all in the immediate vicinity of San Diego, but it has proven to be more widespread than originally thought, particularly across the broad chaparral belt east of San Diego. The Hermes copper is known to extend inland to Viejas Grade, Guatay, and Pine Valley (Murphy 1990; Brown 1991). Thus, a significant amount of its known range is within the Cleveland National Forest.

Habitat: The Hermes copper is restricted to mixed chaparral and coastal sage scrub communities where its larval host plant, redberry *(Rhamnus crocea)*, occurs (Brown 1991). Colonies are confined closely to the vicinity of the host plant, with adults frequently observed nectaring on flat-topped buckwheat *(Eriogonum fasciculatum)* (Thorne 1963).

Conservation Considerations: Redberry, the larval host plant, is a common component of chaparral and coastal scrub and is not believed to be vulnerable to existing land uses or fire regimes.

Coast patch-nosed snake *(Salvadora hexalepis virgultea)*

Status and Distribution: The coast patch-nosed snake is a California Species of Special Concern. Its range extends from near Creston in San Luis Obispo County southward primarily on the coastal side of the mountains into Baja California (Jennings and Hayes 1994). Its known elevation range is from near sea level to around 7,000 feet (Jennings and Hayes 1994), but it is typically found below 5,000 feet (Glaser 1970). The species appears to be widespread on national forest system lands, but not in high densities.

Habitat: Patch-nosed snakes seem to prefer coastal sage scrub and chaparral (Fisher and Case 1997). Their primary prey is whiptail lizards and this may be what determines the habitat preferences of this snake (Jennings and Hayes 1994).

Conservation Considerations: The abundance of coast patch-nosed snakes on public lands in the assessment area is not known. However, this species does not seem particularly vulnerable to existing change agents on public lands. Based on what we currently know of its distribution and life history characteristics, we believe it can be conserved through landscape-scale, habitat-based management. It would be a difficult species to monitor for trends in abundance.

Bell's sage sparrow *(Amphispiza belli belli)*

Status and Distribution: The Bell's sage sparrow is a California Species of Special Concern. Sage sparrows occur on both coastal and desert slopes, but the subspecies *A. b. belli* occurs only on the coastal side. Its geographic range extends from northern California into Baja California. This subspecies extends into lower montane chaparral habitats, which increases its representation in the assessment area. Portions of western Riverside and San Diego counties are identified as centers of abundance for this sparrow (Garrett and Dunn 1981).

Habitat: The Bell's sage sparrow is associated with dry chaparral in interior foothills; it also occurs in coastal sage scrub (Garrett and Dunn 1981). This sparrow is said to inhabit dense stands (Garrett and Dunn 1981; Unitt 1984), but a recent account suggests it is most common in semi-open chaparral and describes areas of bare ground unencumbered by heavy leaf litter as essential (SDNHM 1998). The latter description is consistent with recent data from the Cleveland National Forest, where sage sparrows were found to be significantly more abundant in open, young-age (recently burned) chaparral than they were in denser, older stands (Boyd and Stephenson 1997).

Conservation Considerations: This species appears to be well represented on public lands in coastal foothill and lower montane areas. One recent study suggests that a chaparral age-class mosaic interspersed with open, young stands is important to this sparrow (Boyd and Stephenson 1997).

Inhabitants of Coastal and Desert-side Shrublands

Five of the species that received individual consideration can occur in chaparral and scrub habitats on both coastal and desert sides of the mountains. In general, this wider geographic range increases the potential for these species to occur on public lands within the assessment area.

Pratt's blue butterfly *(Euphilotes enoptes cryptorufes)*

Status and Distribution: This is a recently described subspecies (Pratt and Emmel 1998) and is not on any special concern lists. It is considered here because much of its known range is within the assessment area. Known locations of this butterfly include the south-facing slope of Pyramid Peak in the southern part of the San Jacinto Mountains and on the road to Santa Rosa Mountain at elevations of 4,500 to 5,000 feet (Pratt and Emmel 1998). The range of this subspecies also extends into northern Baja California in the San Pedro Martir Mountains.

Habitat: The Pratt's blue is associated with the wild buckwheat species, *Eriogonum davidsonii*. Specifically it has only been found on the spring blooming, and not the summer blooming, variety of this buckwheat, which occurs predominantly on south-facing slopes (Pratt and Emmel 1998).

Conservation Considerations: More information is needed on the distribution and abundance of this species. There are no imminent threats to the two localities where this butterfly has been observed.

Coast horned lizard *(Phrynosoma coronatum)*

Status and Distribution: Two different subspecies of coast horned lizard occur in the assessment area. *P. c. blainvillii,* the San Diego horned lizard, is a Forest Service Region 5 Sensitive Species and a California Species of Special Concern. *P. c. frontale,* the California horned lizard, is a California Species of Special Concern. The two subspecies combined inhabit all of the mountain subareas in the assessment area.

The geographic range of *P. c. blainvillii* stretches from Ventura County south into Baja California, Mexico. The distribution map for this subspecies in Jennings and Hayes (1994) suggests its northwestern-most occurrence is in the upper Cuyama River watershed. It occurs on all four national forests and reaches almost 7,000 feet elevation in places (e.g., Tahquitz Meadow on Mount San Jacinto) (Jennings and Hayes 1994). Although most common on the coastal slope, San Diego horned lizards also occur on the desert side of the mountains.

P. c. frontale overlaps with *P. c. blainvillii* in northern Los Angeles and Ventura counties and there is evidence of hybridization in some areas (Jennings and Hayes 1994). The range of *P. c. frontale* continues north into Shasta County. It occurs on both the coastal side and the San Joaquin Valley side of the mountains.

Habitat: Horned lizards can be found in a variety of habitats but are most common in shrub-dominated communities. Key habitat elements are loose, fine soils with a high sand fraction; an abundance of native ants; open areas with limited overstory for basking; and areas with low, dense shrubs for refuge (Jennings and Hayes 1994). Fisher and Case (1997) found coast horned lizards primarily in association with either cryptogamic soils or sandy soils. The coast horned lizard's primary food is harvester ants *(Pogonomyrmex* spp.); the lizards do not appear to eat Argentine ants.

Conservation Considerations: Coast horned lizards are reported to be declining, primarily due to loss of habitat in low elevation coastal and inland valleys (Jennings and Hayes 1994). Thus, public lands within the assessment area are becoming increasingly important to the conservation of this species.

The most significant threat to horned lizards on public lands may be progressive elimination of its food base by exotic ants, particularly in areas near human developments (Jennings and Hayes 1994; Suarez et al. 1998). The elimination of native ant colonies from small habitat fragments by Argentine ants has already been documented in southern California (see chapter 3). The recent arrival of red imported fire ants could make this problem worse.

Coastal rosy boa
(Lichanura trivirgata roseofusca)

Status and Distribution: The coastal rosy boa is a Forest Service Region 5 Sensitive Species. It occurs from the foothills of the San Gabriel and San Bernardino mountains, south through Orange, Riverside and San Diego counties, down to the Sierra San Pedro Martir in Baja California (Klauber 1931; Gorman 1965). There reportedly is a record of this species at an elevation of 8,000 feet in the San Gabriel Mountains (Fisher and Case 1997), but it typically is found much lower. It occurs on both coastal and desert sides of the mountains.

Habitat: The coastal rosy boa is primarily associated with rocky habitat in scrub and chaparral, and in the mountains is often found in canyons and washes (Klauber 1931; Fisher and Case 1997).

Conservation Considerations: The rosy boa is an attractive, docile snake that has considerable market value in the pet trade. Illegal collection of wild snakes is believed to be a significant problem in some areas (Holland and Goodman 1998; J. Copp, CA Academy of Sciences, pers. comm.).

Red diamond rattlesnake
(Crotalus ruber ruber)

Status and Distribution: The red diamond rattlesnake is a California Species of Special Concern. It occurs on both coastal and desert slopes of the San Jacinto, Santa Rosa, and Santa Ana mountains, and the mountains of San Diego County (fig. 4.21). Its known elevation range is from near sea level to about 5,000 feet (Jennings and Hayes 1994), although it is typically found below 4,000 feet (Klauber 1972). Sighting records indicate this species is well represented on the Cleveland National Forest and the San Jacinto District of the San Bernardino National Forest (Glaser 1970).

Habitat: The red diamond rattlesnake typically occurs in brushy habitats that contain large rocks or boulders (Klauber 1972). It is frequently observed in chamise and red

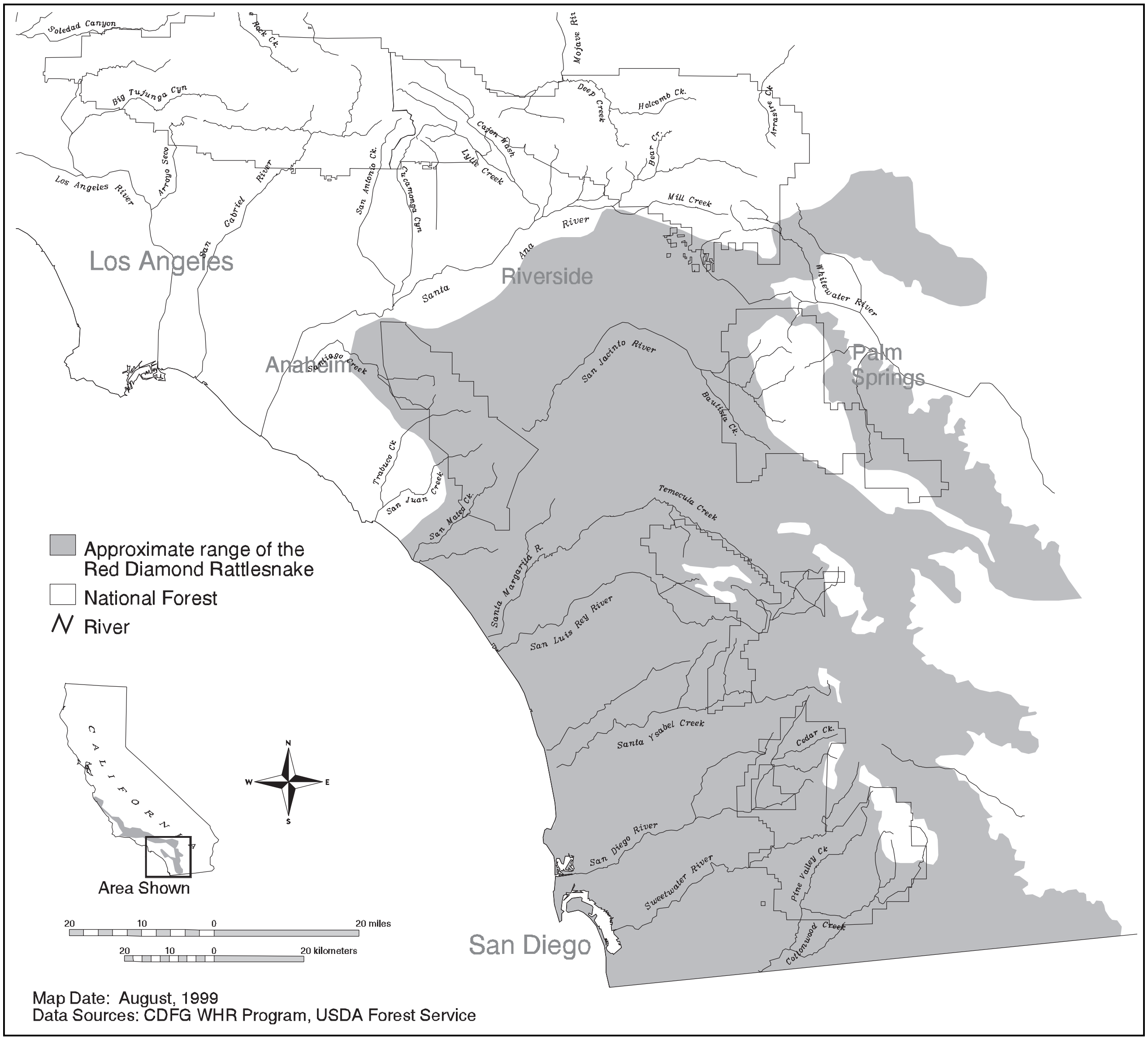


Figure 4.21. The approximate range of the red diamond rattlesnake.

shank chaparral as well as coastal sage scrub and desert scrub (Jennings and Hayes 1994).

Conservation Considerations: Urban development and irrigated agriculture, particularly avocado orchards, have significantly reduced the amount of suitable habitat for this species (Jennings and Hayes 1994). However, the red diamond rattlesnake does not seem particularly vulnerable to existing change agents on public lands. Its distribution and life history characteristics suggest it can be conserved through landscape-scale, habitat-based management. It would be a difficult species to monitor for trends in abundance.

San Diego pocket mouse *(Chaetodipus fallax)*

Status and Distribution: The San Diego pocket mouse is a California Species of Special Concern. The northern limits of this species' range extend from the eastern San Gabriel Mountains in the interior to near San Onofre along the coast (Lackey 1996). It occurs south of that line well into Baja California. Two different subspecies occur in the assessment area. *C. f. fallax* occurs on the coastal side of the mountains and the lighter colored *C. f. pallidus* is found on the desert side (Lackey 1996).

Suitable habitat for this mouse appears to extend well up into the mountains on desert-side slopes. The species has been found at 4,500 feet in the Santa Rosa Mountains and at 6,000 feet at Cactus Flat on the north side of the San Bernardino Mountains (Zeiner et al. 1990b).

Habitat: On the coastal side of the mountains, San Diego pocket mice are found primarily in coastal sage scrub (Vaughan 1954; Lackey 1996), reaching peak abundance in rocky areas within that habitat (Price and Waser 1984). Vaughan (1954) reported that this mouse does not extend into even the lower edge of the chaparral belt on the coastal slopes of the San Gabriel Mountains.

A broader range of habitats appears to be occupied on the desert side of the mountains. It has been found in pinyon-juniper woodland, desert scrub, rocky slopes, and agave-ocotillo habitat (Lackey 1996). On desert slopes of the eastern San Gabriel Mountains, the San Diego pocket mouse's distribution was closely correlated with the presence of yucca, particularly on dry, rocky southern slopes (Vaughan 1954).

Conservation Considerations: The San Diego pocket mouse appears to be well represented on public lands on the desert side of the mountains. It does not seem particularly vulnerable to land use activities in those areas. However, if its coastal-side distribution is strictly limited to coastal sage scrub, it may be quite rare on that side of the assessment area. More information is needed on the distribution and abundance of this species in potential habitat on the coastal side of the assessment area.

Animals of Foothill Oak Woodland and Savanna Habitats

Five of the animal species that received individual consideration are associated with foothill woodland and savanna habitats (table 4.14). Although relatively few rare animal species are restricted to foothill oak woodlands, it should be recognized that species diversity and richness are very high in these habitats, since they provide high quality habitat for many species.

Monterey salamander
(Ensatina eschscholtzii eschscholtzii)

Status and Distribution: The Monterey salamander is a local species of concern because it is relatively uncommon and much of its distribution is at low elevations on private lands. It occurs in the valleys, foothills, and lower montane slopes of every mountain range in the assessment area. No population trend information is reported for this species.

Three subspecies of *Ensatina eschscholtzii* (the other two are considered in the mixed hardwood-conifer forest group) occur in the mountains of southern California, and their evolutionary relationships and taxonomic status have received considerable scientific attention (Stebbins 1949; Brown 1974; Wake and Yanev 1986; Wake et al. 1986; Highton 1998; Wake and Schneider 1998). *E. e. eschscholtzii* is the most distinct of the three subspecies; it is a reddish-brown, unblotched salamander that is believed to have evolved from low-elevation coastal regions to the north. The other two subspecies are darker with prominent yellow or orange blotches. They are believed to have originated in the northern interior mountains and moved south through the Sierra Nevada and Tehachapi mountains (Wake and Yanev 1986).

Habitat: Monterey salamanders are most common in oak woodlands with extensive leaf litter and downed wood (Holland and Goodman 1998). However, they do occupy a wide variety of other habitats and extend to elevations above 6,100 feet in some areas (e.g., Sawmill Canyon north of Banning in the San Bernardino Mountains) (Wake et al. 1986). They are rarely seen on the ground surface except during and immediately after rains.

Conservation Considerations: These salamanders are impacted by habitat loss due to development on private lands but are not considered to be particularly vulnerable to prevailing land use activities on public lands. Over-collection of standing trees and downed logs in oak woodlands can be a problem near roads and undoubtedly reduces habitat quality for this species.

Table 4.14. Animals associated with foothill oak woodland and savanna habitats that received individual consideration. Displayed for each species: (1) the level of knowledge about where it occurs in southern California and, in parentheses, the estimated percentage of locations that are on national forest system lands; (2) the mountain subareas occupied (y = occurs in breeding season, h = historically occurred, p = potentially occurs, t = transient, w = winter visitor)—if the species is localized and data are available, the approximate number of occurrences may be displayed; (3) the vulnerability of populations on national forest system lands to existing threat factors; (4) population trends; and (5) the assigned conservation category.

Foothill Oak Woodland & Savanna Animals *federal status*	(1) Knowledge of SoCal Locations (% on NFs)	(2) areas occupied or estimated # of occurrences if spp. localized: Cleveland NF		San Bern. NF		Angeles NF		Los Padres NF			(3) Vulner-ability on NFs	(4) Pop. Trend	(5) Conser-vation Category
		San Diego Rngs	Snta Ana Mts	San Jac Mts	San Bern Mts	San Gab Mts	Cas-taic Rngs	So. LP Rngs	So. SL Rng	No. SL Rng			
Generalist													
Monterey salamander	Moderate (25-50%)	y	y	y	y	y	y	y	y	y	Low	Unkn	Landscape level
Oak Savanna													
Yellow-billed magpie	High (10-25%)							y	y	y	Low	Stable[1]	Landscape level
Mature Live Oak Groves													
Arboreal salamander	Mod-Low (25-50%)	y	y	y	y	y	y	y	y	y	Low	Unkn	Landscape level
Western screech owl	High (30-60%)	y	y	y	y	y	y	y	y	y	Mod	Unkn	Landscape level
Long-eared owl	Mod-Low (< 25%)	y	y	y	y	y	y	y	y	y	Mod	Unkn	Landscape level

[1] Based on BBS data for California (Sauer et al. 1997)

Arboreal salamander *(Aneides lugubris)*

Status and Distribution: The arboreal salamander is a local species of concern because it is relatively uncommon and much of its distribution is at low elevations on private lands. It reportedly occurs in the foothills and lower elevations of every mountain range in the assessment area (Stebbins 1951), although it is seldom seen. No population trend information is reported for this species.

Habitat: Arboreal salamanders are typically found in oak woodlands, particularly where coast live oak is a major component (Stebbins 1951; Holland and Goodman 1998). However, in southern California it has been observed in other habitats, including sycamore-dominated riparian (R. Fisher, USGS Biological Resources Division, pers. comm.) and chaparral (T. Scott, UC Riverside, pers. comm.). Leaf litter and downed logs are believed to be important habitat elements for this species.

Conservation Considerations: Same as those described for the Monterey salamander.

Yellow-billed magpie *(Pica nuttalli)*

Status and Distribution: The yellow-billed magpie is a local species of concern because it has a small geographic range (Sacramento and central coast valleys) and much of its distribution is at low elevations on private lands. Magpies occur from the upper Salinas Valley south to the Santa Ynez Valley, and east to the inland limit of oak savanna (fig. 4.22) (Garrett and Dunn 1981). They formerly occurred south to Conejo Valley on the Ventura/Los Angeles county line (Willet 1933) but apparently were absent from there by the 1930s (Garrett and Dunn 1981).

Although localized in distribution, magpies are often common where they occur. Breeding bird survey data from 1966 to 1996 for the California foothills and the entire state

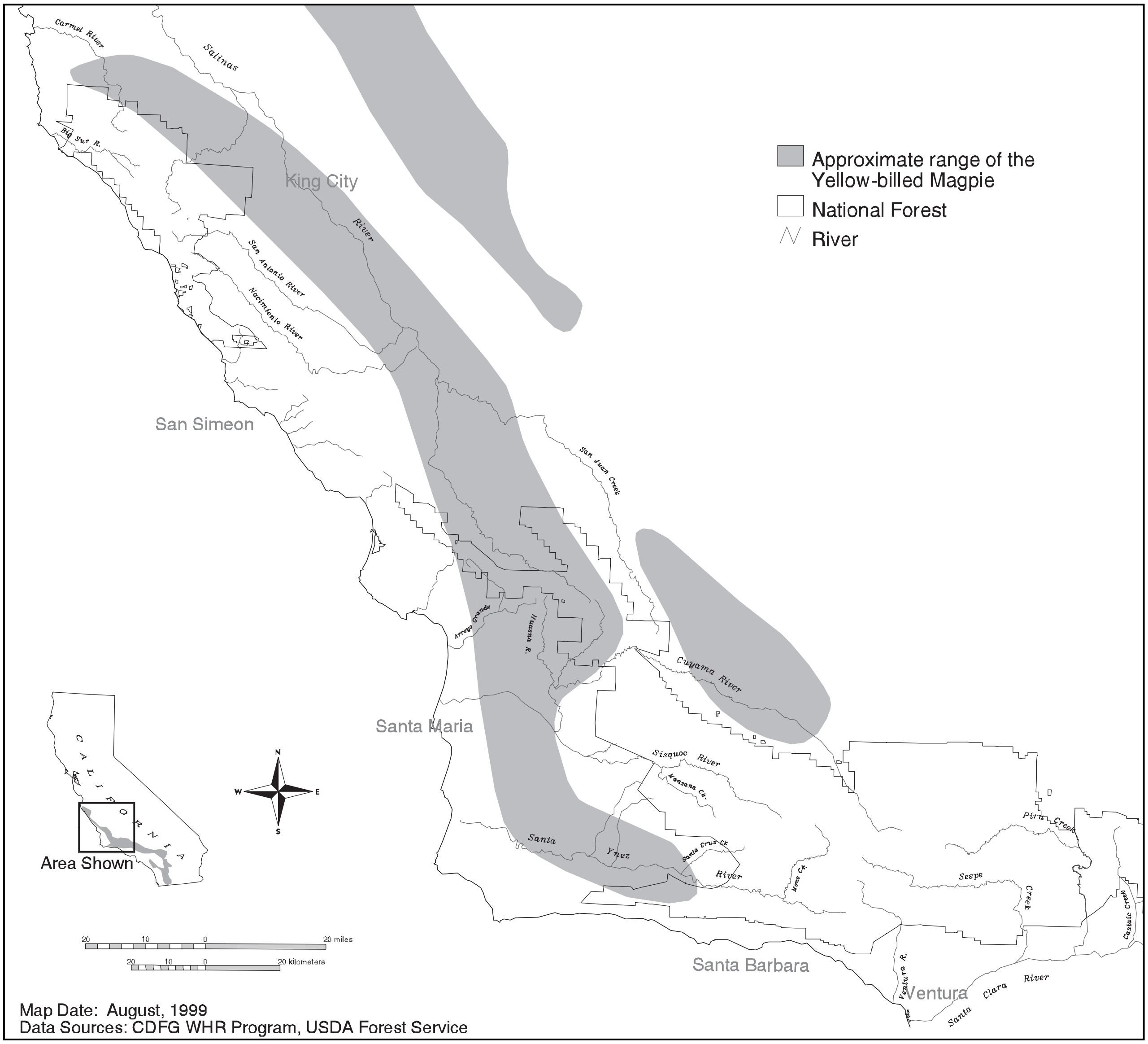


Figure 4.22. The approximate range of the yellow-billed magpie.

both show a very stable trend in the abundance of yellow-billed magpies (Sauer et al. 1997).

Habitat: Yellow-billed magpies occupy oak savanna, open oak-riparian woodland, and pastureland (Lehman 1994).

Conservation Considerations: Magpies are probably not particularly vulnerable to prevailing land use activities on public lands. However, only small portions of the yellow-billed magpie's occupied range lie on public land. The ability of this species to persist in increasingly developed areas is uncertain. Magpies do very well in ranchland situations and probably are okay in more developed ranchette environments, but it is unclear how they fare in suburban areas.

Western screech owl *(Otus kennicottii)*

Status and Distribution: The western screech owl is a local species of concern because it is relatively uncommon and much of its distribution is at low elevations on private lands. It occurs in the valleys, foothills, and lower montane slopes of every mountain range in the assessment area. No population trend information is reported for this species.

Habitat: The screech owl is most common in mature live-oak and oak-riparian woodlands in coastal and foothill areas but also occurs in oak-conifer forests on lower montane slopes up to at least 5,000 feet (Garrett and Dunn 1981; Unitt 1984).

Conservation Considerations: Screech owls nest in mature woodlands and, thus, are dependent on old stands that cannot easily be replaced. Mature oak woodland habitats are declining due to development on private lands, and stands on public lands are vulnerable to loss in stand-replacing fires.

Long-eared owl *(Asio otus)*

Status and Distribution: The long-eared owl is a California Species of Special Concern. Its geographic range extends across the assessment area, but recent observations in the region are rare. There are a few historical records of long-eared owls nesting at high elevations (above 7,000 feet) in the San Bernardino and San Jacinto mountains, but we found no recent observations in those areas. There are recent records from Crowder Canyon and Cajon Wash in the San Bernardino National Forest (D. Freeman, unpubl. notes), but those areas are below 5,000 feet. A pair of long-eared owls with young were observed at 7,500 feet on Mount Pinos in 1981 (Lentz 1993).

Bloom (1994) documented a number of active long-eared owl nest sites along the base of the Santa Ana Mountains in Orange County and within Camp Pendleton in northwestern San Diego County. He also reviewed historic nesting records elsewhere in San Diego County. The vast majority of these locations are west of the assessment area in the coastal valleys and low foothills.

In a map of long-eared owl distribution in California, Zeiner et al. (1990) indicate potential breeding areas on the desert side of the Castaic Ranges, in the upper Cuyama Valley region, and along the immediate coast in San Luis Obispo and southern Monterey counties.

Habitat: In coastal areas of southern California, long-eared owls typically nest in dense, closed-canopy stands of coast live oak or riparian woodland that are in close proximity to open habitats such as grassland, meadow, or desert scrub (Bloom 1994). The need for adjacent grassland foraging habitat may explain why this owl is not more common in upper foothill and lower montane areas. In these areas, closed canopy woodlands are often surrounded by dense chaparral.

In desert-side areas, long-eared owls nest in wooded riparian habitats. They regularly nest in tamarisk groves in the Anza-Borrego Desert (SDNHM 1998) and in riparian woodland in Big Morongo Canyon, both in situations where there is a lot of adjacent open habitat.

Conservation Considerations: More information is needed on the distribution of this species on public lands within the assessment area, particularly in the foothills where long-eared owls are now rare and vulnerable to habitat loss on private lands. Efforts are needed to protect grassland and meadow habitats in the vicinity of long-eared owl nest sites.

Animals of Mixed Hardwood-Conifer Forest Habitats

Ten of the animal species that received individual consideration are associated with forest types that typically contain a mix of hardwoods (e.g., oaks) and conifers (e.g., pines and firs) (table 4.15). Many of these species are found in lower montane forest types such as bigcone Douglas-fir/canyon live oak and Coulter pine/canyon live oak stands. Some of the species in this group, like the spotted owl, also can occur in forests that contain only conifers or hardwoods.

San Gabriel Mountains elfin butterfly *(Incisalia mossii hidakupa)*

Status and Distribution: This is a recently described taxon (Emmel et al. 1998) that is recognized as a Species of Concern by the U.S. Fish and Wildlife Service. The San Gabriel Mountains elfin is known from only six locations in the San Gabriel and San Bernardino mountains (Murphy 1990). Reported locations from the San Gabriel Mountains are in the San Antonio Canyon watershed (i.e., Stoddard Canyon and 5 miles west of Mount Baldy) and the Big Tujunga watershed (i.e., near Hidden Springs) (Murphy 1990). The only reported locality in the San Bernardino

Table 4.15. Animals associated with mixed hardwood-conifer forest habitats that received individual consideration. Displayed for each species: (1) the level of knowledge about where it occurs in southern California and, in parentheses, the estimated percentage of locations that are on national forest system lands; (2) the mountain subareas occupied (y = occurs in breeding season, h = historically occurred, p = potentially occurs, t = transient, w = winter visitor)—if the species is localized and data are available, the approximate number of occurrences may be displayed; (3) the vulnerability of populations on national forest system lands to existing threat factors; (4) population trends; and (5) the assigned conservation category.

Hardwood/Conifer Forest Animals of Concern *federal status*	(1) Knowledge of SoCal Locations (% on NFs)	(2) areas occupied or estimated # of occurrences if spp. localized									(3) Vulner-ability on NFs	(4) Pop. Trend	(5) Conser-vation Category
		Cleveland NF San Diego Rngs	Snta Ana Mts	**San Bern. NF** San Jac Mts	San Bern Mts	**Angeles NF** San Gab Mts	Cas-taic Rngs	**Los Padres NF** So. LP Rngs	So. SL Rng	No. SL Rng			
Invertebrates (butterflies)													
San Gabriel Mtns. elfin	Low (> 80%)				y	y					Unkn	Unkn	Site specific
Thorne's hairstreak	Low (0%)	p									Mod	Unkn	Site specific
Amphibians													
Large-blotched salamander	High (30-60%)	y		y	y[1]						Low	Unkn	Landscape level
Yellow-blotched salamander	Mod (30-60%)				y[1]		p	y			Low	Unkn	Landscape level
San Gabriel Mtn. slender salamander	Mod (> 80%)				p	y					Low	Unkn	Landscape level
Tehachapi slender salamander	Low (0%)						p	p			Unkn	Unkn	Minimal influence
Birds													
California spotted owl	High (50-75%)	~35	3	~20	~120	~60	12	~65	~12	~40	Mod	Decl[2]	Site specific
Northern pygmy owl	Low (25-50%)	y	p	y	y	y	y	y	y	y	Low	Unkn	Landscape level
Purple martin	Mod (25-50%)	y	h	y	y	y	y	y	t	y	**High**	Decl[3]	Site specific
Cassin's solitary vireo	High (< 25%)	y	y	y	y	y	y	y	y	y	Mod	Unkn	Landscape level

[1] Ensatina salamanders in the San Bernardino Mountains have color patterns more similar to the yellow-blotched subspecies, but are genetically closer to the large-blotched subspecies (Wake and Schneider 1998).
[2] LaHaye and Gutierrez 1997. (specific to the San Bernardino Mountains)
[3] Garrett and Dunn 1981, Unitt 1984, Lehman 1994.

Mountains is near Angeles Oaks, in the Santa Ana River watershed.

Habitat: The San Gabriel Mountains elfin butterfly appears to be found primarily on steep, north-facing slopes. The larval host plant is a stonecrop, *Sedum spathulifolim,* that is concentrated and limited in extent (Murphy 1990; Emmel et al. 1998).

Conservation Considerations: All reported localities of this butterfly appear to be on national forest system lands. In Murphy's (1990) status review, *Incisalia mossii hidakupa* is listed as a category A taxon, that is, a taxon in immediate need of protective measures. Two other species identified as category A taxa in this 1990 paper have subsequently been added to the endangered species list (i.e., quino checkerspot and Laguna Mountain skipper).

Ironically, the principal threat identified for this species is over collecting and destruction of host plants by butterfly collectors (Murphy 1990). The locations of these populations should be identified by the Forest Service and protective measures instituted to reduce this threat. Additional surveys are also needed to better determine the distribution, abundance, and habitat requirements of this butterfly.

Thorne's hairstreak *(Mitoura thornei)*

Status and Distribution: The Thorne's hairstreak is a local species of concern. Murphy (1990) considered it a category B taxon, which he defined as one which warrants listing as endangered, but with a less pressing need than category A taxa. This butterfly is currently known only from the vicinity of Otay Mountain near the Mexican border in southwestern San Diego County (Brown 1991). Closely associated with Tecate cypress on Otay Mountain, the Thorne's hairstreak has not been found at other localities where the cypress tree occurs (Brown 1991).

Habitat: The larval host plant for this butterfly is the Tecate cypress. A detailed description of the habitat on Otay Mountain where the Thorne's hairstreak occurs is provided in Brown (1983).

Conservation Considerations: It appears that the Thorne's hairstreak does not occur at sites where Tecate cypress grows within the assessment area (Brown 1991), but additional surveys are needed to make a more conclusive determination. The biggest threat to this species is overly frequent fire that could drastically reduce the abundance of Tecate cypress (see "Tecate Cypress" section in chapter 2). A series of recent fires on Otay Mountain has negatively impacted the cypress.

Large-blotched salamander *(Ensatina eschscholtzii klauberi)*

Status and Distribution: The large-blotched salamander is a Forest Service Region 5 Sensitive Species and a California Species of Special Concern. It occurs from the mountains of San Diego County (i.e., Laguna, Cuyamaca, Volcan, Palomar, and Hot Springs) north to the San Jacinto Mountains (Jennings and Hayes 1994) primarily at elevations between 3,000 and 6,000 feet (fig. 4.23). Localized populations of blotched ensatina salamanders in the San Bernardino Mountains (i.e., Crystal Creek, near Lake Arrowhead, and Sawmill Canyon) appear to be genetically closer to *E. e. klauberi,* but have color patterns more similar to *E. e. croceater* (Wake and Schneider 1998).

Habitat: Large-blotched salamanders occur in a variety of habitats but are most common in mixed stands of oaks (coast live, canyon live, or black) and conifers (pine, fir, and incense cedar). Down logs, leaf litter, and woody debris appear to be important habitat elements (Jennings and Hayes 1994).

Conservation Considerations: These salamanders are impacted by habitat losses resulting from development on private lands but are not considered to be particularly vulnerable to prevailing land use activities on public lands. Over-collection of standing trees and downed logs in oak-conifer forests can be a problem near roads and likely reduces habitat quality for this species.

Yellow-blotched salamander *(Ensatina eschscholtzii croceater)*

Status and Distribution: The yellow-blotched salamander is a Forest Service Region 5 Sensitive Species and a California Species of Special Concern. It occurs in the Tehachapi Mountains and extends into the assessment area in the vicinity of Mount Pinos, Frazier Mountain, and Alamo Mountain (Jennings and Hayes 1994). Potential habitat close to the known range of this subspecies exists on Liebre and Sawmill mountains in the Castaic region. As previously mentioned, blotched ensatina slamanders found in the San Bernardino Mountains have color patterns similar to *E. e. croceater.*

The absence of blotched ensatina salamanders in the San Gabriel Mountains has long been an enigma, since there appears to be an extensive amount of suitable habitat there, and people continue to search for isolated, undiscovered populations (Wake and Schneider 1998).

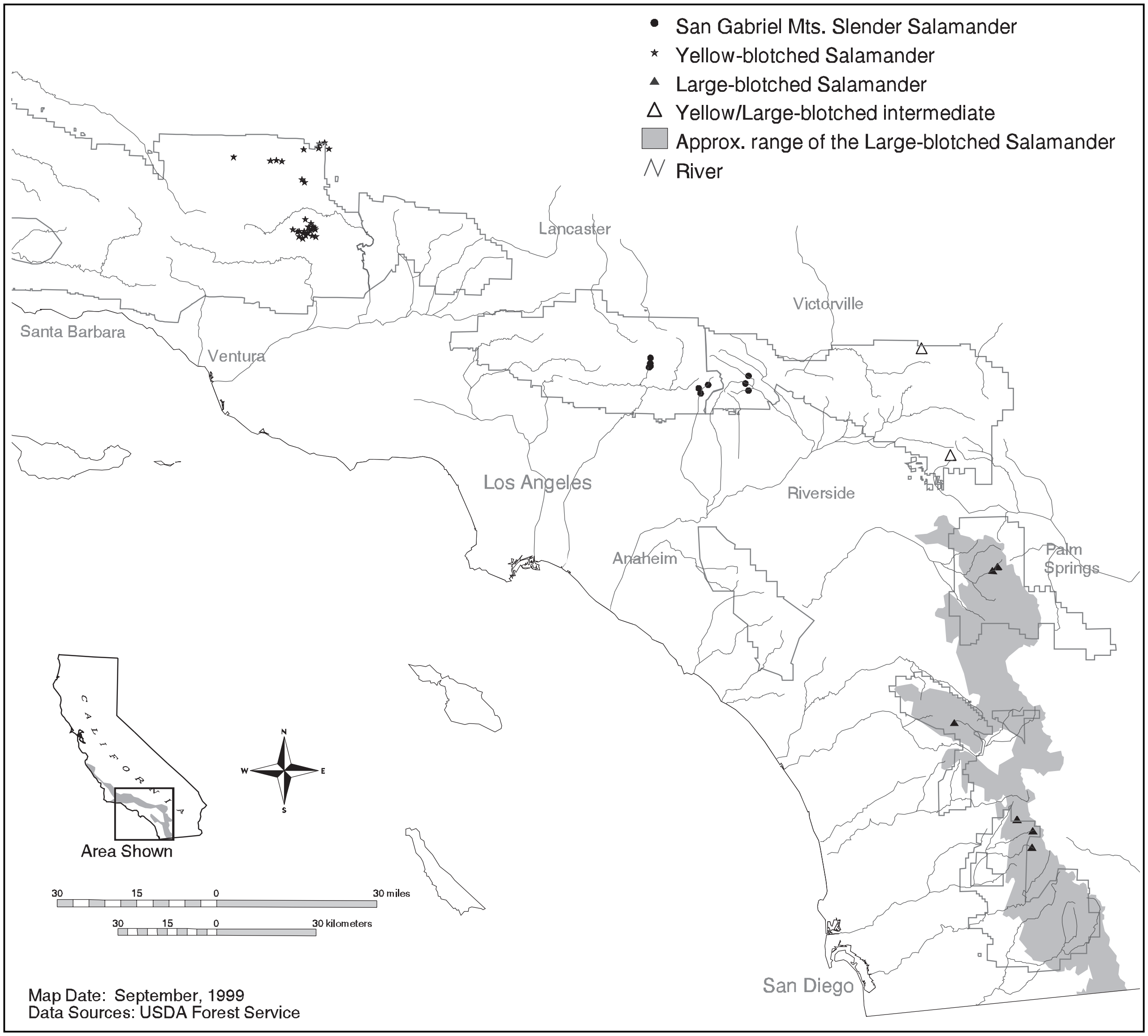


Figure 4.23. Approximate range of the large-blotched salamander and known locations of the yellow-blotched and San Gabriel Mountain salamanders.

Habitat: Yellow-blotched salamanders occur in a variety of habitats but are most common in mixed stands of oaks (black, blue, or canyon live) and conifers (pine or fir). Down logs, leaf litter, and woody debris appear to be important habitat elements (Jennings and Hayes 1994).

Conservation Considerations: Same as those described for the large-blotched salamander. Surveys are needed to determine if this species is present on Liebre or Sawmill mountains.

San Gabriel Mountain slender salamander *(Batrachoseps gabrieli)*

Status and Distribution: The San Gabriel Mountain slender salamander is a Forest Service Region 5 Sensitive Species. This recently described species is known from only a few localities, all in the eastern San Gabriel Mountains (fig. 4.23): at Pine Flats near Crystal Lake and Rockbound Canyon in the upper San Gabriel River watershed (Wake 1996), in San Antonio Canyon, and in the south, middle, and north forks of Lytle Creek (R. Goodman, pers. comm., 1998). A *Batrachoseps* salamander found in Waterman Canyon in the San Bernardino Mountains may also be this species, although it has some different physical characteristics (R. Goodman, pers. comm., 1998).

The known elevation range of this salamander is from 3,800 feet to 7,800 feet (Wake 1996) and all localities are within either the Angeles or San Bernardino national forests.

Habitat: San Gabriel Mountain slender salamanders have been found in mixed hardwood-conifer forest habitats, usually near water and often associated with rocky talus slopes (Wake 1996). They typically occur under large rocks, rotting logs, downed tree limbs, and bark.

Conservation Considerations: This salamander is currently known from only a few locations, all of which are on national forest system lands in the eastern San Gabriel Mountains. Until more information is obtained on the distribution and abundance of this taxon, the few known localities warrant management attention. If it is found to be more broadly distributed, landscape-scale habitat management may suffice since its apparent niche under rocks, logs, and duff suggest it is not particularly vulnerable to existing agents of change. Mesic lower montane forests (e.g., bigcone Douglas-fir/canyon live oak) appear to be important to this species.

Tehachapi slender salamander
(Batrachoseps stebbinsi)

Status and Distribution: The Tehachapi slender salamander is a Forest Service Region 5 Sensitive Species and is state-listed as threatened. The narrow known range of this species is primarily restricted to the Piute and Tehachapi mountains of Kern County at elevations between 2,500 and 5,000 feet (Zeiner et al. 1988). There are no known locations of this species in the assessment area, but areas near the Tehachapi Mountains that contain potential habitat include the Mount Pinos/Frasier Mountain area and also the north sides of Liebre and Sawmill mountains.

Habitat: This salamander is found primarily in mixed pine-oak and riparian woodlands in moist canyons, ravines, and north-facing slopes. It is often found in association with rocky talus slopes (Zeiner et al. 1988).

Conservation Considerations: Surveys are needed to determine if this species is present in areas of potential habitat within the assessment area that are near known populations.

California spotted owl
(Strix occidentalis occidentalis)

Status and Distribution: The California spotted owl is a Forest Service Region 5 Sensitive Species. Spotted owls occur in all of the major mountain ranges in the assessment area, although some ranges support very few pairs (fig. 4.24). They are found at elevations ranging from below 1,000 feet along the Monterey coast to approximately 8,500 feet (Stephenson 1991). A territorial species with large acreage requirements (at least 300 acres of mature forest per pair), spotted owls in southern California are clustered in disjunct mountain and foothill areas where suitable habitat exists. These clusters are surrounded by large areas of unsuitable habitat.

Habitat: Spotted owls are found in mature forests, typically where there is a dense, multi-layered canopy. Nest stands often have a well-developed hardwood understory (e.g., canyon live oak) and a conifer overstory. However, some high-elevation territories (above 6,500 feet) consist primarily or solely of conifers and some low-elevation territories (below 3,000 feet) are found in pure hardwood stands. Territory sizes vary widely depending on habitat type, with territories becoming larger in the high-elevation, conifer-dominated sites. Verner et al. (1992) and LaHaye et al. (1997) provide detailed quantitative information on the habitats occupied by spotted owls in southern California.

Conservation Considerations: Spotted owls in southern California are believed to function as a metapopulation, with separate subpopulations connected by infrequent but persistent interchange of individual owls (Noon and McKelvey 1992; LaHaye et al. 1994). The largest subpopulation is the 200-plus territories in the adjacent San Bernardino

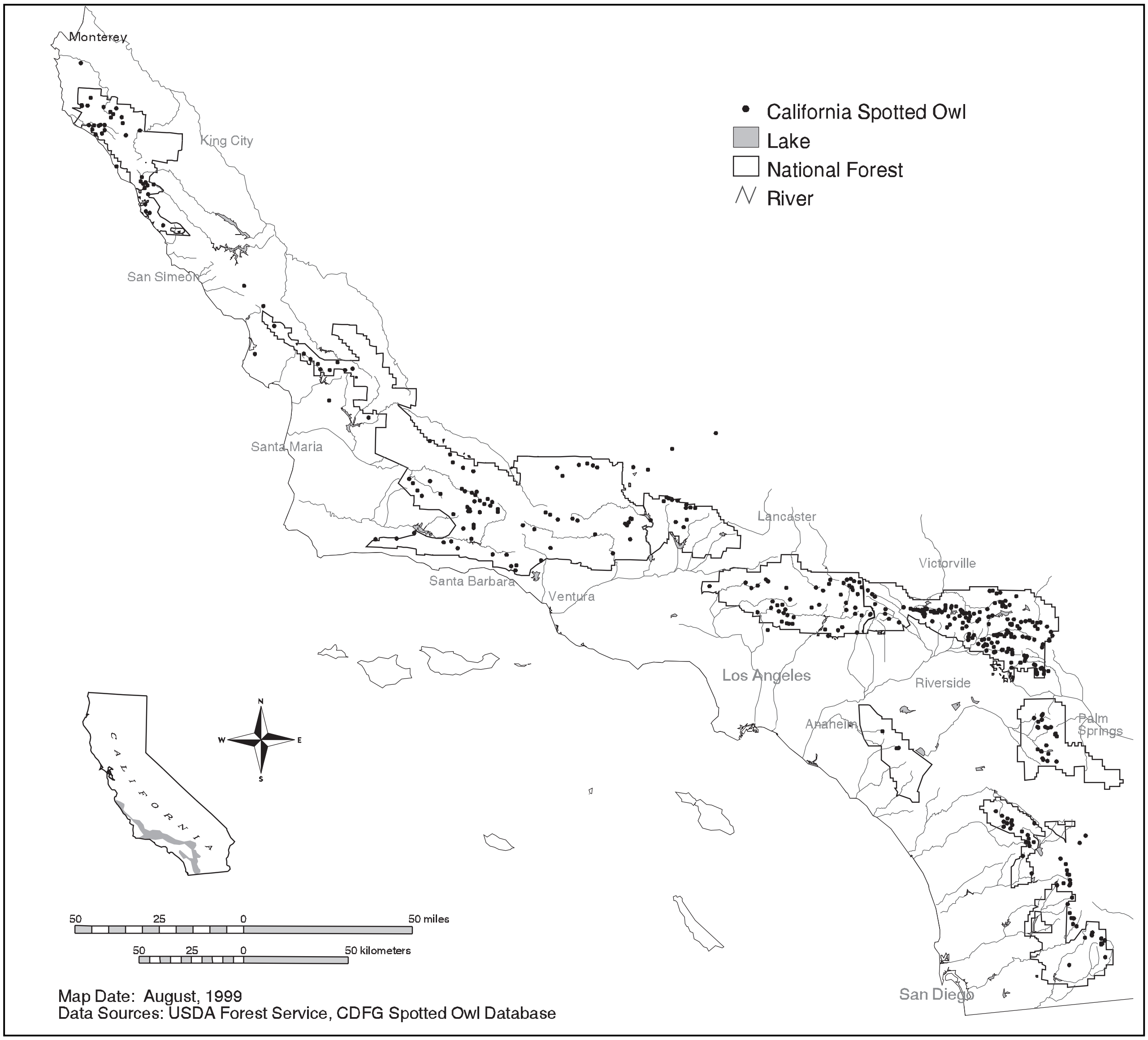


Figure 4.24. Known locations of the California spotted owl in the assessment area.

and San Gabriel mountains. Although Cajon Pass separates these two mountain ranges, there is not a major habitat discontinuity and only 6 miles separate the easternmost San Gabriel territory from the westernmost San Bernardino territory. Noon and McKelvey (1992) stress the importance of this large subpopulation as a likely source area that provides immigrants to sustain the surrounding smaller, isolated subpopulations. However, the simulation modeling results of LaHaye et al. (1994) found the southern California spotted owl metapopulation's stability to be insensitive to rates of dispersal between mountain ranges, suggesting that the subpopulations could be considered effectively isolated.

An important factor to consider is that spotted owls occupy a variety of different habitats across the assessment area. Reproductive success and survivorship rates for individual members of the population may differ, depending on which habitat type they inhabit (Pulliam et al. 1992). There is empirical evidence from the San Bernardino Mountains that spotted owl reproductive success is significantly higher in lower montane bigcone Douglas-fir/canyon live oak forests than it is in high-elevation montane conifer forests (table 4.16) (LaHaye et al. 1997). These lower elevation habitats are believed to be productive because of high woodrat densities (the owl's primary prey) in the surrounding chaparral.

They also tend to be below the snow line of most late winter/spring storms, which may reduce the impact of such weather events during the breeding season. Large, late-season storms have been shown to have a major effect on spotted owl reproductive success in northwestern California (Franklin et al. in press) and appear to have a similar effect in the Sierra Nevada (J. Verner, Pacific Southwest Research Station, pers. comm.).

The apparent high quality of low-elevation live oak and bigcone Douglas-fir dominated habitats may explain the continued persistence of small spotted owl populations in each southern California mountain range. Maintaining these restricted habitats, which are often narrow stringers of dense, mature forest on north-facing slopes and deep canyons, should be a high management priority. They are vulnerable to loss in stand-replacing fires that move in from the surrounding chaparral.

Northern pygmy owl *(Glaucidium gnoma)*

Status and Distribution: The northern pygmy owl is a local species of concern because it is rare in southern California and most known locations are within the assessment area. Garrett and Dunn (1981) report that pygmy owls frequently occur in foothill canyons and forested interior mountains of San Luis Obispo and Santa Barbara counties but become considerably rarer as you move south and east. Sighting records described by Lentz (1993) suggests pygmy owls are fairly common near Big Pine Mountain, less common around Figueroa and Pine mountains, and rare on Mount Pinos. They reportedly occur in the San Gabriel, San Bernardino, and San Jacinto mountains, although detailed information on their distribution and abundance is lacking. They occur rarely if at all in the Santa Ana Mountains, and they are described as "very rare if not now extirpated" from San Diego County (SDNHM 1998).

Habitat: Pygmy owls are found most commonly in oak-conifer and riparian-conifer woodlands, often in canyons (Garrett and Dunn 1981). They can occur from low-elevation foothill canyons up into montane conifer forests but reportedly become less common above 6,000 feet (Zeiner et al. 1990). Pygmy owls typically nest in abandoned woodpecker holes, especially those of the acorn woodpecker (Zeiner et al. 1990). They are often found near forest openings.

Conservation Considerations: Lower montane hardwood-conifer forests (e.g., bigcone Douglas-fir/Coulter pine/live oak associations) may be particularly important to this species. There are indications that these forests are declining due to an increase in stand-replacing fires (see "Fire" section in chapter 3).

Purple martin *(Progne subis)*

Status and Distribution: Purple martins occurred, at least historically, in all of the major mountain ranges in the assessment area. However, many historic localities are no longer

Table 4.16. Reproductive success of spotted owls in the San Bernardino Mountains by habitat type (from LaHaye et al. 1997).

Habitat Type	Number of nests (% successful)	Average fledglings per nest
Oak/bigcone Douglas-fir (low elevation)	42 (81%)	1.39
Conifer/hardwood (middle elevation)	21 (67%)	0.98
Mixed conifer (high elevation)	38 (76%)	0.95

occupied (Garrett and Dunn 1981; Unitt 1984). Three known nesting sites on Palomar Mountain were abandoned in the mid-1980s (R. Higson, pers. comm., 1997). They also have reportedly disappeared from most of the San Gabriel Mountains and may no longer breed there (D. Cooper, UC Riverside, in litt., 1998).

Within the Los Padres National Forest, Lentz (1993) and Lehman (1994) describe observations of purple martins on Big Pine Mountain and San Rafael Mountain in the 1980s, but it is unclear if these sites are still occupied. Nojoqui Falls County Park and the Alisal Ranch area in the Santa Ynez Valley are the most recently documented breeding sites (Lehman 1994).

In the San Jacinto Mountains, Lake Hemet and Garner Valley are historic breeding localities and there are indications that purple martins may still occur there (D. Freeman, unpubl. notes). In San Diego County, recent known sites include Palomar Observatory, Cuyamaca Peak, and Kitchen Creek Road (SDNHM 1998).

Habitat: Purple martins develop colonial nests in cavities of large trees in oak or riparian woodlands and low-elevation coniferous forests (Garrett and Dunn 1981). Nests are often located in a tall, old isolated tree or snag in open forest or woodland, frequently near a body of water (Zeiner et al. 1990).

Conservation Considerations: Competition for nest cavities from European starlings has taken a heavy toll on the purple martin (Garrett and Dunn 1981; Unitt 1984; Lehman 1994). It is also negatively affected by declines in snag densities. More information is needed on locations of active purple martin colonies in the assessment area. Occupied sites should be given site-specific attention as this species is highly vulnerable to extirpation from individual mountain ranges and the entire assessment area. Starling control in the vicinity of active nest sites is a potential habitat improvement action.

Cassin's solitary vireo *(Vireo solitarius cassinii)*

Status and Distribution: The Cassin's solitary vireo is a local species of concern because it is uncommon in southern California and most known breeding locations are within the assessment area. It is broadly distributed along the coastal slopes of the mountains in foothill and lower montane forests and woodlands, particularly in densely wooded canyons (Garrett and Dunn 1981). BBS results from 1980 to 1996 show solitary vireos increasing statewide at a statistically significant rate of 3.6 percent a year (Sauer et al. 1997). Results from the Forest Service riparian bird study also show an increasing trend of 10.3 percent a year in the southern California national forests.

Habitat: The Cassin's solitary vireo breeds in oak and mixed hardwood-conifer woodlands. Lentz (1993) says that this subspecies is encountered on the Los Padres National Forest in shaded areas where oaks and conifers form a canopy, often near riparian vegetation.

Conservation Considerations: Solitary vireos frequently have their nests parasitized by brown-headed cowbirds (Verner and Boss 1980; Erhlich et al. 1988). The taxonomy of solitary vireos needs to be clarified. Recent studies suggest that the Cassins and Plumbeus subspecies should be recognized as distinct species (Johnson 1995).

Animals of Montane Conifer Forest Habitats

Animals species associated with montane conifer forests that received individual consideration in this assessment include three invertebrates, six reptiles (table 4.17), nine birds, and seven mammals (table 4.18). None of these species is federally listed as threatened or endangered, which is a reflection of lower rates of habitat loss in montane areas that are predominately on public lands.

Table 4.17. Invertebrates and reptiles associated with montane conifer forests that received individual consideration. Displayed for each species: (1) the level of knowledge about where it occurs in southern California and, in parentheses, the estimated percentage of locations that are on national forest system lands; (2) the mountain subareas occupied (y = occurs in breeding season, h = historically occurred, p = potentially occurs, t = transient, w = winter visitor)—if the species is localized and data are available, the approximate number of occurrences may be displayed; (3) the vulnerability of populations on national forest system lands to existing threat factors; (4) population trends; and (5) the assigned conservation category.

Montane Conifer Forest Animals of Concern *federal status*	(1) Knowledge of SoCal Locations (% on NFs)	(2) areas occupied or estimated # of occurrences if spp. localized: Cleveland NF: San Diego Rngs	Cleveland NF: Snta Ana Mts	San Bern. NF: San Jac Mts	San Bern. NF: San Bern Mts	Angeles NF: San Gab Mts	Angeles NF: Cas-taic Rngs	Los Padres NF: So. LP Rngs	Los Padres NF: So. SL Rng	Los Padres NF: No. SL Rng	(3) Vulner-ability on NFs	(4) Pop. Trend	(5) Conser-vation Category
Invertebrates													
Bicolored rainbeetle	Low (0-30%)				y						Mod	Unkn	Landscape level
Andrew's marble butterfly	Mod (40-80%)				y						Unkn	Unkn	Landscape level
August checkerspot	Mod (> 70%)				y						Unkn	Unkn	Landscape level
Reptiles													
Sagebrush lizard	Mod (50-70%)	y		y	y	y	p	y		y	Low	Unkn	Landscape level
Southern rubber boa	Mod (30-70%)			y	y			y*			Mod	Unkn	Landscape level
Coastal mtn. kingsnake	Mod (40-70%)						y	y	p	y	Mod	Unkn	Landscape level
San Bernardino mtn. kingsnake	Mod (50-80%)			y	y	y					Mod	Unkn	Landscape level
San Diego mtn. kingsnake	Mod (40-70%)	y	y								High	Unkn	Landscape level
Mountain garter snake	Low (> 60%)				y						Low	Unkn	Landscape level

* Rubber boas near Mount Pinos are intergrades between southern and northern subspecies

Montane Conifer Invertebrates

Bicolored rainbeetle *(Pleocoma bicolor)*

Status and Distribution: The bicolored rainbeetle is a species of local concern because it is endemic to a small portion of the San Bernardino Mountains. The entire known range of this species is confined to an area extending from Rim of the World Drive (Highway 18) near the Crestline cutoff through Crestline, Bluejay, and Arrowhead City to the north shore of Lake Arrowhead (Hovore 1991). Most of this area is private land where there has been intensive recreational and housing development in the past two decades. This rainbeetle has declined and possibly has been extirpated from much of its historical range (Hovore 1991).

Habitat: We have no specific information on the habitat associations of this species. Most of the area within its small geographic range is either pine forest, mixed conifer forest, or black oak woodland.

Conservation Considerations: Information is needed on the current distribution of the species. It would be particularly useful to know the extent to which it occurs on public lands in the San Bernardino Mountains. If not well represented on existing public lands, areas known to still harbor this species should be considered for land exchanges and/or acquisitions.

Table 4.18. Birds and mammals associated with montane conifer forests that received individual consideration. Displayed for each species: (1) the level of knowledge about where it occurs in southern California and, in parentheses, the estimated percentage of locations that are on national forest system lands; (2) the mountain subareas occupied (y = occurs in breeding season, h = historically occurred, p = potentially occurs, t = transient, w = winter visitor)—if the species is localized and data are available, the approximate number of occurrences may be displayed; (3) the vulnerability of populations on national forest system lands to existing threat factors; (4) population trends; and (5) the assigned conservation category.

Montane Conifer Birds & Mammals of Concern *federal status*	(1) Knowledge of SoCal Locations (% on NFs)	(2) areas occupied or estimated # of occurrences if spp. localized — Cleveland NF		San Bern. NF		Angeles NF		Los Padres NF			(3) Vulner-ability on NFs	(4) Pop. Trend	(5) Conser-vation Category
		San Diego Rngs	Snta Ana Mts	San Jac Mts	San Bern Mts	San Gab Mts	Cas-taic Rngs	So. LP Rngs	So. SL Rng	No. SL Rng			
Birds													
Sharp-shinned hawk	Low (> 60%)	w	w	y	y	y	w	p	w	y	Mod	Unkn	Landscape level
Northern goshawk	Low (60-80%)			y	y	p		y			Mod	Unkn	Site specific
Mt Pinos blue grouse	Low (> 90%)							h/p			Mod	Unkn	Site specfic
Flammulated owl	Mod (40-60%)	p		y	y	y	p	y		y	**High**	Unkn	Landscape level
Northern saw-whet owl	Mod (> 60%)	y	p	y	y	y	p	y	p	y	Mod	Unkn	Landscape level
Williamson's sapsucker	Mod (> 60%)	w		y	y	y	w	y		w	Mod	Unkn	Landscape level
White-headed woodpecker	Mod (> 60%)	y		y	y	y	p	y	p	p	Mod	Unkn	Landscape level
Hermit thrush	Mod (> 50%)	p/w	w	p	y	y	w	y	w	y	Mod	Unkn	Landscape level
Virginia's warbler	Mod (> 60%)	t	t	t	y	y	t	t	t	t	Low	Unkn	Landscape level
Mammals													
Long-eared myotis	Mod (> 50%)	y		y	y	y	p	y		p	Unkn	Unkn	Landscape level
Fringed myotis	Mod (> 50%)	y		y	y	y	p	y		p	Unkn	Unkn	Landscape level
Long-legged myotis	Mod (> 50%)	y		y	y	y	p	y		p	Unkn	Unkn	Landscape level
Golden-mantled ground squirrel	Mod (> 70%)				y						Low	Unkn	Landscape level
San Bernardino flying squirrel	Mod (> 60%)			h/p	y	p					Mod	Unkn	Landscape level
San Bernardino white-eared pocket mouse	Low (> 60%)				h/p	p					Unkn	Unkn	Site specific
Porcupine	Low (> 60%)				y	h/p					Unkn	Unkn	Landscape level

[1] based on USFS riparian point count results

[2] Bell's vireo is increasing regionwide, but decreasing on national forest service lands

Andrew's marble butterfly *(Euchloe hyantis andrewsi)*

Status and Distribution: The Andrew's marble is a former C2 Candidate for federal listing. Its geographic range is restricted to the San Bernardino Mountains (Murphy 1990). It is found at elevations above 5,000 feet near Lake Arrowhead and Big Bear Lake, and in other locations across the crest and north slope. Recent records include Baldwin Lake, Sugarloaf Mountain, and Wild Horse Meadow (Murphy 1990).

Habitat: The Andrew's marble is found primarily in pine and mixed conifer forests. The larval host plants for this subspecies are *Streptanthus bernardinus* and *Arabis holboellii* (Murphy 1990).

Conservation Considerations: No threats have been identified for this species. Murphy (1990) considered the Andrew's marble to be a category D taxon, which is defined as being neither in danger of extinction nor likely to be. It is not clear what this determination is based upon, other than that the Andrew's marble appears to be well distributed and largely on national forest system lands.

August checkerspot butterfly *(Euphydryas editha augustina)*

Status and Distribution: This high-elevation relative of the quino checkerspot is a species of local concern because it is endemic to the San Bernardino Mountains. The August checkerspot has been found above 8,000 feet on Sugarloaf Peak and along forest roads and meadows from 5,000 to 7,000 feet near Running Springs, Moonridge, Cedarpines Park, Wild Horse Creek, and Fawnskin (Emmel and Emmel 1973).

Habitat: The August checkerspot occurs in pine and mixed conifer forests. *Collinsia childii* is a known host plant and it is reported that *Castilleja* species are also used (Emmel and Emmel 1973).

Conservation Considerations: No threats have been identified for this species. Similar in known range and habitat to the Andrew's marble, the August checkerspot probably would be similarly described as being neither in danger of extinction nor likely to be.

Montane Conifer Reptiles

Sagebrush lizard *(Sceloporus graciosus)*

Status and Distribution: The sagebrush lizard is considered a species of local concern because it is patchily distributed and restricted to high elevations (primarily above 4,000 feet). Two subspecies occur in the assessment area. The southern sagebrush lizard, *S. g. vandenburgianus,* extends from near Mount Pinos south to the Sierra San Pedro Martir in Baja California. The western sagebrush lizard, *S. g. gracilis,* occurs in the Mount Pinos region and extends north into the Sierra Nevada and along the central and northern California coast (Censky 1986).

S. g. gracilis has a very patchy distribution in small islands of upper-elevation habitat that lie within the Los Padres National Forest. Occupied areas include Mount Pinos, Pine Mountain, Big Pine Mountain, Sierra Madre Mountains, and Cone Peak in the northern Santa Lucia Range (J. Copp, Cal. Academy of Sciences, in litt.). It appears to be absent from the low-elevation southern Santa Lucia Range (Censky 1986).

Fisher and Case (1997) report that *S. g. vandenburgianus* was the most frequently captured species in pitfall trap arrays in the vicinity of Big Bear Lake in the San Bernardino Mountains and the second most frequently captured species at the James Reserve in the San Jacinto Mountains. It also occurs in the San Gabriel Mountains and the higher-elevation mountains in San Diego County.

Habitat: Sagebrush lizards inhabit a variety of montane vegetation types including mixed conifer forest, black oak woodlands, montane chaparral, and pinyon-juniper woodlands (Zeiner et al. 1988). In general, they tend to be in open habitats that receive considerable sunlight.

Conservation Considerations: No threat factors have been specifically identified for sagebrush lizards, other than the fact that their distribution in southern California is limited and highly disjunct. They should be adequately conserved through landscape-scale habitat management.

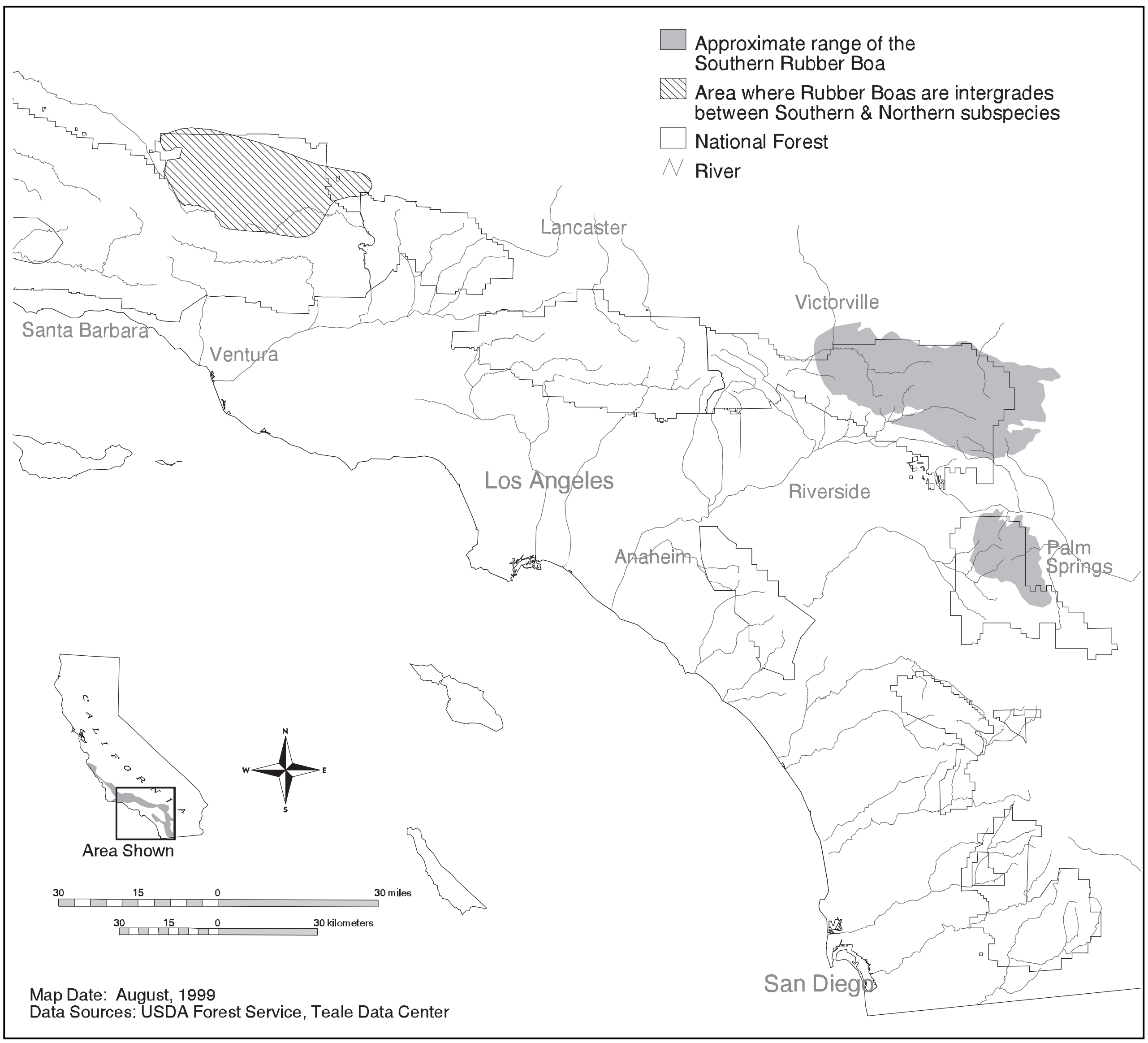
Southern rubber boa *(Charina bottae umbratica)*

Status and Distribution: The southern rubber boa is state listed as threatened and is a Forest Service Region 5 Sensitive Species. It is found in the San Bernardino and San Jacinto mountains, at elevations between 4,900 and 7,900 feet (fig. 4.25) (Stewart 1988). There are approximately eight known localities in the San Jacinto Mountains (including Fern Valley, Dark Canyon, Devil's Slide trail, and the North Fork, San Jacinto River near the Highway 243 crossing) and thirty-five to forty known locations in the San Bernardino Mountains (Keasler 1981; Loe 1985; Stewart 1988). Twenty-six of the localities in the San Bernardino Mountains are in a 10-mile-long strip between Twin Peaks on the west and Green Valley on the east (Stewart 1988). Other locations include Barton Flats and north-facing slopes immediately south of Big Bear Lake.

Isolated populations of rubber boas have also been found in the southern Los Padres ranges on Mount Pinos, Mount Abel, and Alamo Mountain (Alten and Keasler 1978). Morphological and electrophoretic analysis of specimens from these mountains show them to be intergrades between the southern rubber boa and the northern rubber boa *(C. b. bottae)* which occurs in the Sierra Nevada range (G. Stewart, Cal Poly Pomona, in litt.).

Habitat: The southern rubber boa usually occurs in moist woodlands and coniferous forests. It tends to be associated with vegetatively productive sites, usually with deep, well-developed soils (Loe 1985). It is a burrower

Figure 4.25. The approximate range of the southern rubber boa.



and also commonly makes use of rock outcrops as hibernacula. Large downed logs and a well-developed litter/duff layer are considered important for cover and for maintaining high soil moisture. Soil moisture may be a limiting factor for rubber boas, as they are usually found during summer months in damp draws near springs, seeps, and streams (Loe 1985).

Conservation Considerations: The rubber boa is vulnerable to habitat loss from development on private land, water diversion or extraction, and land use activities that destroy soil or surface cover. The majority of known rubber boa locations are on private lands. The lush, mesic forests that are prime habitat for this species tend to be highly interspersed with private lands (e.g., around Lake Arrowhead and Idyllwild). Where such forest conditions occur on public land, care should be taken to maintain mesic conditions, down logs, and leaf cover.

California mountain kingsnake *(Lampropeltis zonata)*

Status and Distribution: Three separate subspecies of mountain kingsnakes occur within the assessment area. The San Diego subspecies, *L. z. pulchra,* is a Forest Service Region 5 Sensitive Species and a California Species of Special Concern. It occurs in the mountains of San Diego County (Laguna, Cuyamaca, Volcan, Hot Springs, and Palomar), and the Santa Ana and Santa Monica mountains (Jennings and Hayes 1994). Although most common in montane forests, *L. z. pulchra* is also found at low elevations in foothill canyons (McGurty 1988). There are scattered historic reports of this subspecies near sea level along the coast, but it was not detected during recent reptile surveys on Camp Pendleton, the largest remaining stretch of undeveloped coastal habitat in southern California (Holland and Goodman 1998).

The San Bernardino subspecies, *L. z. parvirubra,* is also a Forest Service Sensitive Species and a California Species of Special Concern. It occurs in the San Jacinto, San Bernardino, and San Gabriel mountains. The documented elevation range for this subspecies extends from 1,200 feet in Eaton Canyon (San Gabriel Mountains) to 8,100 feet on Mount San Jacinto (Jennings and Hayes 1994). Finally, the coastal mountain kingsnake, *L. z. multifasciata,* which is not identified as a sensitive species, is found in the southern Los Padres ranges and the northern Santa Lucia Range (Zweifel 1975).

Habitat: In southern California, mountain kingsnakes appear to be most common in relatively open stands of ponderosa pine, Jeffrey pine, Coulter pine, and/or black oak at elevations between 4,500 and 6,500 feet (McGurty 1988). They occur at higher elevations as well but are less common. Mountain kingsnakes also occur at lower elevations below the montane conifer belt, where they are found in riparian or mesic oak woodlands characterized by sycamore, cottonwood, and coast live oak. This is the type of habitat where mountain kingsnakes are primarily found in the Santa Ana and Santa Ynez mountains (McGurty 1988; Fisher and Case 1997). Well-illuminated canyons with rocky outcrops in association with bigcone Douglas-fir are also good habitat.

Partially shaded rock outcrops appear to be an important microhabitat element for refugia and basking sites (McGurty 1988). Large downed logs also may be important (Holland and Goodman 1998).

Conservation Considerations: The biggest threat to mountain kingsnakes is poaching by collectors and the destruction of microhabitat caused by this activity (e.g., dismantling rock outcrops and shredding down logs) (Jennings and Hayes 1994). There is a significant illegal commercial trade in this attractive snake that creates a demand for poaching. McGurty (1988) documents a decline in the abundance of mountain kingsnakes on Laguna Mountain in San Diego County that he attributes to illegal collecting.

Mountain garter snake *(Thamnophis elegans elegans)*

Status and Distribution: The mountain garter snake is a taxon of local concern because it occurs only in the San Bernardino Mountains (Fitch 1983). It is found at elevations above 4,900 feet (Fisher and Case 1997b). Information is scarce on the status of this subspecies; we found no locality information for it.

Habitat: Although not as aquatic in habit as the two-striped garter snake, the mountain garter snake is typically found in the vicinity of permanent or semi-permanent sources of water in a variety of habitats (Zeiner et al. 1988).

Conservation Considerations: More information is needed on the distribution and abundance of this snake in the San Bernardino Mountains. The most mesic portion of this range is also where private land is concentrated (i.e., Crestline to Lake Arrowhead), so it is possible that the mountain garter snake is poorly represented on public lands.

Montane Conifer Birds

Sharp-shinned hawk *(Accipiter striatus)*

Status and Distribution: The sharp-shinned hawk is a California Species of Special Concern. It occurs regularly in winter and as a migrant throughout the assessment area, but nesting has been recorded only in the northern Santa Lucia, San Gabriel, San Bernardino, and San Jacinto mountains. It is not known if nesting occurs regularly in these mountains, although summer siting records in the San Bernardino and San Jacinto mountains are common enough to suggest it does (Garrett and Dunn 1981). Reported historic nesting localities include Icehouse Canyon in the San Gabriel Mountains and Lake Arrowhead and Big Bear Valley in the San Bernardino Mountains (Garrett and Dunn 1981).

Habitat: Sharp-shinned hawks nest in coniferous forests often within riparian areas or on north-facing slopes. Nest stands are typically dense patches of small-diameter trees which are cool, moist, well shaded, with little ground cover, and near water (Zeiner et al. 1990). These stands are often in close proximity to open areas.

Conservation Considerations: More information is needed on where sharp-shinned hawks nest, particularly in the San Bernardino and San Jacinto mountains. The breeding population in the southern California mountains is likely small and could easily be extirpated by cumulative disturbances near nesting sites. Large stand-replacing fires are a significant threat, but this hawk's preference for early-seral forest stands indicates it would probably benefit from small-scale disturbances that spur regeneration.

Northern goshawk *(Accipiter gentilis)*

Status and Distribution: The northern goshawk is a Forest Service Region 5 Sensitive Species and a California Species of Special Concern. Rare in southern California, goshawks have been observed during the breeding season only on Mount Abel, Mount Pinos, and in the San Bernardino and San Jacinto mountains (fig. 4.26) (Garrett and Dunn 1981; Lentz 1993). A pair with two young were observed in the vicinity of Mount Abel in June 1989 and an adult and one immature bird were observed at Mount Pinos in July 1991 (Lentz 1993). Mid-summer localities in the San Jacinto Mountains include Tahquitz Valley, Willow Creek, Skunk Cabbage, Humber Park, and Lake Fulmor (Garrett and Dunn 1981). Breeding has not been documented in the San Bernardino Mountains, although goshawks have been observed near Big Bear Lake, Arrowbear (Garrett and Dunn 1981), and on Fish Creek.

Habitat: Goshawks can occur in a variety of coniferous forest communities, including ponderosa and Jeffrey pine, mixed conifer, white fir, and lodgepole pine. Nest stands are typically composed of large, densely spaced trees, with higher canopy closure and more open understories than the surrounding landscape (Woodbridge and Detrich 1994). When foraging, goshawks are forest generalists, using a variety of forest types, structural conditions, and successional stages (Reynolds et al. 1992).

Large snags and downed logs are believed to be important habitat elements because they

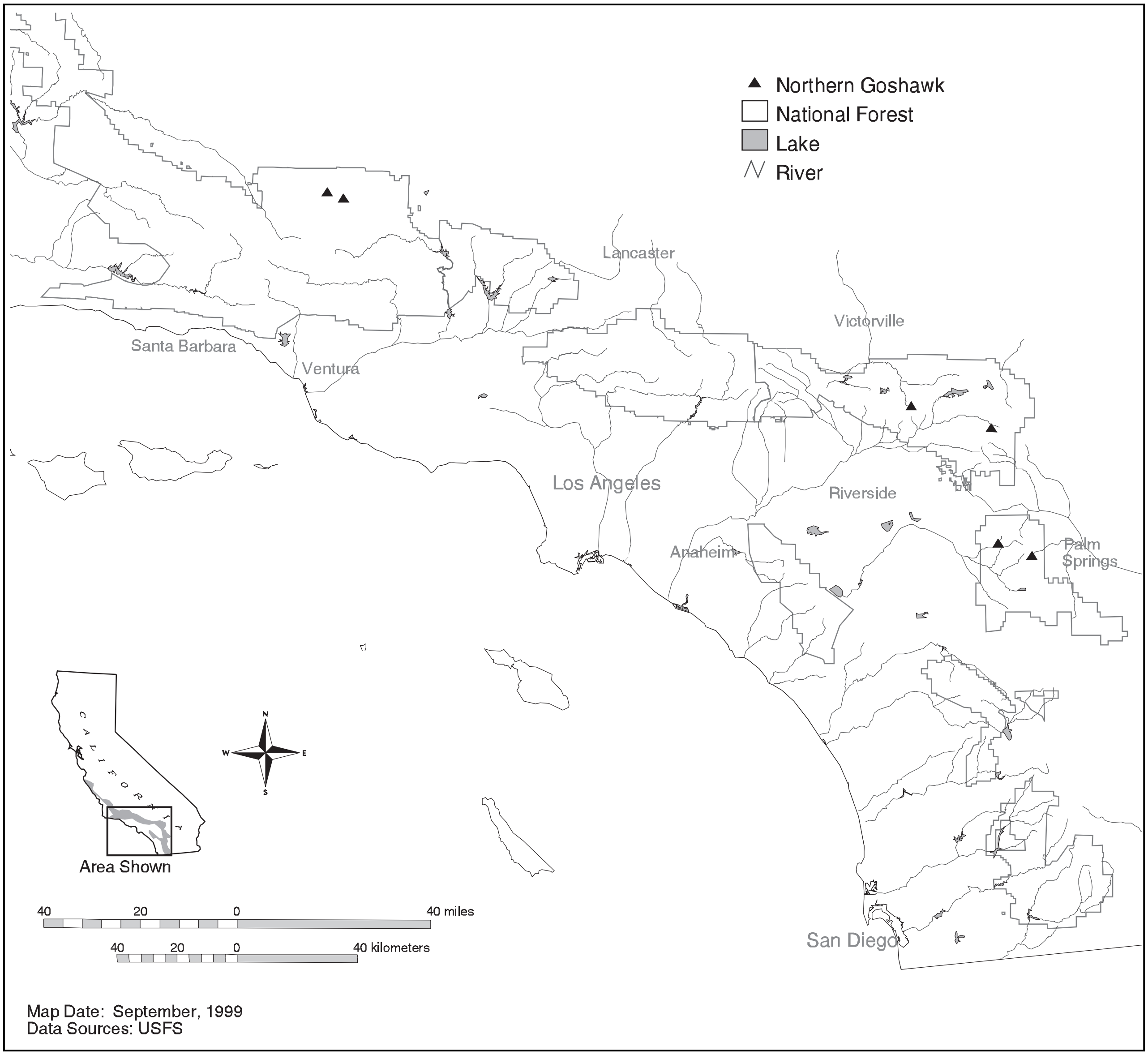


Figure 4.26. Documented locations of northern goshawk in the assessment area.

increase the abundance of small- to medium-sized birds and mammals that goshawks eat (Reynolds et al. 1992). Goshawks have large area requirements; in the southern Cascade Mountains of northern California, goshawk territories were spaced at intervals of one per 1,500 to 2,400 acres of conifer forest habitat (Woodbridge and Detrich 1994).

Conservation Considerations: More information is needed on where goshawks nest in the southern California mountains. The breeding population is clearly small, probably fewer than thirty pairs, and could easily be extirpated by impacts to nesting sites. Efforts to maintain the integrity of these sites cannot be made until we know where they are. Protection of mature conifer forest habitats from stand-replacing fire will be important to maintaining goshawks in this region.

Mount Pinos blue grouse *(Dendragapus obscurus)*

Status and Distribution: The Mount Pinos blue grouse is a species of local concern because of its extremely localized distribution that lies entirely within the assessment area. It is known only from areas above 6,500 feet in the Mount Pinos/Mount Abel area, with the exception of one outlying record of grouse chicks from Big Pine Mountain in the 1930s (Lentz 1993). Dicky and van Rossem (1923) described the grouse of the southern Sierra

Nevada and Mount Pinos as a distinct subspecies, *D. o. howardi,* citing eight specimens from the area.

It is unclear if blue grouse still occur in this region. Lentz (1993) describes several unconfirmed sightings near Sawmill Mountain (just west of Mount Pinos) in the early 1990s, but she says the last verified records are from 1976 and 1979. If they do still occur in the area, the population appears to be very small.

Habitat: Blue grouse inhabit high-elevation coniferous forests and especially favor dense stands of firs on north-facing slopes (Garrett and Dunn 1981).

Conservation Considerations: Surveys are needed to determine if blue grouse still occur in the Mount Pinos/Mount Abel area. The persistence of grouse in this area is probably most threatened by the limited amount of suitable habitat and the stochastic problems faced by small, isolated populations. Land use activities do not appear to be a threat. Most of the area is within the Chumash Wilderness Area and the type of dispersed recreational activity occurring there should not appreciably impact the grouse population.

Flammulated owl *(Otus flammeolus)*

Status and Distribution: The flammulated owl is a species of local concern because its breeding distribution in southern California is patchy and restricted to montane forests within the assessment area. It nests at elevations between 5,500 and 8,200 feet primarily in the San Gabriel, San Bernardino, and San Jacinto mountains (fig. 4.27) (Winter 1974; Garrett and Dunn 1981). A few nest in the Mount Pinos area and possibly on Big Pine Mountain (Lentz 1993). They also occur down to 4,000 feet in the northern Santa Lucia Range. In the San Diego ranges, flammulated owls are occasionally observed in summer in the Palomar, Cuyamaca, or Laguna mountains, but nesting has not been documented (Unitt 1984; SDNHM 1998).

Recent surveys have detected fifteen to twenty-five flammulated owl locations in the San Bernardino Mountains and five to ten locations in the San Jacinto Mountains (R. McKernan, SBNHM, unpubl. data).

Habitat: Flammulated owl breeding habitat in southern California typically consists of open, mature Jeffrey or ponderosa pine forests intermixed with black oak (Garrett and Dunn 1981). The owls occur less frequently in white fir dominated stands (Zeiner et al. 1990) and probably only where at least some large pines are present (Hayward and Verner 1994). Flammulated owls are typically found in xeric mid-slope or ridgetop forests that have an open, park-like quality. They are secondary cavity nesters, and black oaks may be important sources of suitable cavities for them (Marcot and Hill 1980).

Conservation Considerations: Open, mature pine forests have declined in extent in the mountains of southern California due to historic logging practices, reduced fire frequencies, and the development associated with expanding mountain communities. The current lack of low- to moderate-intensity understory fires in montane conifer forests is causing a shift in species composition away from pines and black oak and towards white fir and incense cedar (see “Fire” section in chapter 3). The flammulated owl, perhaps more than any other species, is imperiled by this trend.

Northern saw-whet owl *(Aegolius acadicus)*

Status and Distribution: The northern saw-whet owl is a local species of concern because its breeding population in southern California is small and primarily restricted to montane conifer forests. However, it does have a fairly wide elevation range, extending from over 8,000 feet down to to almost 3,000 feet (SDNHM 1998), which may explain why it’s more widely distributed than the flammulated owl.

Saw-whet owls occur in the northern Santa Lucia Mountains and on Figueroa, Big Pine, Pine, and Pinos mountains in the southern Los Padres (Lentz 1993; Lehman 1994). They also nest in the San Gabriel, San Bernardino,

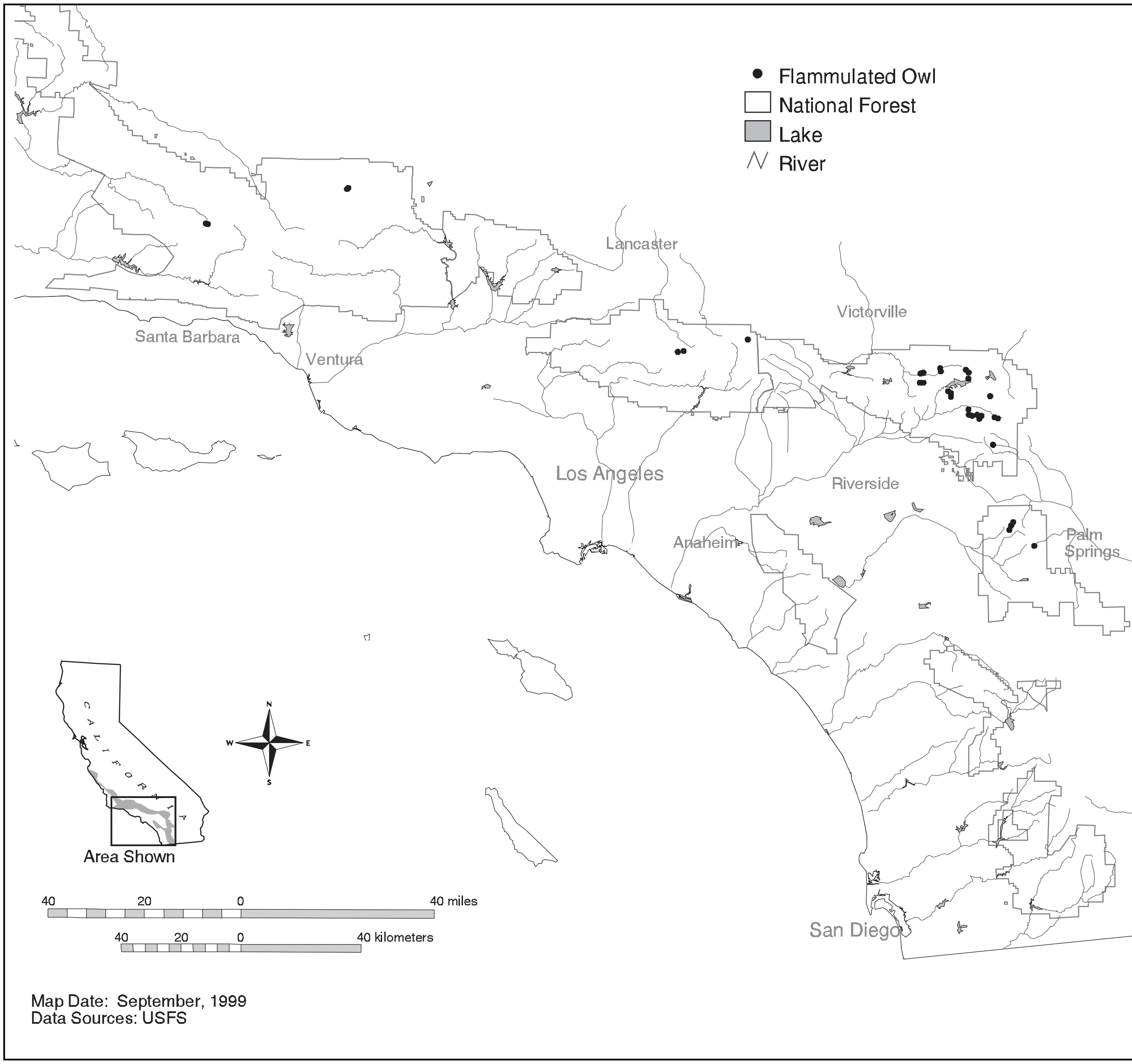


Figure 4.27. Documented locations of flammulated owls in the assessment area.

and San Jacinto mountains, and the higher mountains of San Diego County (Garrett and Dunn 1981; Unitt 1984).

Habitat: Saw-whet owls most commonly breed in dense pine and fir forests that have an oak understory (Garrett and Dunn 1981; Lehman 1994).

Conservation Considerations: Stand-replacing wildfire in dense montane conifer forests is probably the biggest threat to saw-whet owls.

Williamson's sapsucker *(Sphyrapicus thyroideus)*

Status and Distribution: The Williamson's sapsucker is a local species of concern because its breeding population in southern California is small, highly disjunct, and restricted to high elevation forests. On the Los Padres National Forest, Williamson's sapsuckers nest in small numbers on Mount Pinos and Mount Abel, and possibly on Pine Mountain (Lentz 1993). They also breed in the San Gabriel, San Bernardino, and San Jacinto mountains. The greatest concentration of breeding birds is in the San Bernardino Mountains on the north-facing slopes behind Big Bear Lake and in the vicinity of Mount San Gorgonio (Garrett and Dunn 1981). Williamson's sapsuckers are more widely distributed in montane conifer forests during the winter. There is no local information on population trends for this species.

Habitat: Williamson's sapsuckers breed at high elevations in coniferous forests dominated by white fir or lodgepole pine (Garrett and Dunn 1981). In the southern California mountains, they are typically found on north-facing slopes.

Conservation Considerations: Breeding habitat for Williamson's sapsuckers is probably most threatened by the risk of large, stand-replacing fire. Habitat in each occupied mountain range is very limited in extent and vulnerable to loss in a single, large fire event.

White-headed woodpecker *(Picoides albolarvatus gravirostris)*

Status and Distribution: The white-headed woodpecker is a local species of concern because its breeding population in southern California is small and restricted to montane conifer forests. Southern California populations of this species are also considered to be a distinct, endemic subspecies (Kratter 1992). The white-headed woodpecker occurs in all of the mountain ranges that contain montane conifer forests. There is no local information on population trends for this species.

Habitat: White-headed woodpeckers are found in mixed conifer forests dominated by large-coned pines such as Coulter, sugar, Jeffrey and ponderosa; they range only marginally into associations dominated by white fir or lodgepole pine (Garrett and Dunn 1981).

Conservation Considerations: Similar to those described for the flammulated owl. White-headed woodpeckers are closely associated with mature pine trees, which appear to be declining in many areas of southern California's mountains.

Hermit thrush *(Catharus guttatus)*

Status and Distribution: The hermit thrush is a local species of concern because its breeding population in southern California is small, disjunct, and primarily restricted to high-elevation conifer forests. It does nest at relatively low elevations in the northern Santa Lucia Mountains, but elsewhere breeds mainly above 6,000 feet. Small breeding populations exist in the higher mountains of the southern Los Padres. The thrush is most numerous in the San Gabriel and San Bernardino mountains but also probably breeds in the San Jacinto Mountains (Garrett and Dunn 1981). In San Diego County there are only four breeding-season records, one each on Palomar, Hot Springs, Volcan, and Cuyamaca mountains (SDNHM 1998). It is considerably more widespread in winter.

Habitat: Hermit thrushes in southern California breed primarily in forests dominated by white fir. They are usually found on steep, north-facing slopes (Garrett and Dunn 1981).

Conservation Considerations: Stand-replacing wildfire in dense montane conifer forests is probably the biggest threat to hermit thrushes. Otherwise, the densification of forest stands caused by the exclusion of low- to moderate-intensity fires is probably increasing the amount of suitable habitat for this species.

Virginia's warbler *(Vermivora virginiae)*

Status and Distribution: The Virginia's warbler is a California Species of Special Concern and an extremely rare breeder in southern California. Within the assessment area, breeding has been documented only in the San Gabriel and San Bernardino mountains. The warbler has been observed in the summer in the Blue Ridge area on the northeastern end of the San Gabriel Mountains (D. Cooper, UC Riverside, in litt.), and at 6,900 feet along Arrastre Creek and at 6,000 feet along the South Fork of the Santa Ana River in the San Bernardino Mountains (Johnson and Garrett 1974).

Habitat: In the breeding season Virginia's warblers occupy brushy areas (e.g., mountain mahogany, manzanita, and serviceberry) within arid coniferous forest (Garrett and Dunn 1981).

Conservation Considerations: More information is needed on the breeding distribution of this species in the assessment area. However, the habitats occupied by Virginia's warblers are not highly vulnerable to existing land use activities.

Montane Conifer Mammals

Long-eared myotis bat *(Myotis evotis)*

Status and Distribution: The long-eared myotis was a C2 candidate species for federal listing before that designation was discontinued. Its distribution in southern California appears to be restricted to high-elevation habitats. This bat was found in the assessment area at fifteen of seventy-six sites surveyed for bats from 1996 to 1998 (Simons et al. in prep.). Localities include Indian Creek (at Bluff Camp) and Pine Springs (north of Cuddy Valley) on the Los Padres National Forest; Dorr Canyon Spring, Islip Saddle, and Big Rock Campground on the Angeles National Forest; Arrastre Creek, Holcomb Valley, Alpine Canyon, and Coon Creek on the San Bernardino National Forest; and the Laguna and Cuyamaca mountains within the Cleveland National Forest and adjoining Cuyamaca Rancho State Park. Long-eared myotis bats were found only at elevations above 4,000 feet and most were in conifer forests.

Habitat: Long-eared myotis bats can occur in a variety of habitats, but are usually associated with coniferous forests. They roost under exfoliating tree bark, in tree hollows, caves, mines, cliff crevices, and rocky outcrops (Vonhof and Barclay 1996). They also sometimes roost in buildings and under bridges.

Conservation Considerations: Protection of conifer forest habitats from stand-replacing fire will be important to maintaining long-eared myotis populations in the southern California mountains. The ability of this species to roost in a wide variety of sites may help reduce its vulnerability to human activities.

Fringed myotis bat *(Myotis thysanodes)*

Status and Distribution: The fringed myotis was a C2 candidate species for federal listing before that designation was discontinued. Its distribution in southern California appears to be restricted to high-elevation habitats. This bat was found in the assessment area at ten of seventy-six sites surveyed for bats from 1996 to 1998 (Simons et al. in prep.). Localities include Frazier Mountain and Pine Springs (north of Cuddy Valley) on the Los Padres National Forest, Buckhorn and Big Rock campgrounds on the Angeles National Forest, Arrastre Creek on the San Bernardino National Forest and Laguna Mountain on the Cleveland National Forest. Fringed myotis bats were found only at elevations above 4,600 feet, primarily in montane conifer forests but also in pinyon-juniper woodland.

Habitat: Fringed myotis bats reportedly occur in a wide variety of habitats but are most commonly found in dry pine or mixed conifer forests and in pinyon-juniper woodlands. Caves, buildings, mine shafts, rock crevices in cliff faces, trees, and bridges are used for maternity and night roosts, while hibernation has only been documented in buildings and mines (Bradley and Ports 1998). On Laguna Mountain, these bats were observed roosting in cliff crevices along the eastern escarpment (Miner and Brown 1996).

Conservation Considerations: Same as those described for the long-eared myotis, with the addition that abandoned mines may provide important hibernacula for this species and efforts are needed to identify mines that are used and protect them from human disturbance.

Long-legged myotis *(Myotis volans)*

Status and Distribution: The long-legged myotis was a former C2 candidate species for federal listing before that designation was discontinued. Its distribution in southern California appears to be restricted to high-elevation habitats. This bat was found in the assessment area at twelve of seventy-six sites surveyed for bats from 1996 to 1998 (Simons et al. in prep.). Localities include Frazier Mountain and Chief Peak (just north of Ojai) on the Los Padres National Forest; Dorr Canyon Spring and Buckhorn and Big Rock campgrounds on the Angeles National Forest;

Big Bear Lake Dam and Holcomb, Deep, and Arrastre creeks on the San Bernardino National Forest; and Laguna Mountain and Lost Valley (north of Hot Springs Mountain) on the Cleveland National Forest. All but one of the locations where long-legged myotis bats were found were at elevations above 4,500 feet.

Habitat: The long-legged myotis is primarily a bat of coniferous forests but also occurs seasonally in riparian and desert habitats. It uses abandoned buildings, cliff crevices, exfoliating tree bark, and hollows within snags as summer day roosts; caves and mine tunnels as hibernicula (Bogan et al. 1998c).

Conservation Considerations: Same as those described for the fringed myotis.

Golden-mantled ground squirrel *(Spermophilus lateralis)*

Status and Distribution: The golden-mantled ground squirrel is a local species of concern because in southern California it is found only in the San Bernardino Mountains. The population in these mountains is considered to be a distinct subspecies, *S. l. bernardinus* (Bartels and Thompson 1993). It ranges in elevation from approximately 6,000 feet to over 10,000 feet (Williams 1986).

Habitat: Golden-mantled ground squirrels inhabit a wide variety of montane habitats from the upper edge of the pinyon belt to above timberline. They are most common in open, well-illuminated forests with a mix of tall trees, brush, and open ground supporting herbaceous plants (Williams 1986; Bartels and Thompson 1993).

Conservation Considerations: This species does not appear to be sensitive to land use activities; it is typically common around campgrounds and buildings and invades logged timber stands (Bartels and Thompson 1993). It could be negatively affected by the trend toward increasingly dense forests, but the golden-mantled ground squirrel population in the San Bernardino Mountains seems to be large and well distributed in a variety of plant communities.

San Bernardino flying squirrel *(Glaucomys sabrinus californicus)*

Status and Distribution: The San Bernardino flying squirrel is a Forest Service Region 5 Sensitive Species and a California Species of Special Concern. It occurs in the San Bernardino Mountains and, at least historically, in the San Jacinto Mountains. Williams (1986) lists its elevation range as between 5,200 and 8,500 feet. Flying squirrels are preyed upon by spotted owls, and the best information we have on the distribution of this squirrel comes from an analysis of spotted owl pellets which were collected throughout the San Bernardino Mountains (fig. 4.28) (W. LaHaye, unpubl. data). These data suggest that flying squirrels are widespread within the general elevational range reported by Williams.

Grinnell and Swarth (1913) captured a single flying squirrel near Idyllwild in the San Jacinto Mountains, and there reportedly are several other old museum specimens from this range (Williams 1986). However, there have been no recent sightings. Analysis of a substantial number of owl pellets from the San Jacinto Mountains did not turn up any flying squirrel remains (W. LaHaye, unpubl. data). Williams (1986) suggested that flying squirrels were probably present in the San Gabriel Mountains as well, but there is no documented evidence to support that contention.

Habitat: The San Bernardino flying squirrel is known from mid- to upper-elevation coniferous forest habitats. Distributional information from spotted owl pellets indicates that flying squirrels do not inhabit lower montane bigcone Douglas-fir/canyon live oak forests. Flying squirrels use cavities in large trees, snags, and logs for cover. Habitats are typically mature, dense conifer forest, particularly those containing white fir, in close proximity to riparian areas (Zeiner et al. 1990b).

Conservation Considerations: The apparent disappearance of flying squirrels from the San Jacinto Mountains and their limited distribution in upper elevation forests give rise to concerns about their vulnerability in the San Bernardino Mountains. They appear to

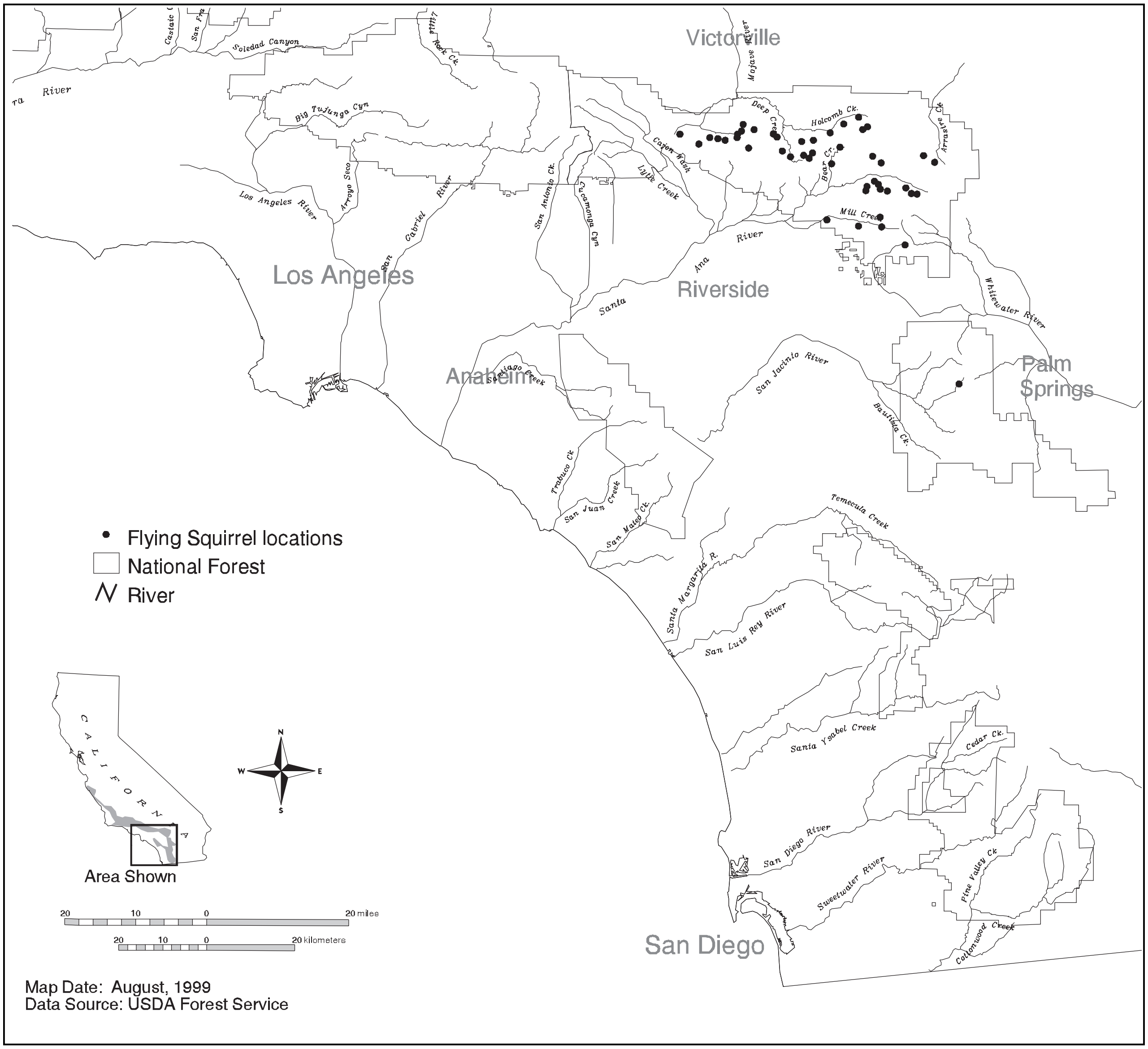


Figure 4.28. The distribution of flying squirrels in the San Bernardino Mountains, based primarily on their occurrence in spotted owl pellets.

still be widespread in the San Bernardino Mountains, but essentially nothing is known about their population dynamics or threat factors. Flying squirrels are often observed using bird feeders around low-density developments in heavily forested areas such as organizational camps and cabins, but it is unclear if they successfully inhabit higher-density residential areas.

An important question is how adept are flying squirrels at dispersing through areas of unsuitable habitat to maintain populations in suitable, but fragmented, areas. They have evolved with a naturally fragmented habitat pattern in the San Bernardino Mountains, but it is unclear what effect, if any, increasing developments on private lands and habitat modifications on public lands (e.g., ski area developments) are having on the squirrel's distribution. This species may respond positively to increases in white fir density resulting from recent fire exclusion, but large stand-replacing fires have the potential to dangerously reduce suitable habitat and isolate populations. Surveys are needed in the San Jacinto Mountains to more conclusively determine its status there.

San Bernardino white-eared pocket mouse *(Perognathus alticolus alticolus)*

Status and Distribution: The San Bernardino white-eared pocket mouse is a Forest Service Region 5 Sensitive Species and a California Species of Special Concern. Known localities of this species are all from the vicinity of Strawberry Peak and Little Bear Valley in the western San Bernardino Mountains at elevations between 5,400 and 5,800 feet (Williams 1986; Best 1994). These are old museum collections; the white-eared pocket mouse has not been collected since 1934 despite extensive surveys to relocate it in the late 1970s and early 1980s (Sulentich 1983; Williams 1986).

Habitat: Little is known, but historic white-eared pocket mouse localities were in open pine forests that contained bracken fern (Best 1994). Williams (1986) suggests that white-eared pocket mice may occur in sagebrush, pinyon-juniper woodlands, and open pine forests on the north side of the San Bernardino and possibly the San Gabriel mountains.

Conservation Considerations: Surveys are needed to determine the current status and distribution of this species within the assessment area. This taxon is endemic to the San Bernardino Mountains, yet there are no recent observations of it.

Porcupine *(Erethizon dorsatum)*

Status and Distribution: The porcupine is a species of local concern because it is rare in southern California and most known locations are within the assessment area. The distribution of porcupines in the assessment area is somewhat of a mystery. Range maps in Zeiner et al. (1990b) suggest they inhabit the northern and southern Santa Lucia Ranges, the southern Los Padres ranges, and the San Gabriel and San Bernardino mountains. However, maps in Ingels (1965) and Dodge (1982) suggest they are only in the San Bernardino and possibly the San Gabriel mountains.

Documented sightings of porcupines in these mountains are very rare. Vaughan's (1954) thorough report on mammalian fauna in the San Gabriel Mountains makes no mention of this species. Glenn Stewart (Cal Poly Pomona, in litt.) saw a road kill porcupine in the San Bernardino Mountains in the 1960s. There are also thirdhand reports of a road kill being found in the San Gabriel Mountains. In 1989, one of the authors (J. Stephenson) observed lodgepole pines stripped of bark, in a fashion that is often indicative of porcupine's presence (Dodge 1982), in the upper end of Balky Horse Canyon in the eastern San Bernardino Mountains.

Habitat: In California, porcupines are primarily found in coniferous forests, but across western North America they occur in a wide variety of habitats including pinyon-juniper woodlands, sagebrush, and desert chaparral (Dodge 1982; Zeiner et al. 1990b). Porcupines feed extensively on the cambium and foliage of woody shrubs and small trees in winter and on forbs, grasses, and succulent riparian vegetation in spring and summer (Dodge 1982).

Conservation Considerations: Surveys are needed to determine the current status and distribution of this species within the assessment area.

Animals of Montane Meadow Habitats

Five animals that are primarily associated with montane meadow habitats received individual consideration in this assessment (table 4.19). Two of these are butterflies and three are birds.

Laguna Mountains skipper *(Pyrgus ruralis lagunae)*

Status and Distribution: The Laguna Mountains skipper was federally listed as endangered in 1997. This butterfly is known only from Laguna and Palomar mountains in San Diego County (fig. 4.29). On Palomar Mountain, it is known to occur in Mendenhall Valley, lower French Valley, and in the vicinity of Observatory Campground. On Laguna Mountain, it occurs near the Laguna-El Prado Campground (Levy 1996). Survey information collected to date indicates that the

Table 4.19. Animals associated with montane meadows that received individual consideration. Displayed for each species: (1) the level of knowledge about where it occurs in southern California and, in parentheses, the estimated percentage of locations that are on national forest system lands; (2) the mountain subareas occupied (y = occurs in breeding season, h = historically occurred, p = potentially occurs, t = transient, w = winter visitor)—if the species is localized and data are available, the approximate number of occurrences may be displayed; (3) the vulnerability of populations on national forest system lands to existing threat factors; (4) population trends; and (5) the assigned conservation category.

Montane Meadow Animals of Concern *federal status*	(1) Knowledge of SoCal Locations (% on NFs)	(2) areas occupied or estimated # of occurrences if spp. localized: Cleveland NF		San Bern. NF		Angeles NF		Los Padres NF			(3) Vulner-ability on NFs	(4) Pop. Trend	(5) Conser-vation Category
		San Diego Rngs	Snta Ana Mts	San Jac Mts	San Bern Mts	San Gab Mts	Cas-taic Rngs	So. LP Rngs	So. SL Rng	No. SL Rng			
Invertebrates													
Laguna Mts. skipper *endangered*	High (40-70%)	y									**High**	Decl[1]	Site specific
San Gabriel greenish blue butterfly	Mod (> 90%)					y					**High**	Decl[2]	Site specific
Birds													
Calliope hummingbird	Mod (> 50%)	p		y	y	y	p	y		p	Mod	Unkn	Landscape level
Macgillivray's warbler	Low (> 50%)	t	t	p	y	y	t	p	t	p	Mod	Unkn	Landscape level
Lincoln's sparrow	Mod-Low (> 50%)	w		y	y	y	w	y	w	w	Mod	Unkn	Landscape level

[1] U.S. Fish and Wildlife Service (1997d)
[2] Murphy (1990)

population in Mendenhall Valley is substantially larger than the others and may support several hundred individuals (Levy 1996; R. Mattoni, in litt., 1998). Laguna Mountain, Observatory Campground, and a portion of Mendenhall Valley are within the Cleveland National Forest. The occupied portion of lower French Valley is within Palomar Mountain State Park.

Habitat: The Laguna Mountains skipper is found in montane meadows where its larval host plant, Cleveland's horkelia *(Horkelia clevelandii)*, occurs. This horkelia, and the butterfly, are typically found in edaphic or topographic situations that provide patches of bare ground or at least reduced grass cover (e.g., areas with shallow rocky soils or the drier upper margins of meadows). They appear to be absent from areas that have dense, tall grass cover (Levy 1996). Adult Laguna Mountains skippers have been frequently observed visiting the flowers of a small annual composite, *Pentachaeta aurea.* This plant may be an important nectar resource (Levy 1996).

Conservation Considerations: This butterfly occurs in very small numbers at only a handful of sites. There is great concern about the viability of remaining populations and much uncertainty over how to manage them. Land use activities occurring in or near areas occupied by the skipper include cattle grazing and developed recreation sites. Actions are currently being taken by the Cleveland National Forest to exclude recreational activity in the vicinity of potential skipper habitat. Fences have also been erected to exclude grazing in some patches of Cleveland's horkelia in Mendenhall Valley.

The effect of cattle grazing on the host plant and the butterfly needs further investigation. In some respects grazing appears to be clearly detrimental, since cattle have been observed foraging on horkelia plants and trampling flowering stalks. However, one theory attributes the skipper's decline to reductions in the extent of horkelia (and bare ground which may be important for skipper thermoregulation) because of increased grass

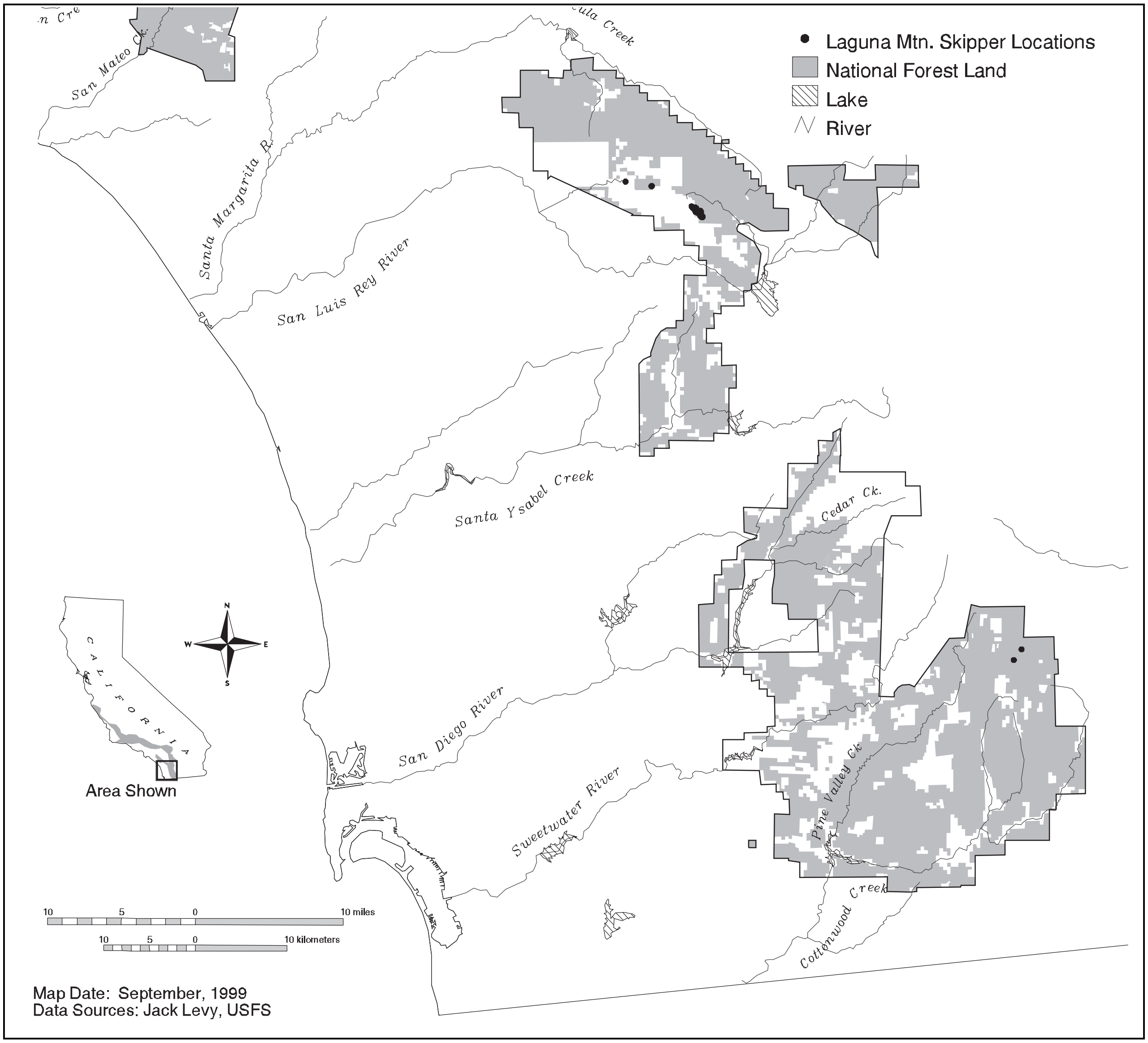


Figure 4.29. Documented localities for the Laguna Mountains skipper.

cover caused by reduced fire frequencies and the spread of non-native grasses (Levy 1996). If this is true, grazing may serve an important function as a surrogate for fire—a useful mechanism to keep grass cover in check. Further research is needed to clarify this situation. Also, additional surveys are needed, particularly on Laguna Mountain, to determine if additional skipper populations are present.

San Gabriel Mountains greenish blue *(Plejebus saepiolus aureolus)*

Status and Distribution: The San Gabriel Mountains greenish blue butterfly is a former C2 candidate species. Murphy (1990) stated it was "arguably the prime conservation emergency among the butterfly taxa of California." It has been collected by several lepidopterists in a single wet meadow on the Angeles National Forest in the immediate vicinity of Big Pines. It is considered to be a distinctive subspecies, well differentiated from *P. s. saepiolus* which occurs in the Sierra Nevada and *P. s. hilda* which occurs in wet meadows above 5,000 feet on Palomar Mountain and in the San Jacinto and San Bernardino mountains (Murphy 1990). This new greenish blue butterfly has not recently been observed at the meadow near Big Pines and is feared to be extirpated.

Habitat: The San Gabriel Mountains greenish blue butterfly is associated with a clover, *Trifolium wormskioldii,* that grows in moist to marshy meadow situations (G. Pratt, UC Riverside, pers. comm., 1999).

Conservation Considerations: Diversion of water from the meadow at Big Pines, and subsequent drying of the habitat, has been implicated in the possible extirpation of this undescribed subspecies (Murphy 1990). Surveys are needed to determine if the taxon still occurs in this meadow or at other potential localities. This situation underscores the importance of maintaining adequate surface and ground water supplies to meadows and other wet microhabitats.

Calliope hummingbird *(Stellula calliope)*

Status and Distribution: The calliope hummingbird is a species of local concern because it is a rare breeder in the southern California mountains. Reported localities on the Los Padres National Forest include the Mount Pinos/Mount Abel area (i.e., around Iris Meadow, Sheep Camp Meadow, and along the McGill trail), Big Pine Mountain (Chokecherry Spring), Frazier Mountain, and Reyes Peak (Garrett and Dunn 1981; Lentz 1993). Calliope hummingbirds are described as rare on the north side of the San Gabriel and San Bernardino mountains (Garrett and Dunn 1981). In the San Jacinto Mountains they are historically known from Round and Tahquitz valleys (Grinnell and Swarth 1913). Calliopes also potentially breed on San Diego County's tallest peak, Hot Springs Mountain (Unitt 1981).

Mist-net and point-count surveys done from 1992 to 1996 at Bluff Lake and Metcalf meadows in the San Bernardino Mountains found calliope hummingbirds present in low numbers at both sites; mist-net results were similar at each meadow, with approximately six captures per year at Metcalf Meadow and five per year at Bluff Lake (Rotenberry and Carlson 1997). Another reported locality in the San Bernardino Mountains is upper Arrastre Creek (D. Freeman, unpubl. notes).

Habitat: Calliope hummingbirds breed along meadow borders and in streamside thickets (especially willows) within arid mixed conifer forests (Garrett and Dunn 1981). Lentz (1993) found them in association with currants (especially *Ribes cereum*) on Mount Pinos.

Conservation Considerations: Maintenance of riparian vegetation in and around montane meadows is important for this species. Heavy recreation use, facilities development, and overgrazing by livestock can degrade montane riparian habitat condition. Surface water diversions and/or groundwater extraction can reduce or eliminate these habitats. More information is needed on the current distribution of this species, particularly in relation to ongoing land use activities in montane riparian and meadow habitats.

MacGillivray's warbler *(Oporornis tolmiei)*

Status and Distribution: The MacGillivray's warbler is a species of local concern because it is a rare breeder in the southern California mountains. It is most common in the San Gabriel and San Bernardino mountains and may only breed in those two ranges (Garrett and Dunn 1981). In the southern Los Padres, Lentz (1993) reports summer observations of MacGillivray's warbler on Big Pine Mountain, upper Quatal Canyon, at Thorn Meadows near Pine Mountain, and at Iris Meadow on Mount Pinos. However, breeding was not confirmed.

Mist-net and point-count surveys done from 1992 to 1996 at Bluff Lake and Metcalf meadows in the San Bernardino Mountains found MacGillivray's warblers present in low numbers at both sites. Mist-net results indicate they were considerably more common at Metcalf Meadow where a high of twenty captures was reached in 1993. The high for Bluff Lake was five in 1994 (Rotenberry and Carlson 1997).

Habitat: MacGillivray's warblers occur in willow thickets and other brushy, montane riparian areas within coniferous forests above 6,000 feet elevation (Garrett and Dunn 1981).

Conservation Considerations: Same as those described for the Calliope hummingbird.

Lincoln's sparrow *(Melospiza lincolnii)*

Status and Distribution: The Lincoln's sparrow is a species of local concern because it is a rare breeder in the southern California mountains. Historic nesting localities include Mount Pinos (Iris Meadow), the San Gabriel Mountains (Big Pines), the San Bernardino Mountains (vicinity of Big Bear Lake, Green Valley, and South Fork of the Santa Ana River), and the San Jacinto Mountains (Tahquitz and Round valleys) (Grinnell and Swarth 1913; Garrett and Dunn 1981; Lentz 1993).

Mist-net and point-count surveys done from 1992 to 1996 at Bluff Lake and Metcalf meadows in the San Bernardino Mountains found Lincoln sparrows to be common at both sites. Twenty to fifty of these sparrows were captured per year in each meadow during constant-effort mist netting (Rotenberry and Carlson 1997).

Habitat: Lincoln's sparrows breed in wet montane meadows; typical vegetation components include corn lily, sedges, and low willows (Garrett and Dunn 1981).

Conservation Considerations: Same as those described for the Calliope hummingbird.

Animals of Subalpine or Alpine Habitats

Two animal species that are primarily associated with subalpine or alpine habitats were considered individually in this assessment (table 4.20).

American (water) pipit *(Anthus spinoletta)*

Status and Distribution: The American water pipit is a local species of concern because it breeds in alpine habitats and is known from only one location in the southern California mountains. A pair of water pipits was present, and probably nested, on Mount San Gorgonio in the summer of 1978 (Garrett and Dunn 1981).

Habitat: Water pipits nest above timberline. They commonly winter in the vicinity of agricultural fields (Garrett and Dunn 1981).

Conservation Considerations: Surveys are needed to determine if water pipits breed regularly on Mount San Gorgonio or if breeding is a rare, irregular occurrence. Potential breeding habitat on Mount San Gorgonio and the highest portions of the San Gabriel Mountains should also be surveyed. All of these areas are within designated wilderness areas, but recreation activity near mountain summits could potentially impact this species.

Lodgepole chipmunk *(Tamias speciosus)*

Status and Distribution: Two subspecies of lodgepole chipmunk occur in the assessment area. The Mount Pinos lodgepole chipmunk, *T. s. callipeplus,* occurs only in the forests around Mount Pinos and Mount Abel (Williams 1986). It is a Forest Service Region

Table 4.20. Animals associated with subalpine or alpine habitats that received individual consideration. Displayed for each species: (1) the level of knowledge about where it occurs in southern California and, in parentheses, the estimated percentage of locations that are on national forest system lands; (2) the mountain subareas occupied (y = occurs in breeding season, h = historically occurred, p = potentially occurs, t = transient, w = winter visitor)—if the species is localized and data are available, the approximate number of occurrences may be displayed; (3) the vulnerability of populations on national forest system lands to existing threat factors; (4) population trends; and (5) the assigned conservation category.

Subalpine or Alpine Animals of Concern	(1) Knowledge of SoCal Locations (% on NFs)	(2) areas occupied or estimated # of occurrences if spp. localized									(3) Vulner-ability on NFs	(4) Pop. Trend	(5) Conser-vation Category
		Cleveland NF		San Bern. NF		Angeles NF		Los Padres NF					
		San Diego Rngs	Snta Ana Mts	San Jac Mts	San Bern Mts	San Gab Mts	Cas-taic Rngs	So. LP Rngs	So. SL Rng	No. SL Rng			
American (water) pipit	Low (100%)	t	t	p	y	p	t	t	t	t	Mod	Unkn	Site specific
Lodgepole chipmunk	Mod (> 70%)			y	y	y		y*			Low	Unkn	Landscape level

* A distinct subspecies, the Mount Pinos lodgepole chipmunk occurs in the southern Los Padres ranges.

5 Sensitive Species. Lodgepole chipmunks in the San Gabriel, San Bernardino, and San Jacinto mountains belong to the subspecies *T. s. speciosus* (Best et al. 1994). The elevation range of this species is from just above 6,000 feet to over 10,000 feet (Williams 1986; Zeiner et al. 1990b).

Habitat: Lodgepole chipmunks are generally found in open-canopy forests with a mix of shrubs and trees. They are common in lodgepole pine forests but also occur in open-canopy stages of other forest habitats including white fir, Jeffrey pine, and mixed conifer. They appear to avoid pure stands of conifers, preferring an understory shrub component, particularly chinquapin or manzanita (Vaughan 1954; Williams 1986; Zeiner et al. 1990b).

Conservation Considerations: The lodgepole chipmunk's high elevation habitats do not appear to be highly vulnerable to existing land use activities or agents of change. However, habitat for the Mount Pinos subspecies is extremely limited, which increases the impact of even small losses of suitable habitat in the Mount Pinos/Mount Abel area. A single, large stand-replacing fire could eliminate this subspecies.

Animals of Desert Montane Habitats

Sixteen animal species that are primarily associated with desert montane habitats were considered individually in this assessment (table 4.21). There are six invertebrates, one reptile, seven birds, and two mammals.

Desert Montane Invertebrates

Desert monkey grasshopper *(Psychomastix pysylla deserticola)*

Status and Distribution: The desert monkey grasshopper is a former C2 candidate for federal listing. It is endemic to lower desert-side slopes of the San Bernardino Mountains (J. Powell, UC Berkeley Department of Entomology, pers. comm.).

Habitat: Little information is available. It is described as occurring in arid environments, and chamise is identified as a possible food plant.

Conservation Considerations: No threats have been identified for this species. More information is needed on its distribution and habitat requirements on the desert side of the San Bernardino Mountains.

San Bernardino Mountains silk moth *(Coloradia velda)*

Status and Distribution: The silk moth *Coloradia velda* is a species of local concern because it is endemic to the San Bernardino Mountains. The type locality for this species is at Coxey Meadow on the north side of the San Bernardino Mountains, and it has also been collected at Horse Springs, Crab Flat, Cactus Flat and Barton Flats (Johnson and Walter 1979).

Habitat: *Coloradia velda* is most commonly found in stands of pinyon pine, which is suspected to be the larval host plant (Johnson and Walter 1979).

Conservation Considerations: More information is needed on the distribution and habitat requirements of this silk moth. No threat factors have currently been identified for it.

Bright blue copper *(Lycaena heteronea clara)*

Status and Distribution: The bright blue copper butterfly is a local species of concern. Murphy (1990) considered it to be a category B taxon, which he defined as one that warrants listing as endangered, but with a less pressing need than category A taxa. This butterfly historically occurred in isolated areas of the Piute and Tehachapi mountains, in the Castac Valley (near Fort Tejon), and near Silverwood Lake in the San Bernardino Mountains (Orzak 1976). However, as of 1976, it is known only from Cuddy and Lockwood valleys near Frazier Park (Murphy 1990). Orzak (1976) estimated that as many as thirty populations existed in this area, with the highest

Table 4.21. Animals associated with desert montane habitats that received individual consideration. Displayed for each species: (1) the level of knowledge about where it occurs in southern California and, in parentheses, the estimated percentage of locations that are on national forest system lands; (2) the mountain subareas occupied (y = occurs in breeding season, h = historically occurred, p = potentially occurs, t = transient, w = winter visitor)—if the species is localized and data are available, the approximate number of occurrences may be displayed; (3) the vulnerability of populations on national forest system lands to existing threat factors; (4) population trends; and (5) the assigned conservation category.

Desert Montane Animals of Concern *federal status*	(1) Knowledge of SoCal Locations (% on NFs)	(2) areas occupied or estimated # of occurrences if spp. localized: **Cleveland NF**		**San Bern. NF**		**Angeles NF**		**Los Padres NF**			(3) Vulner-ability on NFs	(4) Pop. Trend	(5) Conser-vation Category
		San Diego Rngs	Snta Ana Mts	San Jac Mts	San Bern Mts	San Gab Mts	Cas-taic Rngs	So. LP Rngs	So. SL Rng	No. SL Rng			
Invertebrates													
Desert monkey grasshopper	Low (30-70%)				y						Unkn	Unkn	Landscape level
San Bernardino Mts. silk moth	Mod (> 70%)				y						Unkn	Unkn	Landscape level
Bright blue copper butterfly	Mod (10-50%)				h/p		p	y			**High**	Unkn	Site specific
San Emigdio blue butterfly	Low (10-40%)					y	y	y			Unkn	Unkn	Site specific
Dammer's blue butterfly	Mod (> 70%)				y						Unkn	Unkn	Landscape level
Vernal blue butterfly	Mod (> 90%)				y						Unkn	Unkn	Landscape level
Reptiles													
Small-scaled lizard	Mod (< 20%)	y									Low	Unkn	Landscape level
Birds													
Zone-tailed hawk	Mod (40-60%)	y		y							Low	Unkn	Landscape level
Common nighthawk	Mod (40-70%)			p	y	y					Mod	Unkn	Site specific
Gray flycatcher	Low (> 50%)			p	y	y					Low	Unkn	Landscape level
Pinyon jay	Mod (< 20%)			y	y			p			Mod	Unkn	Landscape level
Gray vireo	Mod (40-80%)	y		y	y	y					Mod	Decl[1]	Landscape level
Plumbeus solitary vireo	Low (> 50%)				y	y					Low	Unkn	Landscape level
Hepatic tanager	Mod (> 60%)	t			y			t	t		Low	Unkn	Landscape level
Mammals													
Tehachapi pocket mouse	Mod (> 60%)					p	h/p	y			Unkn	Unkn	Landscape level
Peninsular Ranges' bighorn sheep *endangered*	High (< 5%)			y							**High**	Decl[2]	Site specific

[1] Garrett and Dunn (1981)

[2] USDI Bureau of Land Management et al. (1996)

concentration in Cuddy Valley, 2 to 5 miles west of Interstate 5.

Habitat: In the arid montane valleys around Cuddy Valley and Frazier Park, the bright blue copper occurs in sagebrush-dominated shrublands. Three different buckwheat *(Eriogonum)* species are known larval food plants: *E. heermannii, E. umbellatum munzii, and E. fasciculatum polifolium* (Orzak 1976).

Conservation Considerations: Most of the valley bottomland in Cuddy and Lockwood valleys is private land and a lot of development is occurring in this area. There is some potential habitat for this butterfly on the Los Padres National Forest. Surveys are urgently needed to see if populations of the bright blue copper occur on national forest system lands in this area. Any discovered populations should receive site-specific management attention until the status of this taxon is better determined.

San Emigdio blue butterfly
(Plebulina emigdionis)

Status and Distribution: The San Emigdio blue butterfly is a former Category 2 Candidate Species. Murphy (1990) considers it to be a category B taxon, which he defined as one that warrants listing as endangered, but with a less pressing need than category A taxa. The primary location where this species has been collected is along the Mojave River near Victorville, but isolated colonies within or near the assessment area are reported from Bouquet and Mint canyons near Castaic, in canyons along the north side of the San Gabriel Mountains near the desert's edge, and in arid areas south of Mount Abel near San Emigdio Mesa (Emmel and Emmel 1973; Murphy 1990).

Habitat: The San Emigdio blue is closely associated with the widespread saltbush, *Atriplex canescens,* in alkali sink areas (Murphy 1990). However, the butterfly's distribution is much more localized than the host plant, suggesting that other factors may determine habitat suitability. Murphy (1990) speculates that there may be an obligatory mutualistic relationship between this species and one or more ant species.

Conservation Considerations: Additional information is needed on the distribution and status of this butterfly on public lands in the assessment area. At a minimum, the known localities mentioned above need to be revisted to see if populations still exist. The best-known popuPopulation near Victorville has declined due to urbanization (Murphy 1990).

Dammer's blue butterfly
(Euphilotes enoptes dammersi)

Status and Distribution: This subspecies is newly described and known only from Baldwin Lake, Arrastre Flat, and Arrastre Creek in the San Bernardino Mountains (Pratt and Emmel 1998).

Habitat: At Baldwin Lake and Arrastre Flat, this butterfly is closely associated with spring-blooming populations of the wild buckwheat *Eriogonum kennedyi,* which commonly grows on pebble plains. On dry slopes near Arrastre Creek, a slightly different form of this subspecies is associated with spring-blooming populations of *Eriogonum davidsonii* (Pratt and Emmel 1998).

Conservation Considerations: Too little is currently known about this taxon to assess its conservation status. Gordon Pratt at UC Riverside is the authority on this butterfly.

Vernal blue butterly
(Euphilotes baueri [battoides] vernalis)

Status and Distribution: This newly described subspecies has only been found at Coxey Meadow (elevation 5,600 feet) on the north side of the San Bernardino Mountains (Pratt and Emmel 1998). It also occurs far to the north of the assessment area in the Coso Mountains near China Lake.

Habitat: The vernal blue butterfly is associated with spring-blooming populations of the wild buckwheat, *Eriogonum kennedyi.* This association is similar to that of the Dammer's blue, but it occurs in different areas and is distinctly different taxonomically (Pratt and Emmel 1998).

Conservation Considerations: More information is needed on the distribution and habitat requirements of this species within the assessment area. As yet, no threat factors have been identified for this taxon.

Desert Montane Reptiles

Small-scaled lizard *(Urosaurus microscutatus)*

Status and Distribution: The small-scaled lizard is a local species of concern because its range in the United States is restricted to the rocky mountains and foothills of eastern San Diego County (Zeiner et al. 1988). Known localities in or near the assessment area include canyons in Anza-Borrego Desert State Park that come off the east sides of Bucksnort, Hot Springs and San Ysidro mountains (i.e., Alder Canyon, South Fork of Sheep Canyon, Borrego Palm Canyon, and Hellhole Canyon), and far to the south at Jacumba, Barrett Junction, and near Barrett Dam along the Dulzura Conduit (J. Copp, CA Academy of Sciences, pers. comm.).

Habitat: The small-scaled lizard inhabits arid and semiarid environments in areas where there are rock outcrops or rocky canyons (Zeiner et al. 1988). It is most common in desert-side habitats, particularly desert canyons, but also occurs on coastal slopes in southern San Diego County in chaparral and other habitats (J. Copp, pers. comm.).

Conservation Considerations: Surveys are needed to better determine the distribution and abundance of this species on public lands within the assessment area. However, the small-scaled lizard's habitat requirements are not likely to make it particularly vulnerable to land use activities occurring on national forest system lands.

Desert Montane Birds

Zone-tailed hawk *(Buteo albonotatus)*

Status and Distribution: The zone-tailed hawk is a local species of concern because it is a rare breeder in southern California and the few known nesting localities are within the assessment area. Zone-tailed hawk nests have been documented on Hot Springs Mountain (San Diego County) in 1993 (SDNHM 1998) and on Santa Rosa Mountain (Riverside County) in 1980 (Garrett and Dunn 1981; McCaskie 1982). These locations are the extreme western extent of this species' breeding range.

Habitat: Zone-tailed hawks commonly inhabit desert mountains, particularly in northern and central Arizona.

Conservation Considerations: Additional survey work is needed to determine if zone-tailed hawks breed regularly in either the Santa Rosa Mountains or the eastern mountains of San Diego County. However, we believe their vulnerability to existing land use activities is low.

Common nighthawk *(Chordeiles minor)*

Status and Distribution: The common nighthawk is a local species of concern because it is a rare breeder in southern California and the few known nesting localities are within the assessment area. This species is found only in the eastern San Bernardino Mountains (particularly near Baldwin Lake) and on Table Mountain near Wrightwood in the San Gabriel Mountains (Garrett and Dunn 1981; D. Cooper, UC Riverside, in litt.).

Habitat: Common nighthawks forage over a variety of habitats from open coniferous forest to sagebrush plains and are frequently seen foraging over open bodies of water. Some open, gravelly substrate is required for nesting (Garrett and Dunn 1981).

Conservation Considerations: Surveys are needed to identify the specific areas where this highly localized species nests. Both of the locations where common nighthawks occur are areas that receive a high level of recreation use. More survey work is needed to determine if land use activities in these areas are affecting nighthawk nesting grounds.

Gray flycatcher *(Empidonax wrightii)*

Status and Distribution: The gray flycatcher is a local species of concern because it is a rare breeder in southern California and the few known nesting localities are within the assessment area. This species is found only in northern portions of the San Gabriel and San Bernardino mountains (Garrett and Dunn 1981). This species was not detected in surveys conducted in the early 1900s and may have expanded its breeding range into the assessment area in just the last fifty years (Johnson and Garrett 1974). Documented localities include Sheep Creek near Wrightwood and areas east of Baldwin Lake, including Arrastre Creek (Johnson and Garrett 1974).

Habitat: Gray flycatchers are closely tied to pinyon-juniper-sagebrush associations but do breed locally in other arid conifer associations (Garrett and Dunn 1981).

Conservation Considerations: More information is needed on the distribution and status of gray flycatchers in the assessment area. However, we believe their vulnerability to existing land use activities is low.

Pinyon jay *(Gymnorhinus cyanocephalus)*

Status and Distribution: The pinyon jay is a local species of concern because it is a rare and localized breeder in the assessment area. Known localities include the northeastern San Bernardino Mountains, particularly around Baldwin Lake, and Garner Valley in the San Jacinto Mountains (Garrett and Dunn 1981). Small groups have been seen around Mount Pinos but generally only in the fall and winter (Garrett and Dunn 1981). Lentz (1993) does not mention pinyon jays in her review of birds in the southern Los Padres mountain ranges.

Habitat: Pinyon jays occupy mature pinyon-juniper-yucca woodland on arid mountain slopes and open montane valleys of sagebrush and grassland with are bordered by pinyons, western junipers, or Jeffrey pines (Garrett and Dunn 1981).

Conservation Considerations: Same as those described for the gray flycatcher. However, the pinyon jay may be negatively affected by the steady increase in housing developments on private lands in some montane valleys (e.g., Baldwin Lake and Garner Valley).

Gray vireo *(Vireo vicinior)*

Status and Distribution: The gray vireo is a California Species of Special Concern. It is a summer resident in a few highly localized areas within the assessment area (fig 4.30). It occurs on dry desert-facing slopes in the San Gabriel Mountains (e.g., near Valyermo), San Bernardino Mountains (e.g., Rose Mine and Cactus Flats), and San Jacinto Mountains (e.g., Pinyon Flats) (Garrett and Dunn 1981; D. Cooper, UC Riverside, in litt.). In San Diego County, gray vireos occur in arid shrublands north of Warner Springs between Palomar and Hot Springs mountains, and on the southern flank of the Laguna Mountains from Pine Valley Creek southeast to La Posta Creek (Unitt 1984; SDNHM 1998).

Early work by Grinnell and associates indicates that the gray vireo used to be more widespread, particularly in the San Gabriel and San Jacinto mountains (Grinnell and Swarth 1913; Grinnell and Miller 1944). Little is known about the extent or cause of its decline in these areas.

Habitat: In the San Jacinto Mountains and San Diego ranges, gray vireos are typically found in stands of dense, mature chaparral that are dominated by chamise or redshank (Unitt 1984). In the San Gabriel and San Bernardino mountains they are found on brushy slopes in pinyon-juniper woodlands (Garrett and Dunn 1981). However, gray vireos are highly localized in these plant associations, suggesting that other habitat requirements may be influencing their distribution.

Conservation Considerations: Survey work is needed to better document the distribution and abundance of gray vireos in the assessment area. Systematic surveys resulting from the development of breeding bird atlases in Los Angeles (LACBBA 1999) and San Diego (SDNHM 1999) counties should help in this regard. Like most vireos, gray vireos are considered highly susceptible to cowbird nest parasitism and this has been implicated as a possible reason for their decline (Unitt 1984). Cowbird parasitism of gray vireo nests has

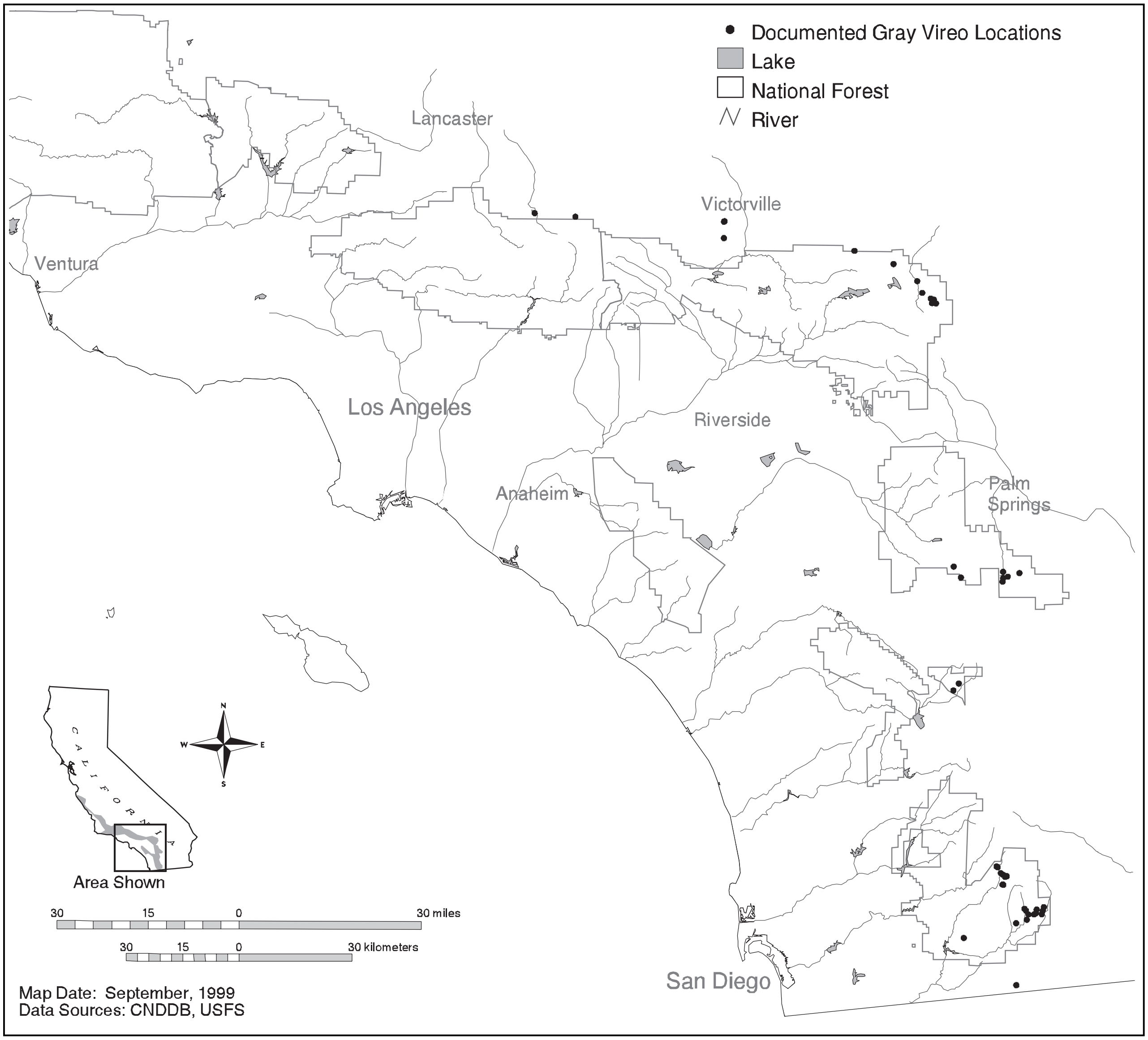


Figure 4.30. Known locations of the gray vireo in the assessment area.

been documented in the San Bernardino Mountains (Hanna 1944).

Plumbeus solitary vireo
(Vireo solitarius plumbeus)

Status and Distribution: The rarity of this distinctive subspecies in southern California and its restriction to arid montane habitats are why the Plumbeus solitary vireo was identified as a local species of concern. It has been observed in Big Rock Creek Canyon on the north side of the San Gabriel Mountains and in upper Arrastre Creek on the north side of the San Bernardino Mountains (Garrett and Dunn 1981). This subspecies was not recorded in California prior to 1962 and appears to have undergone a major westward expansion of its range in the mid-1900s (Johnson and Garrett 1974).

Habitat: Plumbeus solitary vireos breed in arid woodlands of mature pinyon pine, white fir, and Jeffrey pine, often extending into adjacent riparian growth (Garrett and Dunn 1981).

Conservation Considerations: More information is needed on the distribution and abundance of this subspecies in the assessment area. However, we believe its vulnerability to existing land use activities is low.

Hepatic tanager *(Piranga falva)*

Status and Distribution: The rarity of this distinctive species in southern California and its restriction to arid montane habitats are why the hepatic tanager was identified as a local species of concern. It is known to occur only in the San Bernardino Mountains; documented localities include upper Arrastre Creek and Round Valley, both east of Baldwin Lake (Johnson and Garrett 1974; Garrett and Dunn 1981).

Habitat: Breeding habitat for hepatic tanagers in the San Bernardino Mountains consists of mature pinyon pine woodland with a mixture of taller conifers, such as white fir or Jeffrey pine (Garrett and Dunn 1981). Johnson and Garrett (1974) suggest these tanagers also may occur in pine and deciduous oak woodlands on warm, arid slopes.

Conservation Considerations: Additional information is needed on the distribution and abundance of this species in the assessment area. It could also occur in the San Gabriel and San Jacinto mountains. The mature woodland habitats occupied by hepatic tanagers are at some risk to loss in stand-replacing fires but otherwise are not particularly vulnerable to existing land use activities.

Desert Montane Mammals

Tehachapi white-eared pocket mouse *(Perognathus alticola inexpectatus)*

Status and Distribution: The Tehachapi pocket mouse is a Forest Service Region 5 Sensitive Species and a California Species of Special Concern. This taxon is endemic to the Tehachapi Mountains and the western Transverse Ranges (Best 1994). Known localities within the assessment area, based on museum records and historic information, are near Lake Hughes, Elizabeth Lake, and Quail Lake on the desert side of the Castaic Ranges, and at Pinyon Pines, Cuddy Valley, and Chuchupate Campground in the Mount Pinos/Frazier Mountain region (Williams 1986; Best 1994; CNDDB 1999). The only one of these locations where Techachapi pocket mice have been recently observed is at Chuchupate Campground, where they were found in 1998 by public health biologists monitoring vector-borne diseases (R. Davis, CA Department of Health Services, pers. comm. to M. Foster, 1998).

Habitat: Habitat associations of the Tehachapi pocket mouse are not well defined. They have been collected in arid annual grassland, desert scrub communities, pinyon pine woodland, a grain field, and in open desert-side pine forest at elevations between 3,500 and 6,000 feet (Williams 1986).

Conservation Considerations: So little is known about the status of the Tehachapi pocket mouse that it would be shear speculation to suggest threat factors and conservation needs. Surveys are needed to determine the distribution and relative abundance of this species on public lands within the assessment area. Williams (1986) identifies desert-facing slopes of the San Gabriel Mountains, the Castaic Ranges, and the Mount Pinos/Frazier Mountain region as areas where this mouse may be found.

Peninsular Ranges' bighorn sheep *(Ovis canadensis* "cremnobates")

Status and Distribution: Bighorn sheep (fig. 4.31) populations in the Peninsular Ranges of southern California were federally listed as endangered in 1998. There is uncertainty over whether these populations represent a taxonomically distinct subspecies or simply a discrete metapopulation (Wehausen and Ramey 1993; USFWS 1998f). Peninsular Ranges' bighorn sheep occur from the eastern flanks of the San Jacinto and Santa Rosa mountains southeast into the desert ranges of Anza-Borrego State Park to the Mexican border (fig. 4.32) (Rubin et al. 1998).

The Peninsular Ranges' metapopulation is composed of eight distinct populations (Boyce 1995). Four of these populations lie partially within the assessment area; the rest are in desert ranges to the east. There are an estimated 25 sheep in the San Jacinto Mountains, and 117 sheep in three recognized populations within the Santa Rosa Mountains

Figure 4.31. Peninsular Ranges' bighorn sheep are often found in steep, rocky terrain above the desert floor. USFWS FILE PHOTO

(USDI BLM et. al. 1996). However, only an estimated 2 percent of Peninsular Ranges' bighorn sheep habitat occurs on the San Bernardino National Forest; BLM (29 percent) and state park (41 percent) lands make up most of the sheep's range, and some critical lambing habitat also occurs on private lands (USDI BLM et. al. 1996). Studies have documented declines in most of the Peninsular Ranges' populations (USDI BLM et. al. 1996).

Habitat: Bighorn sheep habitat in the Peninsular Ranges is characterized by steep slopes, canyons, and washes. Although they can occur at high elevations, these sheep typically are found at elevations below 4,600 feet, which in this area is below the pinyon-juniper woodlands (Rubin et al. 1998). Topography in a patchwork of varying slopes is important for bighorn sheep. Steep (50 to over 70 percent slope) and rough (i.e., with a lot of small-scale changes in slope) terrain is utilized extensively for escape cover, but flatter areas at the base of the mountains are often used for foraging (USDI BLM et. al. 1996).

Conservation Considerations: The primary factors believed to be affecting Peninsular Ranges' bighorn sheep are (1) habitat loss or abandonment due to encroaching human development along the base of the mountains and extending up into them; (2) diseases that can be transmitted by domestic livestock, particularly sheep; and (3) high levels of predation in some areas by mountain lions and possibly coyotes (USDI BLM et. al. 1996).

Specific management actions for conserving Peninsular Ranges' bighorn sheep and their habitats have been developed by an interagency coordinating committee. This direction is in the process of being adopted by all state and federal land and resource management agencies in the affected region (USDI BLM et. al. 1996).

Animals of Desert Floor Habitats

Six potentially vulnerable animals are desert species whose distributions may extend into the assessment area along its extreme northern and eastern boundaries (table 4.22). Although we knew from the start that the assessment area contains little suitable habitat for these species, it was still important to evaluate their conservation potential and vulnerability. One important reason for doing this is to clearly document that public lands in the assessment area will not be sufficient to conserve these species.

Based on discussions with people who have knowledge of these species' distributions, it appears that none of the six have significant populations on public lands within the assessment area. Thus, we consider all of them to be species whose conservation can be minimally influenced by management of public lands in this area.

Desert tortoise
(Xerobates [Gopherus] agassizii)

Status and Distribution: The desert tortoise is state and federally listed as endangered. Surveys for the desert tortoise have been fairly widespread and it has been documented close to the assessment area (fig. 4.33)(CNDDB 1999). However, suitable habitat for this species disappears rapidly as you move up into the mountains. It is possible that tortoises occur in small numbers along the northern base of the San Bernardino Mountains, where there is friable soil and relatively flat terrain.

Habitat: Desert tortoises occur in a wide variety of desert habitats, including washes and Joshua tree woodlands. They reach highest

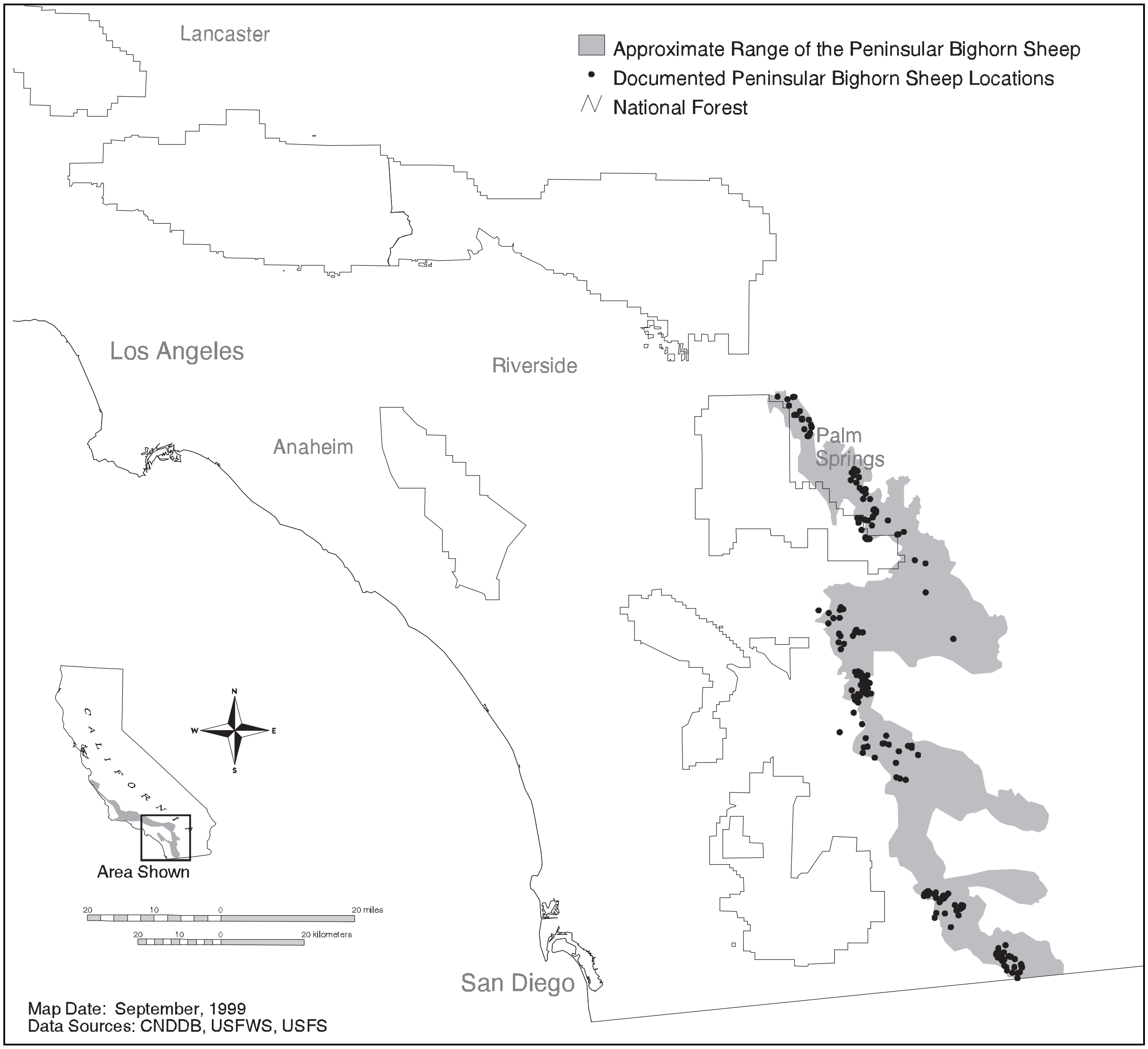


Figure 4.32. Distribution of the Peninsular Ranges' bighorn sheep.

densities in creosote bush communities with extensive annual wildflower blooms, such as occur in the western Mojave Desert (Zeiner et al. 1988). They require friable soil for burrow construction.

Conservation Considerations: It appears unlikely that desert tortoises occur within the assessment area in any significant numbers. Thus, management of public lands within the assessment area will have little influence on the conservation of this species.

Bendire's thrasher *(Toxostoma bendirei)*

Status and Distribution: The Bendire's thrasher is a California Species of Special Concern and is identified as an "extremely high priority" watch list species by Partners in Flight (Carter et al. 1998). There are several reported locations of Bendire's thrasher in Joshua tree woodlands along the northern and eastern base of the San Bernardino Mountains, including Lucerne Valley and Pioneertown (England and Laudenslayer 1989).

Habitat: At almost all sites where Bendire's thrashers nest in California the most prominent plants are Joshua tree, Spanish bayonet *(Yucca baccata)*, or Mojave yucca *(Yucca schidigera)*. They seem to avoid steep slopes and rocky terrain (England and Laudenslayer 1989).

Conservation Considerations: Protection of Joshua tree woodlands is important for this

Table 4.22. Animals associated with desert habitats that received individual consideration. Displayed for each species: (1) the level of knowledge about where it occurs in southern California and, in parentheses, the estimated percentage of locations that are on national forest system lands; (2) the mountain subareas occupied (y = occurs in breeding season, h = historically occurred, p = potentially occurs, t transient, w = winter visitor)—if the species is localized and data are available, the approximate number of occurrences may be displayed; (3) the vulnerability of populations on national forest system lands to existing threat factors; (4) population trends; and (5) the assigned conservation category.

Desert Floor Animals of Concern *federal status*	(1) Knowledge of SoCal Locations (% on NFs)	(2) areas occupied or estimated # of occurrences if spp. localized **Cleveland NF** San Diego Rngs	**Cleveland NF** Snta Ana Mts	**San Bern. NF** San Jac Mts	**San Bern. NF** San Bern Mts	**Angeles NF** San Gab Mts	**Angeles NF** Cas-taic Rngs	**Los Padres NF** So. LP Rngs	**Los Padres NF** So. SL Rng	**Los Padres NF** No. SL Rng	(3) Vulner-ability on NFs	(4) Pop. Trend	(5) Conser-vation Category
Reptiles													
Desert tortoise *threatened*	Mod (< 1%)				p	p					Low	Unkn	Minimal Influence
Birds													
Bendire's thrasher	Mod (< 1%)				y						Low	Unkn	Minimal Influence
Le Conte's thrasher	Mod (< 1%)			p	p	p			p		Low	Unkn	Minimal Influence
Summer tanager	Mod (< 5%)	t		t	t	y					Low	Unkn	Minimal Influence
Mammals													
California leaf-nosed bat	Low (< 5%)	y	p	p	p	p		p			Unkn	Unkn	Minimal Influence
Mohave ground squirrel	Low (0%)				p	p					Low	Unkn	Minimal Influence

species. More information is needed on the distribution and abundance of Bendire's thrashers on public lands in the San Bernardino Mountains. However, the assessment area is on the extreme edge of this species' range with only a small amount of potential habitat.

Le Conte's thrasher *(Toxostoma lecontei)*

Status and Distribution: The Le Conte's thrasher is a California Species of Special Concern and is identified as an "extremely high priority" watch list species by Partners in Flight (Carter et al. 1998). LeConte's thrashers are known to occur in Joshua tree woodlands in the Mojave Desert and arid desert scrub in the Carrizo Plain (Garrett and Dunn 1981), but we found no documented localities within the assessment area.

Habitat: Le Conte's thrashers require less vegetation than other thrashers; they inhabit very sparse desert scrub (e.g., creosote bush), especially around small washes. They also occupy Joshua tree woodlands in the Mojave Desert, although the Joshua trees themselves seem an unimportant element. In the southwestern San Joaquin Valley, stands of saltbush are occupied and nesting usually takes place around the edges of washes (Garrett and Dunn 1981).

Conservation Considerations: It appears unlikely that Le Conte's thrashers currently occur within the assessment area. Thus, management of public lands within the assessment area will not influence the conservation of this species.

Summer tanager *(Piranga rubra)*

Status and Distribution: The summer tanager is a California Species of Special Concern. There is recent (1998) documentation of summer tanagers nesting along the Santa Clara River in Soledad Canyon and along Big Rock Creek near the town of Valyermo (D. Cooper, UC Riverside, in litt.), although neither location appears to be on public land. Dan

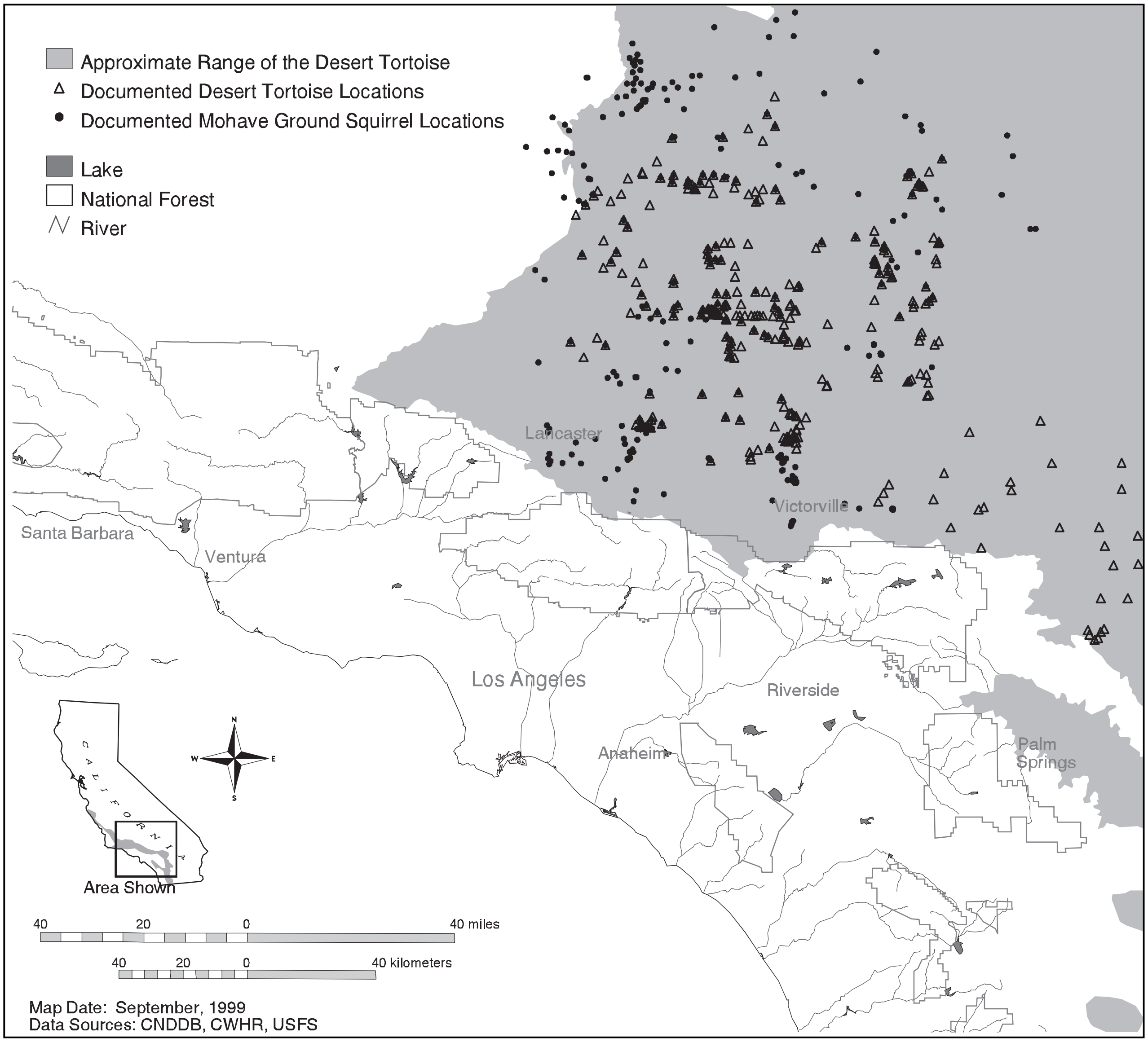


Figure 4.33. Range of the desert tortoise and known locations of the tortoise and Mohave ground squirrel in the vicinity of the assessment area (from CNDDB 1999).

Cooper stated that they probably nest in Fremont cottonwood groves all along the northern base of the San Gabriel Mountains. Summer tanagers are also reported from the Mojave River at Mojave Narrows Regional Park and Whitewater Canyon along the base of the San Bernardino Mountains (P. Unitt, SDNHM, unpubl. document), and the lower reaches of Palm and Andreas canyons on the desert-side of the San Jacinto Mountains (D. Freeman, San Bernardino NF, unpubl. notes).

Habitat: Summer tanagers nest in desert riparian groves, typically dominated by mature Fremont cottonwoods (Garrett and Dunn 1981).

Conservation Considerations: Riparian gallery forests on the desert's edge at the base of the San Gabriel, San Bernardino, and San Jacinto mountains are important habitats for summer tanagers and should be protected. There is a need to document where these habitats occur on public lands and survey those areas for summer tanagers.

California leaf-nosed bat
(Macrotus californicus)

Status and Distribution: The California leaf-nosed bat is a California Species of Special Concern. The distribution of this species in the assessment area is poorly known; it was not detected in bat surveys conducted by the Forest Service from 1996 to 1998 (Simons et al. in prep.). California leaf-nosed bats have reportedly been observed in the Arrastre Creek area of the San Bernardino Mountains and on the desert side of the San Jacinto Mountains (Diane Freeman, San Bernardino NF, unpubl. notes).

Habitat: California leaf-nosed bats are strongly associated with desert riparian and wash habitat. Radio-telemetry work done on this species in the California desert found them foraging almost exclusively in desert washes (Brown et al. 1993). They roost in mine shafts and caves (Brown 1998). Long, warm mine tunnels are utilized for winter roosts and maternity colonies (Berry and Brown 1995).

Conservation Considerations: Desert riparian habitats and suitable mine shafts are important to the conservation of this species. Surveys are needed to determine if occupied roosting or foraging habitat occurs within the assessment area.

Mohave ground squirrel *(Spermophilus mohavensis)*

Status and Distribution: The Mohave ground squirrel is state listed as threatened. The current range of this species, delineated, is well north of the San Gabriel and San Bernardino mountains in the Mojave Desert (Best 1995). However, there are historic records from Apple Valley and Lucerne Valley (fig. 4.33) (Whitaker 1991). These are close to the San Bernardino Mountains and potential habitat seems to extend a short ways up into the mountains. Mohave ground squirrels have been found at elevations up to 5,000 feet in some desert ranges (Best 1995).

Habitat: Optimal habitats for Mohave ground squirrels are open desert scrub (e.g., creosote bush), open alkali scrub (e.g., saltbush), and Joshua tree woodlands (Zeiner et al. 1990b). They typically construct burrows in the sandy soils of desert washes (Best 1995).

Conservation Considerations: It appears unlikely that Mohave ground squirrels currently occur within the assessment area. Thus, management of public lands within the assessment area will not influence the conservation of this species.

Chapter 3 – Factors Influencing Ecosystem Integrity

Ecosystems are not defined so much by the objects they contain as by the processes that regulate them.

— Christensen et al. 1989

Key Questions

- **What are the primary natural processes and human activities that drive change in the composition, structure, and extent of southern California mountain and foothill ecosystems?**
- **How are those processes and activities currently affecting the landscape and what can be determined regarding the natural range of variability?**
- **What current trends are apparent and what threats or opportunities are presented by them?**

This chapter considers the primary processes and activities that modify ecological communities in the mountains and foothills. These include (1) natural disturbance processes such as fire, flood, drought, and outbreaks of insects or disease; (2) human uses of the land for development, resources, and recreation; and (3) the spread (often unintentionally) of new elements such as air pollution and non-native plants and animals.

Each of these "change agents" acts upon the landscape and modifies its character. To persist over time, plant and animal species must continually be able to survive, reproduce, or recolonize as the landscape changes. Thus the disturbance processes that shape local ecosystems are as important to understand as the physical components of those ecosystems.

Since disturbance and climatic variability are inherent components of natural systems, all species have adaptations to survive in a changing world. Yet, their ability to respond to change is not limitless and some organisms are clearly more adaptable than others. In general, the complete assemblage of native plants and animals is most likely to be maintained when environmental conditions remain within their natural historic range. Thus we need to develop an understanding of what the historic or natural ranges of variability are for various ecological processes. These serve as the reference conditions to which present day conditions can be compared. The closer current conditions are to reference conditions, the greater our confidence that all the ecological components will continue to persist (for detailed description of the "reference variability" concept see Manley et al. 1995). This is the basis for the "coarse-filter" approach to conservation described in chapter 2.

In our analysis, we first asked the assessment task group to identify and describe the key interactions between landscape elements and the change agents (e.g., ecological processes or human activities) currently shaping them. Then we examined those interactions, using the best available information on reference conditions to assess how today's dynamics compare with the historic range of variability. Of particular interest is how the current management of natural processes (e.g., fire suppression or streamflow regulation) has affected the species and habitats that evolved under the influence of those processes.

The element/process interactions identified by the assessment task group are summarized in the following sections. A separate matrix was developed for each of the six large-scale vegetation mosaics described in chapter 2. The matrices were used to clarify the effects of different activities and prioritize those having the biggest impact on species conservation and ecosystem integrity. We believe this information will be useful when the time comes to formally describe desired conditions and management priorities. What follows is a description of the primary change agents and how they influence ecosystems.

The Influence of Fire

> *Experience has taught us that we cannot prevent fire. In my opinion, it is better to have a fire every year, which burns off a ... small area, than to go several years ... and have a big one denuding the whole watershed at once.*
>
> — *William Mulholland, 1908*

Fire is a primary agent of change in vegetation patterns across the southern California landscape. The distribution, composition, and structure of almost all plant communities in this region are influenced by fire, and as the quote above illustrates, prominent southern Californians have long recognized its importance and offered opinions on how it should be managed.

The significance of fire in shaping southern California wildlands is reflected in a large body of scientific research on the subject. It is not by coincidence that the Forest Service research station in southern California is the Forest Fire Laboratory and, as the name implies, is largely devoted to fire research. Yet, even with the extensive scientific attention given this subject there are widely divergent opinions among researchers regarding historic patterns of fire frequency, size, and intensity (Zedler 1995). This uncertainty can largely be attributed to the inherent difficulties associated with studying a phenomenon that affects large areas, recurs sporadically over time intervals that range from a few years to several hundred, and whose individual events vary widely in extent and severity.

Fire history information provides valuable insights, but the sources suffer from being (1) anecdotal (e.g., accounts of a few early inhabitants); (2) incomplete and less reliable the further back in time you go (e.g., official records of past fires); or (3) based on indirect information that is subject to varying interpretations (e.g., fire scar analyses, vegetation patterns observed in old aerial photographs, and patterns observed in nearby areas where fire suppression is less of a factor). Unfortunately, this body of evidence does not provide clear, unequivocal answers; thus, there will always be different interpretations of how things used to be.

In this assessment we examined various theories and supporting evidence on how today's fire regime may differ from historic conditions and what is relevant about those changes. We focused primarily on factors influencing the persistence of native ecological communities and how today's conditions compare with what is known about the natural range of variability. In this section we present some of the local fire history data, describe key concerns, and try to identify where there is strong scientific consensus and where there is not.

Has the Fire Regime Changed?

There is little argument that the fire regime in southern California has changed as human populations have grown and fire suppression practices have become increasingly effective. Even assuming that Native Americans actively burned, there are many more ignitions today with the combination of human- and lightning-caused starts, and those ignitions are more concentrated along the interface between urban development and wildlands. However, most of those ignitions are quickly suppressed unless conditions are conducive for rapid fire spread. Most acres now burn in human-caused fires (Davis and Michaelsen 1995; Conard and Weise 1998), presumably because these fires can arise at any time and thus have the greatest chance of igniting vegetation during key periods when conditions are prime for fire spread (e.g., during extended heat waves or when "Santa Ana" or "sundowner" conditions bring high temperatures, ultra-low humidity, and high winds).

It is reported that 10 percent of the fires in southern California wildlands account for over 75 percent of the area burned (Strauss et al. 1989; Keeley et al. 1999). Thus, most areas currently burn in large fires. It is unclear whether this is a natural, historic pattern or an artifact of fire suppression. Keeley et al. (1999) analyzed fire history records and found that this pattern dates back to at least 1910. However, we have no way of knowing if it was the pattern prior to the arrival of Europeans.

Most of the vegetation that burns in southern California is chaparral, which is well known for its tendency to go from being difficult to burn under moderate conditions to exploding into a fire storm under extreme conditions (P.H. Zedler, Univ. of Wisconsin, in litt. 1998). Thus, chaparral has characteristics that make it naturally susceptible to large fires. However, it also seems evident that fires in today's environment are able to grow significantly in size only when weather and fuel moisture conditions are severe enough to limit the effectiveness of suppression actions. A resulting hypothesis is that active suppression has changed the fire regime such that fires are now less frequent but likely to be larger in size and more severe in intensity.

Support for this hypothesis is found in comparisons of fire patterns in southern California with those in northern Baja California, Mexico, where fires are generally not suppressed (Minnich 1983; Chou et al. 1993). In a detailed comparison of 1920 to 1970 fire patterns in San Diego County and northern Baja based on examination of aerial photographs, Minnich (1989) found a similar number of acres burned, but the fires in San Diego County were significantly fewer and larger. The vegetation patterns on each side of the border were strikingly different, with chaparral habitats in northern Baja exhibiting a much more diverse and fine-grained age-class mosaic (Minnich 1989). Minnich attributed this difference primarily to fire suppression north of the border and lack of suppression south of it.

Studies looking solely at southern California fire history records do not support the hypothesis that fires have become fewer and larger. Using fire perimeter maps that extend back roughly ninety years, Conard and Weise (1998), Weise et al. (in press), and Keeley et al. (1999) did not find statistically significant increases in average fire size over the recorded time period. Keeley et al. (1999) also found that most southern California counties have had a statistically significant *increase* in the number of reported fires per decade. These authors conclude that large fires, usually fanned by fall Santa Ana weather conditions, have always been a dominant component of southern California's fire regime and this has not been changed by fire suppression activities. Moritz (1997) came to a similar conclusion in a statistical analysis of Los Padres National Forest fire history data, but he did detect a significant decline in the frequency of small fires. It is suggested that suppresson may actually be helping maintain something approximating the historic fire regime by neutralizing the large increase in human-caused ignitions (Conard and Weise 1998; Keeley et al. 1999).

It is likely that these differing findings and interpretations each have some merit. It is undoubtedly true that large fires occurred historically; there is evidence of such fires in old charcoal deposits (Byrne et al. 1977), and the combination of extensive chaparral vegetation and extreme southern California weather conditions is conducive to such events. It also seems highly probable that fire suppression has helped offset the impact of a large increase in the number of fire ignitions. But there is also compelling evidence that suppression effectively narrows the range of conditions under which fires are allowed to consume vegetation and that the direction of this narrowing is likely to result in an increase in the proportion of high-severity fires. Demonstrating such a change is difficult because there is little quantitative information on the severity or intensity of historic fires.

Historically, fires appear to have burned under a wide range of environmental conditions, exhibiting erratic smolder-and-run behavior patterns as weather and fuel conditions changed. Unsuppressed, some fires would continue for months until extinguished by rain or lack of fuel. The landscape would experience smoldering burns, punctuated often by short-duration, high-intensity afternoon runs and occasionally by large conflagrations (Minnich 1987b; Minnich 1988). Today (and for at least the last fifty years), smoldering fires are actively suppressed and most are quickly extinguished, thereby significantly reducing opportunities for short-duration runs. Thus, by effectively reducing the other burn patterns, suppression has seemingly increased the likelihood that when an area burns, it will do so in a relatively fast-moving, high-severity fire.

There does not appear to be much change in the average return interval of chaparral fires. There is general consensus among experts that (1) natural fire-return intervals in chaparral were probably in the range of fifty to eighty years and (2) current fire-return patterns in chaparral appear to be either within or near this range across most of the landscape (Minnich 1995; Zedler 1995; Conard and Weise 1998). Fire frequency appears to have significantly increased only in ignition-prone areas near the urban interface, usually where there are high proportions of scrub (i.e., thin-stemmed, semi-woody shrubs) and grass vegetation that facilitate rapid fire spread (fig 3.1).

It is in montane conifer forests where the disappearence of smolder-and-run fires appears to have markedly decreased fire frequency. Fire-scar studies suggest that understory fires were historically common in conifer forests, with average return intervals of fifteen to thirty years (McBride and Lavin 1976). However, over the last seventy years, fires have been rare in southern California montane conifer forests, particularly in interior forest habitats away from the chaparral interface (fig 3.1). This is probably due to a high level of suppression effectiveness in the conifer belt. Ignitions in the forest are not prone to rapid fire spread and thus are quickly extinguished. In addition, firefighters have been largely effective at keeping fires that come up out of the chaparral from moving into the montane conifer forest interior.

It is important to understand how the fire regime has changed and how those changes are affecting ecological communities. Yet, in densely populated southern California there is little likelihood that we can adopt a policy where wildfires are allowed to smolder and run at will. There are too many lives, structures, and resources that would be put at risk by such a strategy. Consequently, we are better served by focusing our attention on specific key issues pertaining to fire's effect on the biota (table 3.1) and exploring the range of options available for addressing those specific issues.

Fire Issues in Foothill Habitats

There are two primary concerns regarding the current fire regime's effect on foothill habitats. First, overly frequent fires in coastal sage and buckwheat scrub can result in the degradation of these habitat types. Short intervals between fires (i.e., less than ten years) can lead to pronounced declines in shrub cover and concurrent increases in herbaceous cover, particularly non-native annual grasses (O'Leary 1990; Zedler et al. 1983). This tends to be a self-perpetuating shift, because dense annual grass cover hinders shrub re-establishment (Minnich and Dezzani 1998) and increases the habitat's flammability, making it more prone to frequent fires (D'Antonio and Vitousek 1992). Degradation of coastal sage and buckwheat scrub has been widespread in the "front country" foothills where fires along the urban interface have been frequent (table 3.2).

There is particular concern about the degradation of coastal sage scrub because its extent has already declined by almost 80 percent due to development in the coastal basins and it is the primary habitat for the California gnatcatcher and other imperiled species (Westman 1981; Davis et al. 1994; Beyers and Wirtz

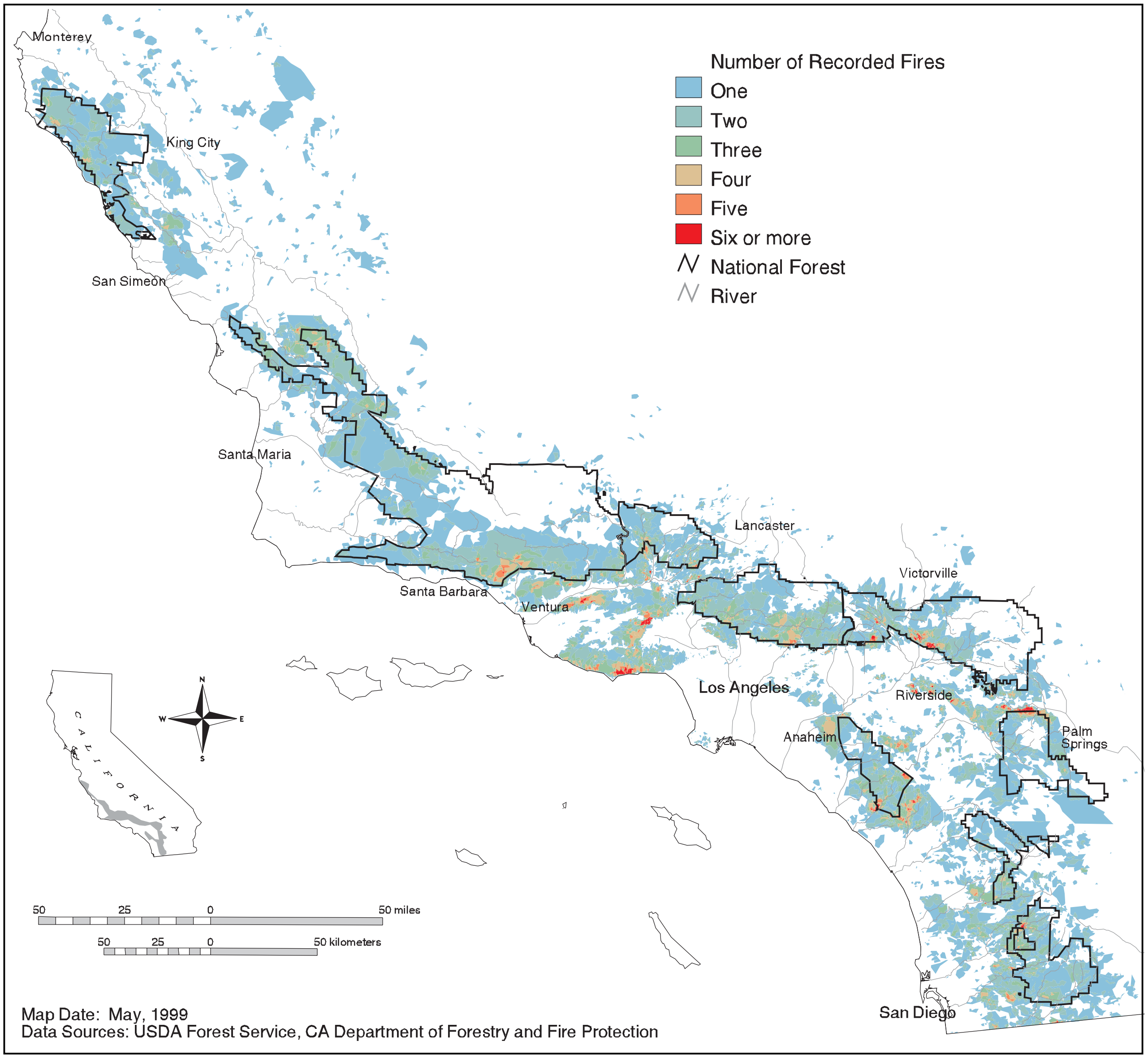


Figure 3.1. Fire frequency patterns. Shows the number of times that different areas have burned over the last century. Areas shown in white have no recorded incidence of fire. This is based on our fire history database (see the "Information Sources" section of chapter 1 for more information on the fire data).

1997). Coastal sage is restricted to low elevations (below 3,000 feet) and most of it occurs near the urban interface. The pervasive increase in non-native grass cover has increased the flammability of this vegetation type, such that it is often capable of reburning one or two years after a fire. Given these characteristics, increased management effort will probably be needed to keep coastal sage from burning at overly frequent intervals.

Existing management direction in southern California Forest Plans calls for short-rotation burning to frequently rejuvenate coastal sage scrub habitats (e.g., seventeen-year rotations on the Cleveland National Forest and twelve-year rotations on the Angeles National Forest) (Cleveland NF 1986; Angeles NF 1987). The information presented above suggests that a different management approach, which emphasizes retention of older stands of coastal scrub, may be necessary to achieve desired conditions (table 3.3).

The second concern in the foothills is the tendency for very large fires (e.g., 10,000 acres or larger) in chaparral-dominated habitats. There have been a number of these large fires,

Table 3.1. Key ecological issues that are influenced by the current fire regime.

Key Issues	Habitats/Species Most Affected	Effects Associated with Current Fire Regime	Current Trends and Areas Most Affected
Overly **frequent** habitat disturbance, leading to a shift in composition and structure of plant communities.	Coastal sage scrub. Bigcone Douglas-fir forests. Possibly pinyon-juniper woodlands.	• Fires spread rapidly in coastal scrub and an abundance of ignitions along the urban interface can lead to frequent reburns. • Chaparral fires are increasingly carrying into bigcone Douglas-fir stands, which are very slow to recover from stand-replacing fires. It is unclear if the situation is being caused by increased fire intensity or frequency or both.	• Coastal scrub in the foothills is being converted to annual grassland in many areas. • Extent of bigcone Douglas-fir has declined by 18% in San Bernardino Mts. since 1930s and is declining elsewhere too. • Recent large fires in pinyon-juniper woodlands may be related to increased grass cover in desert-side areas.
Overly **infrequent** habitat disturbance, leading to a shift in composition and structure of plant communities.	Mixed conifer forest. Ponderosa pine forest.	Fires have been effectively suppressed in montane conifer forests, essentially eliminating understory burns that historically occurred in these forests. This increases the risk of stand-replacing crown fires, although such an event has yet to occur in this region.	• Mesic forests have had substantial increases in the number of small diameter, understory trees. • White fir and incense-cedar have increased in abundance; ponderosa pine and black oak have decreased.

particularly in the Los Padres National Forest, over the last several decades. Whether a change from historic conditions or not, a high incidence of large burns substantially reduces the structural diversity of chaparral and scrub habitats and causes high amounts of erosion and stream siltation. Large chaparral fires also have the propensity to be self-perpetuating, since they create a continuous block of single-age vegetation that becomes ready to burn again at the same time.

An issue that is not of particular concern is the potential for chaparral stand senescence or decadence due to the long-term absence of fire. Formerly believed to be a problem, long fire-free intervals (i.e., seventy to one hundred years) have been found in recent studies not to be detrimental to chaparral shrubs (Keeley 1986; Zedler 1995). Many species, in fact, continue to produce new stems and even seedlings during long fire-free intervals (Lloret and Zedler 1991; Keeley 1992). The potential for negative effects associated with overly frequent fire appears to be a much greater threat to chaparral and scrub habitats.

Fire Issues in Lower Montane Habitats

Recent fire frequencies in lower montane habitats are similar to patterns in the foothills (table 3.4). This reflects the dominant influence of chaparral in both the foothills and lower montane region. Studies suggest that most chaparral plant communities are adapted to considerable variability in fire frequency and are not believed to be adversely affected by current return intervals (Keeley 1986; Zedler 1995).

The primary fire issue in lower montane habitats is the apparent loss of bigcone Douglas-fir in stand-replacing wildfires. This problem has not been thoroughly studied; thus, there is uncertainty about the amount of loss incurred and the reasons for it. Minnich (1999) states that stand-replacement fires in the San Bernardino Mountains have resulted in a net decline of 6,016

Table 3.2. A look at recorded fire history patterns in foothill habitats by mountain range. (a) Shows the percentage of the foothill landscape that has burned 0, 1, 2, or 3-plus times over approximately the last eighty years. (b) Shows the percentage of the foothill landscape by categories of time elapsed since the last fire.

Values are the percent of area meeting the described condition	Cleveland NF		San Bernardino NF		Angeles NF		Los Padres NF			**Entire Foothill Zone**
	San Diego Ranges	Santa Ana Mts	San Jacinto Mts	San Bernar-dino Mts	San Gabriel Mts	Castaic Ranges	S. Los Padres Ranges	S. Santa Lucia Rng	N. Santa Lucia Rng	
(a) Number of Fires										
0 Fires	27%	17%	17%	16%	8%	14%	19%	26%	48%	**25%**
1 Fire occurrence	38%	33%	42%	35%	22%	43%	43%	41%	40%	**39%**
2 Fires	22%	27%	26%	24%	41%	26%	25%	21%	9%	**22%**
3 or more fires	13%	23%	15%	25%	29%	17%	13%	12%	3%	**14%**
(b) Year of Last Fire										
1-19 years ago	16%	48%	37%	47%	26%	35%	22%	45%	10%	**28%**
20-39 years ago	26%	25%	17%	22%	54%	29%	17%	3%	16%	**20%**
40-59 years ago	20%	7%	3%	8%	6%	6%	23%	8%	19%	**14%**
60-90+ years ago	11%	3%	26%	7%	6%	16%	19%	18%	7%	**13%**
No recorded fires	27%	17%	17%	16%	8%	14%	19%	26%	48%	**25%**
Acres of Foothill Habitat	540,499	229,344	62,297	72,200	156,603	208,903	637,922	468,623	162,586	**2,538,976**

acres of bigcone Douglas-fir or 18 percent of what was present in 1938.

Fires seldom start in bigcone Douglas-fir stands but rather carry into them from the surrounding chaparral (fig. 3.2). Thus, chaparral fire dynamics strongly influence how these forest patches are affected by fire. Their distribution in deep canyons and on steep north-facing slopes helps limit exposure to fire. A possible explanation for the recent frequency of stand-replacing fires in bigcone Douglas-fir stands is an increase in the number of high-intensity chaparral fires, which are more likely to carry into forest patches. There is not adequate fire-intensity data to determine if this is indeed the case. It is considered plausible because of the current tendency for fires to escape rapid control only when conditions are severe, and because urban interface ignitions may result in more base-of-the-mountain fires that are prone to high-intensity runs up steep lower montane slopes.

One thing for certain is that bigcone Douglas-fir forests have been slow to recover from crown fires and many stands do not appear to be recovering at all (Minnich 1978). Chaparral invades these sites and for many decades the new community will be more likely to reburn than the old one—until live oaks again attain tree stature and shade out the shrubs. Bigcone Douglas-firs are particularly slow to

Table 3.3. Desired conditions for managing fire in foothill habitats of special concern.

Coastal Sage Scrub: Fire-free intervals of sufficient length (twenty-five years or more) to allow this vegetation type to reach structural maturity and remain there for an extended period of time. This would promote increased shrub cover and provide higher quality habitat for at-risk species associated with coastal sage scrub (e.g., California gnatcatcher).

Table 3.4. A look at recorded fire history patterns in lower montane habitats by mountain range. (a) Shows the percentage of the lower montane landscape that has burned 0, 1, 2, or 3-plus times over approximately the last 90 years. (b) Shows the percentage of the lower montane landscape by categories of time elapsed since the last fire.

Values are the percent of area meeting the described condition	Cleveland NF		San Bernardino NF		Angeles NF		Los Padres NF			**Entire Lower Montane**
	San Diego Ranges	Santa Ana Mts	San Jacinto Mts	San Bernar-dino Mts	San Gabriel Mts	Castaic Ranges	S. Los Padres Ranges	S. Santa Lucia Rng	N. Santa Lucia Rng	
(a) Number of Fires										
0 Fires	34%	24%	34%	18%	6%	30%	23%	4%	7%	**19%**
1 Fire occurrence	48%	56%	49%	40%	35%	52%	44%	7%	53%	**44%**
2 Fires	16%	16%	14%	30%	38%	17%	26%	68%	35%	**28%**
3 or more fires	2%	4%	3%	12%	21%	1%	7%	21%	5%	**9%**
(b) Year of Last Fire										
1-19 years ago	15%	52%	11%	18%	21%	9%	21%	90%	19%	**20%**
20-39 years ago	13%	4%	19%	35%	40%	31%	17%		66%	**30%**
40-59 years ago	27%	17%	10%	23%	17%	14%	2%		3%	**11%**
60-90+ years ago	11%	3%	26%	6%	16%	16%	37%	6%	5%	**20%**
No recorded fires	34%	24%	34%	18%	6%	30%	23%	4%	7%	**19%**
Acres of Lower Montane Habitat	179,071	22,711	112,443	151,113	281,590	128,016	550,298	31,954	255,971	1,713,167

return when there are no surviving seed trees nearby (Weatherspoon et al. 1992).

Coulter pine forests also occur mainly in lower montane areas but do not appear to be as adversely affected by the current fire regime. Coulter pine regenerates extremely well after fire (Vale 1979; Borchert 1985), but it requires fire-free intervals of approximately sixty to seventy-five years for adequate seed crops to develop (table 3.5). Thus, Coulter pine can be negatively affected by frequent reburns or by extremely long intervals without fire. This may be a problem in localized areas (M. Borchert, Los Padres NF, pers. comm.), but overall fire frequency in lower montane landscapes does not appear to be outside the historic range of variability.

Fire Issues in Montane Conifer Habitats

The widespread and prolonged absence of fire is a concern in montane conifer forests (table 3.6). Fire-scar studies suggest that moderate intensity fires (i.e., hot enough to scar but not kill most mature trees) historically occurred every fifteen to thirty years (McBride and Lavin 1976). However, over the last ninety years understory fires have been virtually eliminated from large areas, particularly in interior forest areas. The result is denser stands and a dramatic increase in the number of understory trees (Minnich et al. 1995). The concern is that this increase in stand density and fuel loading makes the forests more susceptible to large, stand-replacing crown fires (table 3.7).

Using data on precipitation, elevation, slope, stand density, and fire history, we developed a model to predictively map areas at risk to stand densification. Almost 30 percent

Figure 3.2 Bigcone Douglas-fir stands are at risk in high-intensity fires. This stand is located west of Coldbrook Campground on the Angeles National Forest. RICHARD HAWKINS

(108,500 acres) of mixed conifer and pine stands in the assessment area were predicted to be experiencing this problem (see fig. 2.17 in chapter 2).

Over the last fifty years, there have been very few "forest" fires in southern California's montane conifer region. Those that have occurred were either (1) driven primarily by steep terrain and extreme winds (e.g., the 1980 Thunder Fire in the San Gabriel Mountains) (R. Hawkins, Cleveland NF, pers. comm.); or (2) took place in forest stands that were surrounded and interspersed with mature chaparral that facilitated the spread of high-intensity fires into them (e.g., the 1950 Conejos and 1970 Laguna fires in the Cuyamaca and Laguna mountains, the 1970 Bear Fire in the San Bernardino Mountains). There seem to be few instances where the severity of these fires was attributed primarily to increased fuel loads in overcrowded forests.

However, events in other areas give cause for concern. On the Boise National Forest in Idaho, many years of near-complete fire exclusion came to an abrupt end when a series of intense crown fires from 1986 to 1995 consumed 45 percent of the area's ponderosa pine forest (Weiland 1996). The severity of these fires was attributed to excessive fuel loading resulting from the prolonged absence of fire. Similar large and unusually intense stand-replacing wildfires have occurred in recent

Table 3.5. Desired conditions for managing fire in lower montane habitats of special concern.

Bigcone Douglas-Fir/Canyon Live Oak: Minimal occurrence of high-severity crown fires in these forest stands. This is needed to maintain or increase the distribution and extent of this forest type which has recently been declining.

Coulter Pine: Fire return intervals of approximately 60 to 75 years are desired in this forest type, which requires fire for regeneration. At maturity, stands should be fairly open (40% to 60% canopy closure) with trees reaching 20 inches diameter at breast height (dbh).

Table 3.6. A look at recorded fire history patterns in montane conifer habitats by mountain range. (a) Shows the percentage of the montane conifer landscape that has burned 0, 1, 2, or 3-plus times over approximately the last ninety years. (b) Shows the percentage of the montane conifer landscape by categories of time elapsed since the last fire.

Values are the percent of area meeting the described condition	Cleveland NF		San Bernardino NF		Angeles NF		Los Padres NF			**Entire Montane Conifer**
	San Diego Ranges	Santa Ana Mts	San Jacinto Mts	San Bernar-dino Mts	San Gabriel Mts	Castaic Ranges	S. Los Padres Ranges	S. Santa Lucia Rng	N. Santa Lucia Rng	
(a) Number of Fires										
0 Fires	45%		56%	78%	53%	32%	71%			**66%**
1 Fire occurrence	47%		31%	20%	31%	40%	27%			**27%**
2 Fires	8%		12%	2%	13%	27%	2%			**6%**
3 or more fires			1%		3%	1%				**1%**
(b) Year of Last Fire										
1-19 years ago	12%		13%		21%	3%	2%			**7%**
20-39 years ago	5%		4%	7%	5%	36%	2%			**5%**
40-59 years ago	24%		18%	9%	12%	7%	4%			**11%**
60-90+ years ago	14%		9%	6%	9%	22%	21%			**11%**
No recorded fires	45%		56%	78%	53%	32%	71%			**66%**
Acres of Montane Conifer Habitat	49,467	0	55,749	202,112	105,681	1,748	96,544	0	0	**511,301**

years in the Sierra Nevada and the mountains of northern Arizona.

At higher elevations, subalpine forests dominated by lodgepole pine (Pinus contorta) typically do not carry fire well. In a study of fire patterns in lodgepole pine forests of the San Jacinto Mountains, lightning-caused fires occurred every few years but were typically small (less than 20 acres) and of low intensity (Sheppard and Lassoie 1998). This fire regime appears to be within the natural range of variability and not substantially influenced by fire suppression activities.

Fire Issues in Desert-Montane Habitats

Fires have historically been infrequent in sparsely vegetated desert-side habitats and, for the most part, this continues to be the case (table 3.8). Proximity to urbanized areas appears to be a significant factor in historic fire frequencies. A high occurrence of multiple fires on the desert side of the San Jacinto Mountains (table 3.8) appears to be concentrated in the vicinity of Beaumont and Palm Springs (fig. 3.1). The most remote desert-montane areas (i.e., the southern Los Padres ranges around Mount Pinos and the extreme northeastern corner of the San Bernardino Mountains) have had very little fire history (fig. 3.1).

Vegetation type is also a factor in fire-return intervals, with fires being more frequent in desert chaparral and scrub than in pinyon-juniper woodlands. The sparse understories and open canopies typical of pinyon-juniper woodlands translate into long fire-free periods. A study of these woodlands in the San Bernardino Mountains estimated that the average fire-return interval was 480 years (Wangler and Minnich 1996). The authors concluded that twentieth-century fire suppression has had little effect on this vegetation type.

Table 3.7. Desired conditions for managing or mimicking fire regimes in montane conifer forests.

Forest stands with understory species ratios that are similar to the current overstory species composition. The emphasis is on arresting encroachment of shade-tolerant white fir and incense-cedar and providing opportunities for pine and black oak regeneration.

Landscape patterns that are resilient to large crown fires. Forest thickening and fuel continuity problems must be addressed at a landscape scale (e.g., watersheds) to avoid large stand-replacing fires. Understory fires (or thinning) should occur in each forest stand at twenty to forty year intervals. Some overstory kill during these events (2% to 4% of the stand) is desirable to create small openings for pine and oak regeneration. Under existing conditions, heavy fuels create a high potential for forest fires that kill a much larger fraction of the overstory.

A continuous and well distributed supply of large trees. Large trees are both highly characteristic of pre-suppression forests and vital to many wildlife species. They have declined in number over the last fifty years and are threatened further by stand thickening and crown fire risk.

However, Wangler and Minnich's (1996) study looked at fire patterns up to 1983. Since that time, there have been several large fires in pinyon-juniper woodlands on the north end of the San Bernardino Mountains. This has led to speculation that increases in non-native grass cover (e.g., cheatgrass), combined with increased ignition sources associated with the rapidly growing human populations just north of the mountains (i.e., Hesperia, Apple Valley, and Victorville) could be facilitating fire spread in these woodlands. The hypothesis is that this problem would only be present after particularly wet winters, when grass cover reaches its peak. This issue needs further study. Pinyon woodlands are extremely slow to regenerate; thus, an acceleration in fire return intervals would be of concern (table 3.9).

Fire Management Considerations

Options for managing fire or mimicking its ecological function fall into three general categories: (1) prescribed burning where a fire is intentionally set under controlled conditions; (2) fuels treatments where vegetation is manually or mechanically cut to reduce fire hazard or mimick an effect that fire would have; and (3) wildfire suppression strategies, which include confine-and-contain approaches where an unplanned or natural ignition is allowed to burn within a predefined containment area. The potential opportunities and barriers associated with these approaches are summarized in table 3.10.

The defensible fuel profile is a fuels treatment option that is being considered throughout the western United States for reducing crown-fire hazards in conifer forests. A defensible fuel profile zone (DFPZ) is defined by Olson (1993) as a "low-density, low-fuel zone averaging 0.4 km (0.25 mi.) in width, located mostly along roads and designed to support suppression activities." DFPZs can be likened to shaded fuel breaks, only on a larger scale. The focus of DFPZs is to break up fuel continuity over landscapes. A network of DFPZs is expected to do several things: (1) reduce wildfire severity in treated areas; (2) create broad zones where suppression efforts can be conducted safely and effectively; (3) effectively break up continuity of fuels; and 4) become anchor lines for further areawide fuel treatments.

According to Weatherspoon and Skinner (1996) and Olson (1993), DFPZs should be placed primarily on ridges and upper south and west slopes. Where possible they should also coincide with existing roads to simplify construction and maintenance and to facilitate their use by suppression forces. This treatment will result in a fairly open stand, which is dominated by large trees of fire-tolerant species. Post-treatment canopy closure is recommended to be no more than 40 percent. One of the key features of this is the general openness and discontinuity of crown fuels (horizontal and vertical) to produce a very

Table 3.8. A look at recorded fire history patterns in desert-montane habitats by mountain range. (a) Shows the percentage of the desert-montane landscape that has burned 0, 1, 2, or 3-plus times over approximately the last ninety years. (b) Shows the percentage of the desert-montane landscape by categories of time elapsed since the last fire.

Values are the percent of area meeting the described condition	Cleveland NF		San Bernardino NF		Angeles NF		Los Padres NF			Entire Desert Side
	San Diego Ranges	Santa Ana Mts	San Jacinto Mts	San Bernar-dino Mts	San Gabriel Mts	Castaic Ranges	S. Los Padres Ranges	S. Santa Lucia Rng	N. Santa Lucia Rng	
(a) Number of Fires										
0 Fires	56%		32%	61%	43%	60%	83%			**65%**
1 Fire occurrence	38%		35%	28%	50%	35%	13%			**26%**
2 Fires	5%		20%	9%	6%	5%	4%			**7%**
3 or more fires	1%		14%	2%	1%					**2%**
(b) Year of Last Fire										
1-19 years ago	8%		50%	22%	15%	12%	6%			**15%**
20-39 years ago	6%		1%	11%	17%	7%	<1%			**4%**
40-59 years ago	29%		17%	4%	24%	4%	3%			**11%**
60-90+ years ago	1%			2%	1%	17%	8%			**5%**
No recorded fires	56%		32%	61%	43%	60%	83%			**65%**
Acres of Desert-Side Habitat	78,406	0	110,135	134,468	88,560	61,092	418,145	0	0	**1,713,167**

low probability of sustained crown fire. Conard and Weise (1998) propose similar fuel management zones in southern California chaparral habitats.

Table 3.9. Desired conditions for managing fire in desert montane habitats of special concern.

Pinyon-Juniper Woodlands: Long fire-free intervals (one hundred to three hundred years) to allow this vegetation type to reach structural maturity and remain there for an extended period of time. Pinyon-juniper woodlands recover very slowly from crown fires.

The Influence of Water: Hydrology, Regulation, and Withdrawal

The flow of water, both on the land surface and underneath it, is a powerful force in shaping landscape patterns and ecological communities (Dunne and Leopold 1978). The dynamics of streamflows and the proximity of groundwater largely determine the extent and character of riparian, wetland, and aquatic habitats. Seasonality, volume, duration, and year-to-year variability of streamflows all greatly influence the structure and composition of ecological communities found in the channel and floodplain. Groundwater fluctuations have a similar effect on communities associated with springs, seeps, and ephemeral water bodies.

Southern California is an arid region where the human demand for fresh water greatly exceeds the natural supply. Consequently, all of

Table 3.10. Summary of the opportunities and barriers associated with the primary management tools available for restoring or mimicking the role of fire on the landscape.

	Prescribed Burning	Fuel Treatments	Wildfire "Confine & Contain"
Opportunities	• Understory burns to thin forest stands. • Chaparral burning to manage fire frequency and intensity.	• Selective timber harvests to thin the forest understory. • Fuel breaks or defensible fuel profiles to increase ability to control wildfires.	Confine and contain strategies allow unplanned ignitions occurring under desirable conditions to burn within defined containment boundaries.
Treatment Potential (acres per year)	Moderate. Considerable preparatory work is often required. Most efficient in areas far removed from buildings.	Low. High cost per unit area; requires accessible locations.	Moderate. Low cost per unit area, but is feasible only in remote areas where life or property is not at risk.
Effectiveness in and around Developed Areas	Moderate. Only very low intensity fires can usually be prescribed near developed areas.	High. Can be done in areas where burning is too risky.	Not an option near developed areas; The risk of property damage is too high.
Environmental Barriers to Implementation	• Complexities of keeping fire on the wildland side of the urban/wildland interface. • In forests, high fuel buildups now make it difficult to underburn in many stands. • Air quality regulations limit when burning can be done.	• Forest thinning is not cost effective on steep slopes or in areas that lack road access. • Fuel breaks require maintenance and can have environmental impacts.	• Limited to areas where the risk to life and property are very low. • Air quality considerations may also limit this option.
Institutional Barriers to Implementation	• Inadequate funding. Need authority to use suppression money to fund this work. • Lack of institutional incentives to burn. • Liability risks are a major disincentive to burning.	• Lack of viable commercial markets for small-diameter trees. • Inadequate funding. Need authority to use suppression money to fund fuels reduction work.	• Need change in Forest Plan direction • Requires change in attitudes towards suppression — immediate control is not always the desired objective. • Liability risks

the major streams that originate in the mountains contain dams or diversions at some point along them. In addition, many small streams and springs are dammed or diverted, both for water supply and flood control. Subsurface waters are also heavily tapped. Yet this still does not come close to meeting the needs of the region's human population, so large quantities of water are imported into the area from northern California and the Colorado River.

The result is a dramatic reduction in the extent and distribution of native freshwater habitats in this region. Faber et al. (1989) estimate that 95 to 97 percent of riparian habitat in southern California floodplain areas has been eliminated. In addition, much of what remains must function under a highly modified hydrologic regime with upstream dams regulating streamflows. Clearly no other landscape feature has been so drastically altered by human activities as has freshwater habitat.

The presence of dams and diversions on most of the region's major streams (fig. 3.3) has greatly altered aquatic and riparian habitats and reduced the capability of these habitats to support native species (table 3.11). However, the importance of these structures in preserving domestic water supplies and controlling downstream flooding ensure that most, if not all, are here to stay. Recognizing that their continued presence is necessary, there are important factors in the operation of major dams and diversions that significantly affect native habitats and species.

The Effect of Dams and Water Release Regimes

Dams destroy riparian habitat directly by inundation, but their greater effect (in terms of miles of habitat degraded) is downstream. By retaining all or part of flood flows, or modifying the shape of the discharge curve, dams tend to rob the drainage below of the hydraulic forces necessary to maintain a natural form.

Sweet (1992) illustrates the downstream effect of dams by comparing the Santa Ynez River below Gibraltar Dam (completed in 1921) with Piru Creek below Pyramid Dam (completed in 1973). Most of the regulated streams within the assessment area resemble one of these two downstream patterns:

> After 70 years, the affected section of the Santa Ynez River is characterized by a near-total lack of sand and fine

Figure 3.3. The locations of dams and diversions on central and south coast streams. Notice that the majority are concentrated in the foothills below 3,000 feet.

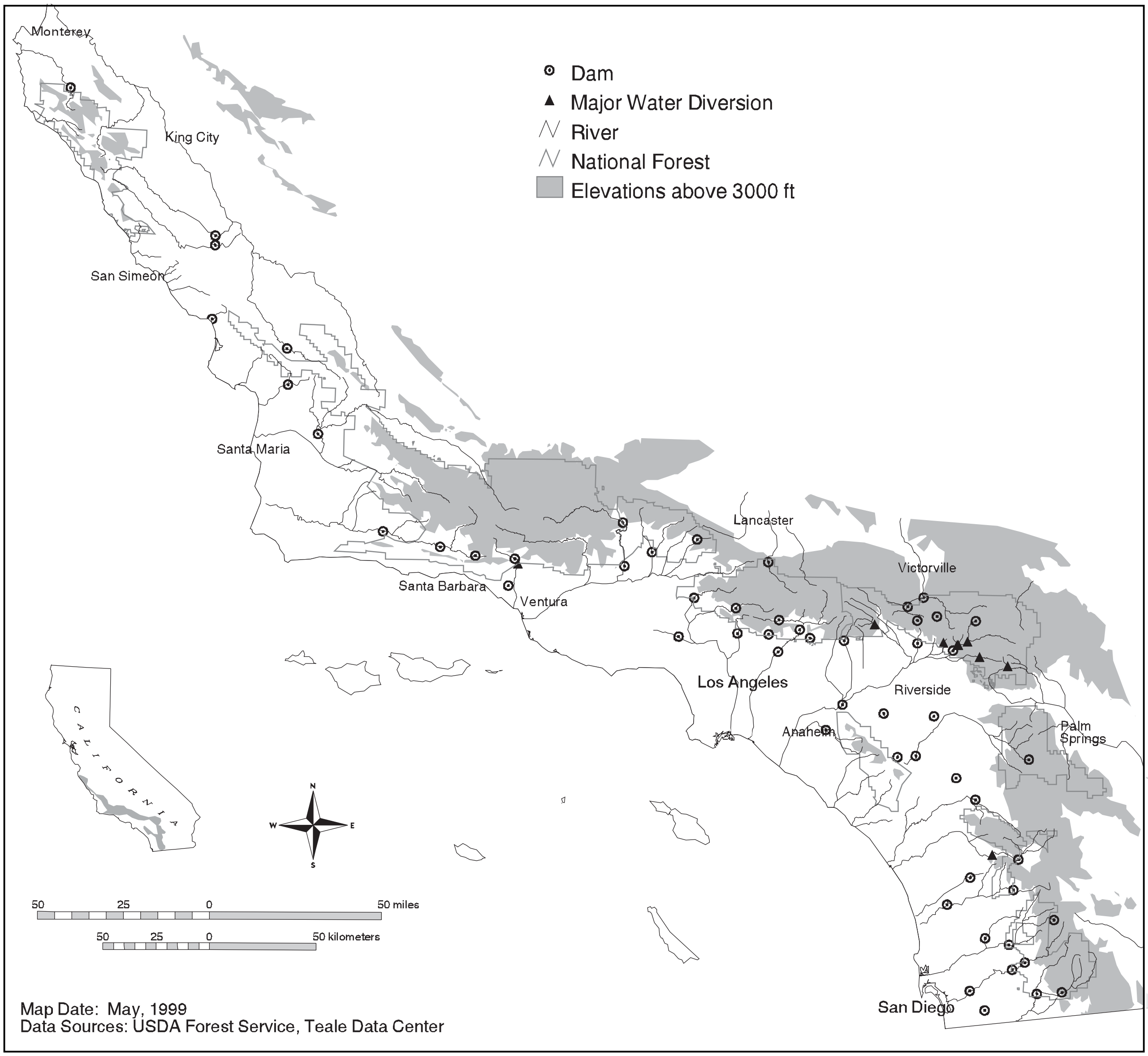


Table 3.11. Key ecological issues that are influenced by water storage, control, and withdrawal.

Key Issues	Habitats/Species Most Affected	Effects Associated with Water Storage, Control and Withdrawal	Current Trends and Areas Most Affected
Declines in habitat capability caused by major changes in the volume, duration, timing, and variability of stream flows.	Aquatic and riparian habitats below dams and diversions.	Dams and diversions dramatically alter flow regimes. Water releases below dams, if they occur at all, tend to be either "high volume, short duration," or "continuous low volume," neither of which resemble historic patterns. Downstream transport of sediment is also curtailed by dams, resulting in channel downcutting over time.	Most large streams have been dammed or diverted for many years and will remain so. Efforts are ongoing in some areas to establish release schedules that more closely mimic historic flow regimes.
Establishment and spread of invasive, non-native species.	Aquatic and riparian species.	Reservoirs, both large and small, tend to be dominated by non-native flora and fauna. These serve as points of spread into nearby native habitats.	Streams downstream of reservoirs tend to be most affected.
Reductions in surface water flows.	• Wet meadows • Aquatic and riparian habitats	Withdrawals of sub-surface water (i.e., spring- and ground-water extraction) can lower the water table and reduce availability at the surface.	The popularity of bottled mountain spring water is leading to an increase in extractions, particularly on private lands in the mountains.

gravel, and by a succession of very deep scour pools floored with boulders and mud. There are no sandy levees, only cobble bars, and several oak terraces are being eroded as the channel moves laterally. Little if any arroyo toad habitat remains in the first 4 stream miles below the dam, and only marginal habitat below this as a consequence of the scarcity and small size of tributary canyons which can supply the sediment and flood discharge needed to maintain the system.... Gibraltar Dam appears to have rendered the entirety of the downstream length of the Santa Ynez river on the LPNF uninhabitable for arroyo toads.

Pyramid Dam has been affecting lower Piru Creek for less than 20 years, and presents a somewhat different picture. As on the Santa Ynez River the sand deposits are disappearing from the segment between Frenchman Flat and the dam, and the creek has acquired a deep and boulder-filled channel. Unlike the Santa Ynez, large tributaries join Piru Creek within a few miles below Pyramid Dam and restore part of its sediment load. There is a second difference in that Pyramid Dam releases 10-25 cfs throughout the summer and early fall, resulting in the development of a very dense riparian corridor which is protected from flood scouring. This vegetation effectively channelizes the creek, and has transformed it into a habitat quite unsuitable for most native aquatic and riparian species. (Sweet 1992, pg 154)

The timing and duration of water releases from reservoirs can greatly influence downstream habitats. Large, sudden releases of water, particularly in the summer months, can quickly scour away a whole year's reproductive effort for native species such as arroyo toad, red-legged frog, pond turtle, and California newt. Conversely, low-level year-round flow regimes facilitate the spread of exotic predators (e.g., bullfrogs, sunfish, bass, bluegill, catfish, and Asian clams) into downstream areas that historically would have gone dry in late summer (Sweet 1992). Neither of these water release schedules is similar to historic flow conditions.

The historic flow pattern in southern California streams reflects the region's climate of long, dry summers and short, wet winters. Thus, flows would peak in the winter and early spring and decline dramatically in the summer months, where in many cases they would dry up in the uppermost and lowermost reaches (Faber et al. 1989). The high variability of runoff and precipitation in southern California also produced large flood events, which periodically scoured channels and redistributed sediment.

There is little ability to recreate large flood events, and the sediment transport that comes with them, below existing dams (fig. 3.4). Yet in some drainages, rather minor changes in the management of water releases could greatly improve habitat capability for species of concern. On Piru Creek, spring and summer discharges from Pyramid Lake used to fluctuate on a daily or weekly basis from zero to 150 cubic feet per second (cfs) and arroyo toad clutches and larvae were often stranded or swept away. In 1992, a shift to constant releases during the spring/summer period resulted in a large increase in larval arroyo toad survivorship (Sweet 1993).

Similar changes would be beneficial in other drainages within the assessment area. The resource management agencies should pursue opportunities to work with water and flood control agencies to address flow release issues (timing, duration, and volume of water releases) on a site-specific basis. In particular, efforts should be made to limit the practice of rapid, large changes in the volume of spring and summer water releases.

The Influence of Invasive, Non-Native Species

The spread of non-native species that displace, prey upon, or otherwise harm native species is a major problem in both aquatic and terrestrial habitats. Alternately referred to as "exotic," "alien," or "non-indigenous" species, the alarming consequences of their invasion on the capability of habitats to support native species is becoming increasingly recognized (Dudley and Collins 1995; Quammen 1998). Survival and reproductive success are greatly affected by predation and competition for limited resources (e.g., food and breeding sites). Introductions of new species, particularly highly successful or predatory ones, can dramatically decrease the ability of some native species to survive and reproduce in what otherwise would be suitable habitat (table 3.12).

In a statewide survey of non-indigenous species, Dudley and Collins (1995) concluded that the South Coast Bioregion was particularly hard hit, with more non-native species than any other California bioregion. To better

Figure 3.4. Sutherland Dam on Santa Ysabel Creek in the Cleveland National Forest is typical of impoundments in the assessment area. Water from Sutherland is released downstream only in high rainfall years when the lake level rises to the spillway height. GENA CALCARONE

Table 3.12. Key ecological issues that are affected by the spread of invasive, non-native species.

Key Issues	Habitats/Species Most Affected	Effects Associated with the Spread of Non-Native Species	Current Trends and Areas Most Affected
Shifts in composition and structure of plant communities.	• Riparian habitats • Grasslands • Coastal scrub	• Arundo, tamarisk, and other successful non-natives can dramatically alter the composition and structure of riparian habitats. • Non-native grasses and forbs have come to dominate many grassland and coastal scrub habitats, displacing native species.	Arundo is spreading rapidly in many low-elevation streams. Efforts to control or eradicate it are ongoing in several areas and have been successful, but where uncontrolled it is increasing. Tamarisk is present in many foothill streams, but does not seem to be spreading rapidly in most of them, particularly if stream channel is rocky.
Declines in survival rates of native animals that breed in aquatic habitats.	• Red-legged frog • Yellow-legged frogs (mtn & fthill) • Arroyo toad • Santa Ana sucker • SA speckled dace	Predation and competition by aquatic non-natives (bullfrogs, African clawed frogs, bass, sunfish, bluegill, brown trout, bullhead, and crayfish) can cause steep declines in survival rates.	• Aquatic non-native species are well established in many streams; those below reservoirs are particularly prone to infestation. • Some targeted control efforts have recently been initiated
Declines in reproductive success of native animals	• Least Bell's vireo • Willow flycatcher • Riparian birds • CA gnatcatcher • Native fish and amphibians • Purple martins	• Cowbirds parasitize the nests of many bird species • Non-native frogs and fish consume egg masses and young of native amphibians and fish • European starlings displace native cavity nesters	• Aggressive cowbird control across so. CA has helped increase Bell's vireo numbers • Most native fish and amphibians are declining
Shifts in composition of invertebrate fauna.	• Coast horned lizard • Habitats along the urban interface	Argentine ants and red imported fire ants displace native ants and other invertebrates in areas near the urban or agricultural interface. Native ants are the primary food of coast horned lizards and arroyo toad.	Argentine ants appear to be spreading, particularly in habitat fragments and in riparian areas. Red imported fire ants have just appeared in southern CA, so it is too early to say how far and fast they will spread.

document the extent of this problem in the assessment area, we developed a database that compiles occurrences of the most problematic, non-native species by stream or watershed. Many of these species are associated with riparian habitats and thus their presence or absence on individual streams is important to consider when assessing overall habitat capability. The database (displayed in appendix C) provides a good snapshot of what is currently known about the distribution of exotic pest species. However, it does not allow us to conclusively say where they do not occur; areas may lack observations of these species simply because thorough surveys have not been conducted. Also, in most areas where we know an exotic species is present, we lack accurate information on the extent of the infestation. These are important information needs.

Non-Native Forest Pathogens

The pitch canker fungus, *Fusarium subglutinans* ssp. *pini* (also called *Fusarium circinatum)*, is established in native and planted Monterey, knobcone, and bishop pines from Mendocino County south. This fungal pathogen is native to the southeast United States. Although there appears to be some natural resistance in the Monterey pine population (gene pool), it is predicted that 25 percent of the Monterey pines in infested stands will be killed by the fungus. Because the disease is new to the West Coast it is not known how many other pine species will be similarly affected. Several pine species and Douglas-fir are capable of being infected by the fungus (Dallara et al. 1995), but it may be rare for some of these species to develop the disease. Pines native to southern California which may be at risk include bishop pine *(Pinus muricata)*, Coulter pine *(P. coulteri)*, gray or foothill pine *(P. sabiniana)*, knobcone pine *(P. attenuata)*, Monterey-knobcone cross, ponderosa pine *(P. ponderosa)*, lodgepole pine (*P. contorta*), and Torrey pine *(P. torreyana)* (Dallara et al. 1995). Even with resistant genes, re-establishing a forest is an expensive and slow process, and survival of other plant, wildlife, and microbial species dependent on the affected conifers could be threatened by the disease.

Unfortunately, pitch canker is probably only the first of many exotic pests of native trees which will profoundly affect southern California forests. Despite restrictions on importation of raw wood products, increasing trade and movement of people have increased the probability of the inadvertent or deliberate introduction of pest species. One pathogen expected to appear soon in southern California forests is white pine blister rust *(Cronartium ribicola)*, which affects sugar pine.

Invasive, Non-Native Plants

Over one thousand non-native plants have become naturalized in California wildlands since the late 1700s when European settlement began (Randall et al. 1998). Some of these plants have caused little impact, while others are both invasive and damaging to natural ecosystems. The California Exotic Pest Plant Council (CalEPPC 1996) has developed a list of seventy-six exotic plants known to be invading native ecosystems and plant communities. These species can cause ecologic and economic damage by changing the natural processes associated with succession, nutrient cycling, hydrology, substrate stability, soil chemistry, or the frequency and intensity of wildfires (Randall et al. 1998; D'Antonio and Haubensak 1998). Many of these species outcompete native plants, thereby changing the composition and structure of ecological communities and sometimes reducing the quality of forage and cover for wildlife. Non-native plants can also hybridize with related native species [e.g., the non-native dandelion *(Taraxacum officinale)* is hybridizing with California dandelion *(T. californicum)* in montane meadows].

Probably because many non-native plants first became established in coastal areas of California (i.e., in and around ports, missions, and early settlements), their numbers tend to decline with increasing elevation and increasing distance from the coast. A relatively low number of exotic plants (approximately twenty-five) have invaded the desert areas of southeastern California (Kemp and Brooks 1998). High levels of disturbance and habitat modification tend to favor a non-native flora. For example, powerline right-of-ways that run through intact vegetation in southern California have been shown to be points-of-entry for several exotic species, including black mustard *(Brassica nigra)* and ripgut brome *(Bromus diandrus)* (D'Antonio and Haubensak 1998). In addition, hydrologic changes to streams brought on by dams and diversions appear to reduce the ability of native riparian plants to survive, creating conditions that promote the establishment of exotic species.

CalEPPC's Exotic Pest Plants of Greatest Ecological Concern list (1996) is divided into several categories based on level of invasiveness and distribution. The non-native plants considered to be of particular concern in our assessment area are addressed individually below.

Arundo or Giant Reed *(Arundo donax)*

Arundo is a large, perennial grass that has become widespread in many states (Dudley 1998). It was intentionally introduced to California in the 1820s in the Los Angeles area as an erosion-control agent in drainage canals (Robbins et al. 1951; Bell 1999). It forms dense thickets primarily in riparian areas but also in places that receive runoff (e.g., roadsides) or where there is a shallow water table (fig. 3.5).

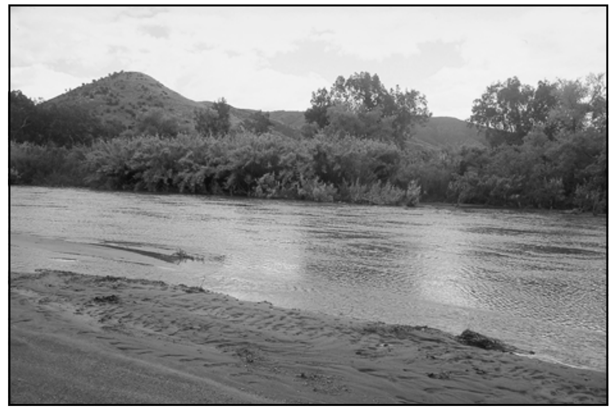


Figure 3.5. *Arundo donax* forms dense thickets like this one along Santa Ysabel Creek in San Pasqual Valley, San Diego County. GENA CALCARONE

Within the assessment area arundo occurs in foothill areas, primarily along large streams but also in other areas where there is pooled water. It reaches peak abundance downstream of the assessment area along major rivers in the coastal basins. The Ventura, Santa Clara, Santa Ana, Santa Margarita, San Luis Rey, and San Diego river systems are particularly infested. Arundo has generally not spread into the mountains or up the steep, narrow canyons that characterize lower montane areas. It apparently is restricted to low elevations (primarily below 2,000 feet according to Hickman 1993) and requires well developed soils to become established. We have documented the presence of arundo in fifty drainages within the assessment area.

We briefly describe the effects of arundo here, but see Bell (1999) for a thorough review of arundo's impacts in southern California streams. Arundo tends to have a competitive advantage in riparian areas where there is a modified hydrologic regime. It has rapid growth rates; in a comparison between arundo and two willow species *(Salix goodingii* and *S. laevigata)*, arundo grew 2.1 to 4.9 times faster (Rieger and Kreager 1989). Arundo can reportedly reach heights of 8 to 13 feet in less than one growing season. This rapid growth is sustained by the consumption of prodigious amounts of water—as much as 2,000 liters per meter of standing arundo (Iverson 1994)—and causes a decline in the availability of surface water.

Once established, the reed often forms monocultural stands that physically inhibit the growth of other plant species. These stands provide neither food nor cover for most native species of wildlife (Bell 1999; Reiger and Kreager 1989). Only a small number of bird species have been observed using arundo for nest sites and dramatic reductions (50 percent or more) in the abundance and diversity of invertebrates were documented in arundo thickets compared with those found in native willow/cottonwood vegetation (Dudley 1998). Arundo also provides less shade in riparian areas when compared to native vegetation, causing increased water temperatures and lower oxygen concentrations, which in turn negatively affect fish and other aquatic animals (Kan 1998).

Arundo thickets are highly flammable and known to carry wildfire up and down riparian corridors (Scott 1994; D'Antonio and Haubensak 1998). In recent years there have been a significant number of fires fueled by arundo in the Prado Dam area and along the Santa Ana River (J. Wright, Riverside County Fire Dept., pers. comm.). The most recent occurred in 1998 when an intense wildfire threatened to burn homes in the Santa Ana River drainage. Firefighting in arundo thickets is proving to be a significant drain on fire management resources (J. Wright, Riverside County Fire Dept., pers. comm.; R. Hawkins, Cleveland NF, pers. comm.).

A number of private and public organizations (including the U.S. Forest Service) have formed alliances (Team Arundo) to coordinate efforts in controlling the spread of this species. Considerable progress has been made in the refinement of techniques for effective arundo eradication (Lawson 1998; Nickerman 1999).

Tamarisk or Salt Cedar (*Tamarix* spp.)

Tamarisk is widely distributed in southern California, in both coastal and desert-side drainages. There are at least four different species of tamarisk invading native riparian habitat in the assessment area: *Tamarix chinensis, T. gallica, T. parviflora,* and *T. ramosissima.*

Tamarisk has the ability to uptake large quantities of water from the soil, effectively lowering the water table and reducing the amount of available surface water. One mature tree can reportedly absorb upwards of 200 gallons of water per day (Johnson 1987). In some areas, tamarisk has reduced or eliminated water supplies for bighorn sheep, pupfish, salamanders, and desert palm groves (Johnson 1987).

Tamarisk also provides poor forage and nesting sites for wildlife. The scale-like leaves are unpalatable to grazers and, in one study done by Bertin Anderson and Robert Ohmart of Arizona State University, birds were shown to favor native riparian vegetation over tamarisk at a ratio of approximately 38:1 (Johnson 1987). Tamarisk is often called salt cedar because it exudes salts from its leaves. These salts accumulate in the soil, making the area less hospitable to native plants.

Tamarisk appears to be most successful in drainages with unnatural or reduced flow regimes, such as those containing dams or diversions (D'Antonio and Haubensak 1998). Robert Ohmart of the Center for Environmental Studies at Arizona State University believes that tamarisk is not displacing cottonwoods but actually replacing them in areas now incapable of supporting a native riparian vegetation.

Because the species is sometimes planted as an ornamental on private lands, invasions into riparian habitat are likely to continue. The tree produces enormous quantities of seed which are dispersed by wind and water (Schierenbeck et al. 1998; Johnson 1987).

Tamarisk is documented in at least sixty drainages in the assessment area. It appears to spread most aggressively in foothill and desert streams with deep alluvial channels (e.g., arroyos). It occurs in a number of lower montane drainages as well, but seems to spread slowly in narrow bedrock channels.

Brooms

Three weedy species of European broom have become naturalized in California. These plants are members of the legume family that were introduced into the state as ornamentals and have since escaped into native habitats. Now well established in our study area, these shrubs have proven to be very difficult and expensive to eradicate.

Of the three brooms, French broom *(Genista monspessulana)* is the most widespread. It ranges from northern California south to San Diego County and east to San Bernardino County (McClintock 1985). In the assessment area, it is reported below 1,700 feet in the Santa Lucia Ranges, southern Los Padres region, and San Diego region. It has been found in coastal scrub, grasslands, oak woodlands, and the understory of Santa Lucia fir forests. *The Jepson Manual* reports the species to be toxic to both humans and livestock (Hickman 1993).

Scotch broom *(Cytisus scoparius)* occurs primarily in northern and central California (including Monterey County) where it grows up to 3,300 feet (McClintock 1985). Occurrences are also reported further south, in the interior valleys of Los Angeles, San Bernardino, Riverside, and Orange counties. The species is not as aggressive as French broom; however, it is beginning to invade chaparral and lower montane habitats in the San Bernardino Mountains (E. Allen, UC Riverside, in litt. 1998).

Spanish broom *(Spartium junceum)* is distributed from northern California to San Diego County but is less widespread than the other brooms. In the assessment area it is most prevalent below 2,000 feet in the Santa Lucia Ranges, southern Los Padres region, Castaic region, and the interior valleys of Los Angeles, San Bernardino, Riverside, and Orange counties. This species primarily occupies disturbed areas and is not as invasive in native habitats (McClintock 1985).

Knapweeds and Star Thistle (*Centaurea* spp.)

The genus *Centaurea* contains many invasive weeds including yellow star-thistle *(C. solstitialis)* and spotted knapweed *(C. maculosa)*. Yellow star-thistle is one of the most pervasive weeds in California, occupying pastures, roadsides, and disturbed grasslands or woodlands below approximately 4,300 feet. The *Jepson Manual* reports yellow star-thistle as cumulatively toxic to horses (Hickman 1993).

Spotted knapweed is widespread in California, occurring in disturbed areas up to 6,600 feet (Hickman 1993). The biennial species is reported in the assessment area in the southern Peninsular Ranges. Its early spring growth makes spotted knapweed very competitive for soil moisture and nutrients. The species tends to thrive under agricultural conditions and is listed as a "noxious weed" by both state and federal governments.

Mediterranean Grasses

Grasses account for the greatest number (181) of non-native plants in California. Over 40 percent of grasses in the state are exotic and now dominate vast areas of California's grasslands and savannas (Randall et al. 1998). Some of these grasses have become especially problematic, outcompeting native perennial bunchgrasses and hardwood seedlings. The most widespread grasses are the Mediterranean annuals, which include the oats, bromes, and barleys. They are well established in the assessment area and it is unlikely they could ever be eradicated on a broad scale.

All oat species are non-native. Three occur in the assessment area: slender wild oat *(Avena barbata)*, wild oat *(A. fatua)*, and cultivated oat *(A. sativa)*. All three are highly successful in disturbed areas.

Red brome *(Bromus madritensis* ssp. *rubens)* is known to carry fire in areas below approximately 3,200 feet in the San Bernardino and San Jacinto mountains (R. Minnich, UC Riverside, pers. comm.). Red brome, oats, barley *(Hordeum* spp.), and foxtail fescue *(Vulpia myuros)* have invaded coastal sage scrub and chamise chaparral in many areas. These invasions have led to increased fire frequencies and type conversion of shrub-dominated habitats to grassland (Minnich and Dezzani 1998).

The primary distribution of red brome occurs east of the assessment area in the Mojave and Sonoran deserts, where it has the ability to invade intact native habitats. Red brome is also prevalent in the Cuyama Valley (J. O'Hare, Angeles NF, pers, comm.). The grass spreads rapidly in wet years, and studies have indicated that repeated fires fueled by this grass have occurred in places where fire was previously rare (D'Antonio and Haubensak 1998; Kemp and Brooks 1998). While fires fueled by red brome are periodic (depending on rainfall patterns), their cumulative effect over time is expected to alter native vegetation.

Cheatgrass *(Bromus tectorum)* is distributed primarily in the Great Basin, Mojave Desert, and Sonoran Desert. However, it is also found within the assessment area, primarily on desert-facing slopes around Mount Pinos and in the San Gabriel, San Bernardino, San Jacinto, and Laguna mountains. It has invaded a variety of mainly arid habitats, including pinyon-juniper woodlands, yellow pine and mixed conifer forests, montane chaparral, and pebble plains (M. Lardner, San Bernardino NF, pers. comm.).

Like red brome, cheatgrass has the ability to invade pristine habitats. However, occurrences of cheatgrass in the assessment area are sparser and distributed at higher elevations than red brome. Where abundant, cheatgrass is known to cause increased fire frequencies (D'Antonio and Haubensak 1998), but there is little evidence to suggest that this is currently a problem in the assessment area (R. Minnich, UC Riverside, pers. comm.).

Ripgut brome is distributed widely in the assessment area. It forms a dense understory in open ponderosa pine forest near Lake Gregory, west of Lake Arrowhead in the San Bernardino Mountains. At this location the grass poses a fire threat and appears to be inhibiting conifer recruitment (R. Minnich, UC Riverside, pers. comm.).

Pampas Grasses

Two species of pampas grass have been introduced in California. *Cortaderia selloana,* native to Argentina and southern Brazil, seldom spreads from where it is planted. It often is cultivated as a lawn ornamental in warmer areas. In the past, it was planted by the Soil Conservation Service for supplemental dryland pasture in Ventura and Los Angeles counties (Hitchcock and Chase 1971).

Andean pampas grass *(Cortaderia jubata)*, native to Bolivia, Peru, and Ecuador, is very invasive. It was originally introduced for landscaping and by the 1960s was spreading into intact native ecosystems (e.g., redwood forest) in coastal areas of California (Kerbavaz 1985). Now considered a major weed, the species is very difficult to eradicate. In the assessment area, Andean pampas grass is especially problematic along the coast of Monterey County, where it frequently occupies road cuts, cliff habitat, and hillsides. The species is susceptible to frost, however, and may remain naturally restricted to milder climates near the coast.

Invasive, Non-Native Animals

The introduction and spread of invasive non-native animals have been particularly prevalent in riparian and aquatic habitats. These infestations often coincide with habitat disturbance, making it difficult to separate the influence of one from the other. For example, introduced fish and amphibians tend to thrive in highly modified habitats, confounding habitat degradation with the exotic predators as the primary source of native amphibian declines. However, observations of successful breeding activity by native amphibians in extremely modified breeding sites that were free of exotics supports the interpretation that the exotic species themselves are an important problem (Fisher and Shaffer 1996; Kiesecker and Blaustein 1997).

Table 3.13 lists the principal non-native animals that are considered to be a problem in southern California. The ones considered to be most problematic within the assessment area are described below.

Bullfrog *(Rana catesbeiana)*

Bullfrogs are strongly implicated in the decline of many native amphibians and aquatic reptiles (Schwalbe and Rosen 1988; Jennings and Hayes 1994). First introduced into California in 1896 (Jennings and Hayes 1985), they have progressively spread over much of the state and today occur in most suitable streams and water bodies west of the Sierra Nevada Mountains and southern deserts (Stebbins 1972). They are an effective predator of amphibians and aquatic reptiles, including California red-legged frogs (Bury and Luckenbach 1976; Hayes and Jennings 1986), arroyo toads (Sweet 1992), western pond turtles (Holland 1994) (fig 3.6), and two-striped garter snakes (Sweet 1992). Recently in San Mateo Creek, a single bullfrog was found to have three adult arroyo toads in its stomach (P. Griffith, UC San Diego, pers. comm.).

Bullfrogs have a competitive advantage over native frogs and toads because of their large size, generalized food habits, extended breeding season which allows for production of two large clutches each year, and larvae that are less palatable to predatory fish (Kruse and Francis 1977; Bury and Whelan 1984). They also tolerate elevated water temperatures better than native frogs, which is often advantageous in human-modified habitats (Jennings 1988). Bullfrogs are able to occupy a wide variety of aquatic habitats, from coastal estuaries to mountain waters at elevations over 5,000 feet (e.g., Doane Pond on Palomar Mountain).

Table 3.13. Some of the non-native animals occurring in southern California wildlands with an assessment of the level of threat they pose (modified slightly from Dudley and Collins 1995). Threat level category definitions: 1 = Serious, documented threat to sensitive species or ecosystems; 2 = Moderate threat to native species or ecosystems; 3 = Benign, low risk; 4 = Potential threat, but impacts not well documented. Species with multiple threat levels are considered a threat in some areas, but not a problem in other areas.

Invertebrates			**Threat Level**
Mollusca			
	Potamocorbula amurensis	Asian clam	1
Arthropoda			
	Apis mellifera scutellata	Africanized honey-bee	4
	Apis mellifera ssp.	European honey-bee	3
	Forficula auricularia	European earwig	3
	Linepithema humile	Argentine ant	2
	Solenopsis invicta	red imported fire ant	4
	Procambarus clarkii	Louisiana crayfish	2
Reptiles and Amphibians			
	Chelydra serpentina	snapping turtle	4
	Chrysemys picta, C. scripta	red-eared slider, painted turtle	4
	Rana catesbeiana	bullfrog	1
	Xenopus laevis	African clawed frog	1
Fish			
Centrarchidae			
	Lepomis spp.	green sunfish, bluegill, pumpkinseed	1
	Micropterus spp	largemouth and smallmouth bass	1
Cyprinidae (minnows and carps)			
	Carrasius auratus	goldfish	2
	Cyprinella lutrensis	red shiner	1
	Cyprinus carpio	carp	2
	Pimephales promelas	fathead minnow	2
Ictaluridae (catfish)			
	Ameiurus (Ictalurus) *melas*	black bullhead	1
	Ictalurus punctatus	channel catfish	3
Percichthyidae			
	Morone saxitilis	striped bass	1,3
Poeciliidae			
	Gambusia affinis	mosquitofish	1
Salmonidae			
	Oncorhynchus mykiss	rainbow trout (stocked pops.)	1,3
	Salmo trutta	German brown trout	1
Mammals			
	Castor canadensis	beaver	1,3
	Didelphus virginiana	opossum	3,4
	Equus cabullus	feral horse	2
	Equus asinus	feral burro	2
	Rattus rattus, R. norvehicus	black rat, Norway rat	1
	Sus scrofa	European boar, feral pig	1
	Vulpes fulva	red fox	1
	Felis domesticus	feral cats	2
Birds			
	Bubulcus ibis	cattle egret	3
	Meleagris gallopavo	wild turkey	4
	Molothrus ater	brown-headed cowbird	1
	Sternus vulgaris	European starling	1

Figure 3.6. Non-native bullfrogs prey on many native amphibians and reptiles, including western pond turtles. ROBERT H. GOODMAN JR.

The effect of bullfrogs on red-legged frogs has been particularly well documented. Hayes and Jennings (1988) found that California red-legged frogs were still present at 81 percent (n=70) of sites lacking introduced bullfrogs and no longer present at all sites (n=10) where bullfrogs were established. Using field enclosure experiments, Kiesecker and Blaustein (1998) found an 84 percent survival rate of red-legged frog metamorphs when bullfrogs were absent; the survival rate was only 27 percent when adult bullfrogs were present.

The work of Kiesecker and Blaustein (1998) suggests an increased negative effect when bullfrogs occur in combination with predatory fish. Survival rates of red-legged frog tadpoles averaged 89 percent when occurring alone or in the presence of only bullfrog tadpoles or only smallmouth bass. However, the survival rate decreased to 47 percent when bullfrog tadpoles and smallmouth bass were both present. Apparently, red-legged frog tadpoles respond to the presence of bullfrog tadpoles by retreating to deeper waters and reducing their activity levels. This can be effective at reducing competition. But when smallmouth bass (or other predatory fish) are present in the deeper water, they prey extensively on the tadpoles (Kiesecker and Blaustein 1998). This phenomenon probably affects the survival of other amphibians as well.

Our database of species occurrences by watershed and drainage shows bullfrogs being present in fifty-three drainages within the assessment area. Of those fifty-three occupied drainages, forty-three (81 percent) are also known to be occupied by predatory fish (primarily sunfish, bass, and bullheads).

African Clawed Frog *(Xenopus laevis)*

African clawed frogs are currently not as widespread as bullfrogs (eleven known occurrences in the assessment area), but they are a potent predator of native fish and amphibians. Concerns about their consumption of the endangered unarmored threespine stickleback fish have led to eradication efforts on the Santa Clara River in Soledad Canyon (Dick 1988). Although trapable, African clawed frogs are difficult to eradicate because they are highly aquatic and resistent to chemical toxins such as rotenone (Dick 1988).

African clawed frogs tend to become established in ponds and spread from there. The planting of mosquitofish by vector-control agencies may be contributing to their spread due to the presence of clawed frog larvae in several mosquitofish source ponds in San Diego County (R. Fisher, USGS Biological Resources Division, pers. comm.).

Predatory Warm-Water Fish (Centrarchids, Ictalurids, Cyprinids)

Green sunfish *(Lepomis cyanellus)*, bluegill *(Lepomis macrochirus)*, largemouth bass *(Micropterus salmoides)*, black bullheads *(Ameiurus melas)*, fathead minnows *(Pimephales promelas)*, carp *(Cyprinus carpio)*, and red shiners *(Cyprinella lutrensis)* have been widely planted into south coast reservoirs and streams as sport fish or as bait for sport fish (Dudley and Collins 1995). These are hardy fish that thrive in warm waters of lakes, ponds, and low-elevation streams. They all prey on one or more life stages (i.e., eggs, larvae, metamorphs or adults) of native amphibians and fish.

Native frogs are often absent from aquatic habitats where benthos-disturbing ictalurid (bullheads) and centrarchid (sunfish, bass) fish are introduced (Hayes and Jennings 1986).

This is caused by high levels of predation on frog eggs and tadpoles, particularly when tadpoles and predatory fish are crowded into small pools during periods of interrupted surface flow during the driest parts of the year (Jennings 1988). This pattern of interrupted surface flow is common in many streams within the assessment area.

Red shiners and fathead minnows are effective predators on the eggs of native fish. Red shiner predation is believed to be a primary factor in the disappearence of Santa Ana speckled dace from Big Tujunga Creek (Moyle et al. 1995).

One or more of these warm-water fish are known to be present in eighty-one streams within the assessment area. As described in the section on bullfrogs, the impact of these predatory fish appears to be exacerbated when bullfrogs are also present (Kiesecker and Blaustein 1998). They are known to co-occur in forty-three steams within the assessment area.

German Brown Trout *(Salmo trutta)*

As with many of the warm-water fish, brown trout have been introduced into mountain streams in southern California as a sport fish. They tend to be more predatory on native fish and amphibians than rainbow trout, and thus are considered more of a problem. The extirpation of Santa Ana suckers from the upper Santa Ana River has been attributed to brown trout predation (Moyle et al. 1995).

Although brown trout have historically been stocked into many streams, they have not persisted in most locations. Currently, they are documented as present in only three assessment area streams: upper Little Rock Creek, Bear Creek, and the upper Santa Ana River.

Crayfish *(Procambarus clarkii)*

Non-native crayfish are commonly sold as live bait and have been widely introduced into streams, lakes, and ponds. Crayfish are omnivorous and thus consume aquatic plants, algae, invertebrates, amphibian eggs, and fish eggs (Hobbs et al. 1989). In laboratory and field experiments, Gamradt and Kats (1996) found that crayfish were effective predators of California newt (*Taricha torosa*) egg masses and larvae, inflicting mortality rates of greater than 80 percent.

In natural habitat within the Santa Monica Mountains of southern California, newts were absent from all streams where crayfish were present (Gamradt and Kats 1996). In one instance where crayfish were washed out of a stream by winter floods, newts were back breeding in the stream the next summer.

Crayfish have been documented in forty-three streams within the assessment area.

Mosquitofish *(Gambusia affinis)*

Mosquitofish are distributed freely by county vector-control personnel (Gamradt and Kats 1996) and thus have been introduced into a large number of aquatic habitats. Once believed to be an environmentally benign biological agent for mosquito control, studies have since determined that they can cause considerable ecological impact (Dudley and Collins 1995). Mosquitofish prey on amphibian eggs and hatchlings (Grubb 1972; Gamradt and Kats 1996) and are capable of dramatically altering aquatic community structure (Hurlbert et al. 1972).

In the Santa Monica Mountains, Gamradt and Kats (1996) found that California newts were present in all eight streams where mosquitofish and crayfish were absent, but newts were absent from all four streams that contained either of these two exotics.

Our database shows that mosquitofish are present in forty-seven drainages within the assessment area. This is likely to be a substantial undercount, however, since mosquitofish are often taken for granted and not recorded in fish surveys.

Brown-Headed Cowbird *(Molothrus ater)*

Brown-headed cowbirds are brood parasites that lay their eggs in the nests of other "host" birds, particularly those that build open-cup nests (fig 3.7). Because many hosts raise cowbird young instead of their own,

Figure 3.7. Speckled brown-headed cowbird eggs in a least Bell's vireo nest. The cowbird hatchlings will be fed and raised by the adult vireos as if they were their own offspring. USFWS

brood parasitism can substantially reduce host breeding productivity. High levels of brood parasitism can threaten some host populations; thus, cowbirds have been implicated in the decline of many North American birds (reviewed in Robinson et al. 1995).

Brown-headed cowbirds are native to North America but prior to European settlement were largely confined to short-grass prairies in the middle of the continent (Mayfield 1965). Cowbirds feed by walking on the ground in areas of short grass and bare ground. They originally followed the herds of bison present in the prairies and are likely to have used scattered trees and riparian woodlands within prairie areas for nest searching (Robinson et al. 1995).

European settlement was beneficial to cowbirds and enabled them to expand their range both westward and eastward. Irrigated agriculture, livestock grazing, and urbanization all facilitated the spread of cowbirds and they were well established in coastal southern California by the 1920s (Rothstein 1994).

In southern California, cowbirds reach their highest densities near dairies, stables, and other areas where livestock are concentrated and provided with supplemental food. Cowbirds forage on insects attracted by the livestock concentrations and on the hay and grain that are supplied to such areas (Rothstein et al. 1980). They are capable of traveling considerable distances between foraging sites and breeding areas. In the San Luis Rey River Valley in San Diego County, Nickel (1992) found radio-tagged male cowbirds travelling as much as 5.4 miles (9 kilometers) from foraging to breeding sites. Females traveled a maximum of 2.1 miles (3.5 kilometers) (Nickel 1992).

Cowbirds occur throughout the assessment area but are especially numerous in the foothills where riparian woodlands are in close proximity to grass or agricultural lands. Riparian woodlands support a rich diversity of nesting birds from which the cowbirds select hosts (Unitt 1984). Densities of cowbirds are much lower in montane coniferous forests (Verner and Ritter 1983) and desert-montane habitats where high-quality foraging habitat is scarce.

Many birds are parasitized by cowbirds in southern California, including threatened and endangered species such as the least Bell's vireo, southwestern willow flycatcher, and California gnatcatcher. One of the primary recovery actions for the least Bell's vireo has been the widespread trapping of cowbirds near known vireo populations (Beezley and Rieger 1987). These trapping efforts have been highly successful in some areas.

On the Santa Margarita River within the Camp Pendleton Marine Corps Base, the rate of cowbird parasitism on least Bell's vireo nests was at 47 percent in 1983 when the base began an intensive cowbird trapping program. With annual trapping, by 1990 the brood parasitism rate had dropped to less than 1 percent (Griffith and Griffith, in press). The population of Bell's vireos on the Santa Margarita River rose from 60 pairs in 1983 to 319 pairs in 1993 (Griffith and Griffith 1995). Since the initiation of annual cowbird removal programs, similarly dramatic population increases have occurred on the Tijuana and San Luis Rey rivers and in the Prado Basin (Kus 1995; Kus 1996; Pike and Hays 1997).

European Starling *(Sturnus vulgaris)*

European starlings cause ecological problems because of their sheer abundance and their ability to outcompete native birds for nest sites in tree cavities. Starlings have benefited from human habitat modifications, irrigated agriculture in particular (Ehrlich et al. 1988).

First introduced in New York City in 1890, starlings were first documented in California in the 1940s (Jewett 1942). Populations in southern California apparently exploded in the 1960s. San Diego Christmas Bird Counts during the 1960s show the following pattern in starling numbers: 153 in 1963, 974 in 1964, 1500 in 1965, 4,448 in 1968, and 7,928 in 1969 (Unitt 1984).

The purple martin is a native bird whose decline in southern California has been largely attributed to competition for nest sites from starlings (Garrett and Dunn 1981). Western bluebirds have also been significantly affected.

Argentine Ants *(Linepithema humile)*

Argentine ants are abundant in many areas of human habitation, particularly where there is irrigated landscaping. They have spread into wildland habitats from developed areas and thus are primarily a problem near the urban interface and in areas fragmented by development.

Suarez et al. (1998) studied Argentine ant invasions in habitat fragments of various sizes in urbanized coastal San Diego County. Argentine ants were found in each fragment, but activity was correlated with proximity to the urban edge and the amount of exotic vegetation. Activity was always high within 320 feet (100 meters) of an urban edge.

Areas invaded by Argentine ants had fewer native ant species than uninvaded areas. Species most frequently absent in areas occupied by Argentine ants were army ants (*Neivamyrmex* spp.) and harvester ants (genera *Messor* and *Pogonomyrmex*) (Suarez et al. 1998). Studies elsewhere have documented similar declines in the abundance of native ant species in areas where the Argentine ant has become established (Ward 1987; Holway 1995).

Ants and other invertebrates are fundamental components of many ecological communities and large shifts in abundance and species composition are likely to have significant effects on other species. Harvester ants are an important food source for the coast horned lizard. These lizards appear to be declining in natural habitat fragments in southern California. This decline may be related to the influence of Argentine ants on harvester ants.

Red Imported Fire Ants *(Solenopsis invicta)*

Red imported fire ants have only recently invaded southern California. They were first discovered in November 1998 at a nursery and golf course in Orange County (CDFA 1998; Schoch 1999). Since that time, colonies have been discovered in San Diego, Los Angeles, Riverside, and Kern counties (CDFA 1999). The ant is now thought to have been present in the region for five to seven years (anonymous 1999).

The red imported fire ant is native to the Pantanal region of Brazil, Paraguay, and Argentina, and is thought to have been accidentally introduced multiple times to Mobile, Alabama, between 1933 and 1945 (Buren et al. 1974; Greenberg et al. 1999). Concerns about its arrival in southern California stem from the well-documented damage caused by infestations of red imported fire ants in twelve southeastern states. In that region, the ant has invaded residential areas and some natural habitats. It aggressively stings when disturbed and thus is considered to be a major nuisance pest in developed areas.

From an ecological standpoint, the threat posed by imported fire ants is similar to that of the Argentine ant, although perhaps greater in magnitude. Like the Argentine ant, the red imported fire ant readily invades disturbed areas around human habitation. It requires moisture and cannot survive cold temperatures (Vinson and Greenberg 1986). Thus, occupation of wildlands is expected to be limited to lower elevation riparian zones or irrigated areas adjacent to urban areas. However, red imported fire ants have recently invaded areas of west Texas formerly thought to be too dry for the species, and there is evidence that this represents a heritable adaptation (Mackay and Fagerlund 1997; Li and Heinz 1998; Phillips et al. 1996). Thus, there is potential for the ants to eventually occupy portions of California previously thought to be too dry. At a minimum, they pose a threat to the integrity of any habitats that lie along the urban-wildland interface, particularly small wildland patches that are largely surrounded by development or irrigated land.

Similar to the Argentine ant, red imported fire ants have greatly reduced the abundance of native ants and other invertebrates in portions of the southeastern United States (Porter and Savignano 1990; Morris and Steigman 1993). Yet, they have the additional impact of being an aggressive predator of vertebrate nests and young, commonly swarming the nests of ground-nesting birds, mammals, and reptiles (Hill 1969; Mount et al. 1981; Ridlehuber 1982; Drees 1994; Allen et al. 1995).

Management Considerations for Exotic Species Control

Exotic species are widespread and most are difficult to eradicate even from small areas. The potential is high for control efforts to be ineffective if they are not carefully planned and sustained. Consequently, management activities to control exotics should (1) have clearly defined and achievable objectives, (2) be sustained over time, and (3) be monitored in an adaptive management framework to ensure objectives are being met and the most effective techniques are being used.

To succeed, exotic species control efforts probably need to be narrowly targeted to specific key areas where both the circumstances for control are favorable and the potential for recovery of rare habitats or species is high. Examples of successful, targeted control efforts currently ongoing within the assessment area include:

- Arundo removal to restore high-quality, low-elevation riparian habitat along San Francisquito Creek and Elizabeth Lake Canyon in the Angeles National Forest and along the Santa Margarita River in San Diego County;
- Brown-headed cowbird trapping to control nest parasitism on the southwestern willow flycatcher and least Bell's vireo along the San Luis Rey River in the Cleveland National Forest;
- Bullfrog control to improve arroyo toad and red-legged frog survivorship along portions of Sespe Creek in the Los Padres National Forest; and
- Mediterranean grass control through the careful timing of prescribed fire to increase the abundance of native grasses and forbs and improve Engelmann oak regeneration on the Santa Rosa Plateau Reserve in Riverside County.

Another important management consideration is how best to minimize or prevent additional introductions of undesirable, nonnative species. This is a difficult task, since introductions can occur in a multitude of ways that are usually difficult to anticipate and prevent. However, some feasible preventative measures include (1) close coordination with CDFG representatives on planned introductions and stockings; and (2) careful screening of seed mixes or plantings used for erosion control, landscaping of recreation facilities, and habitat restoration projects.

The Influence of Native Insect and Disease Outbreaks

Vegetation is continually preyed upon by indigenous insects and pathogens. Most of the time these organisms remain at levels where they do not cause rapid, large-scale changes in the structure or composition of plant communities. Yet certain conditions can trigger major insect or disease outbreaks that result in substantial plant mortality. The specific insects and diseases prone to damaging outbreaks are often described as pest species.

Historically, pests of forest trees have received more attention than those of other native plants, perhaps because of the economic value of the commodity affected and the highly visible nature of concentrated tree mortality. Native insect herbivores and pathogens of forest trees perform important functions in natural ecosystems, killing decadent trees, creating dead and down woody habitat for other species, recycling nutrients, and creating gaps for regeneration (Pronos et al. 1999). However, these pests also increase fuel loading, contributing to fire hazards in forests. The following discussion concerns the major forest pests (in terms of numbers of trees damaged or killed) in southern California.

The pests discussed below are not inclusive; there are many other insects and pathogens of importance in southern California forests. Of particular interest here are those pest species whose populations have greatly increased as a result of twentieth-century management activities, particularly tree removal and changes in natural fire regimes.

Root Diseases

Foremost among the root diseases in southern California is annosus root disease of pine, caused by a strain of *Heterobasidion annosum.* This fungus colonizes freshly cut, untreated conifer stumps and grows down through the woody tissue and into the roots, where it may survive saprophytically for up to fifty years. Live pines and other susceptible woody plants become infected when their roots contact infected roots in the soil. The fungus may kill the pines directly or debilitate them to the point where they are readily colonized and killed by bark beetles or other woodboring insects (Smith 1993). Annosus root disease has significantly reduced vegetative cover in some recreation sites, particularly since the openings created by the disease cannot be replanted with pines. Infection by this pathogen can be prevented by treating freshly cut stumps with borate (Sporax®)(Graham 1970; Smith 1970). Tree removal in southern California forests, particularly in the years prior to the mid-1970s, when borate treatment became common, is thought to be responsible for the widespread occurence of annosus root disease centers. This disease is particularly common in the Jeffrey pine forests of Laguna Mountain and to the northeast of Big Bear Lake in the San Bernardino Mountains where western juniper is also affected, and in the mixed conifer forests of the San Bernardino and San Gabriel mountains, as well as in other forested lands in the Transverse and Peninsular ranges.

Another strain of *H. annosum* causes a root, butt, and heart rot of true fir. The fungus enters the wood through logging and other injuries, fire scars, broken tops, and freshly cut stumps (Scharpf and Goheen 1993). In firs this disease causes a general decline rather than rapid mortality, and is found in mixed conifer forests throughout the Transverse and Peninsular ranges.

Black stain root disease, caused by *Leptographium wageneri,* causes extensive mortality in one species of single leaf pinyon pine *(P. monophylla)* in portions of the San Bernardino Mountains, but not elsewhere in southern California. In the San Bernardino Mountains, 8,000 acres are reported to be affected. The disease has not been reported from two southern California endemics, *P. californiarum* ssp. *californiarum,* a lower elevation single leaf pinyon, and *P. quadrifolia,* Parry pinyon. Spread is through root contact and most likely, though not adquately investigated, through the activities of root-feeding insects. Trees infected with black stain are often attacked and killed by the pinyon pine engraver, *Ips confusus* (see below), although the disease alone often kills trees. This disease is second only to stand-replacing fires as a mortality agent in pinyon. It is not known if management activities have affected the incidence of the disease (Merrill et al. 1992).

Armillaria root disease, caused by *Armillaria mellea,* can build up on dead or dying native oaks and attack and kill young conifers nearby. In southern California this fungus does not cause extensive mortality but can be a problem when large oaks are removed from a site and conifers are planted. The newly killed oak stumps provide a large food base, allowing the fungus to grow rapidly and overcome nearby conifers.

Dwarf and True (Leafy) Mistletoes

The dwarf mistletoes *(Arceuthobium* spp.) are serious parasites of pines in southern California. These mistletoes are both water and nutrient parasites, and heavily infected trees are readily killed by bark beetles and other insects or drought. The most widespread species are the western dwarf mistletoe, *A. campylopodum*—which infects ponderosa, Jeffrey, knobcone, and Coulter pine—and sugar pine dwarf mistletoe, *A. californicum,* which infects sugar pine. *A. occidentale,* which infects gray (foothill) pine, as well as *A. divaricatum,* in pinyon pines, and *A. cyanocarpum,* in limber pine, also occur in southern California (Scharpf and Hawksworth 1993). Although birds can carry dwarf mistletoe seeds on their feet and feathers, infection most often occurs as a result of the forceful ejection of seeds from the female plant. Thus, susceptible understory trees can be infected by mistletoe in the overstory.

Management of dwarf mistletoes can be accomplished by removing diseased overstory, isolation of susceptible understory from diseased overstory trees by distance or the use of buffers (nonhost trees planted between the infected and uninfected trees), and pruning or removal of infected trees (Scharpf et al. 1988). The latter method is used in southern California campgrounds and other high-use recreation sites where the value of individual trees can justify treatment costs. Dwarf mistletoe is a good example of an organism which should not be considered a pest where infection, dieback, and some tree mortality do not interfere with management objectives. The mistletoe plants support their own herbivores, and the witches' brooms, dead limbs, and dead trees that result from mistletoe infections create habitat for other species.

It is not known if fire suppression and other management activities in the twentieth century have changed the relative abundance of dwarf mistletoes. Stand-replacing fires can eliminate local populations as the host trees are able to return to sites more rapidly than their mistletoe parasites. Spotty fires can leave infested overstory trees which both regenerate the stand and reinfect it. Heavily infested stands may contain more fuels because of the accumulation of dead witches' brooms and trees, and fires in them may turn into conflagrations. Smoke may inhibit dwarf mistletoe seed germination, depending on length of exposure (all reviewed by Hawksworth and Wiens 1996). It is likely that prior to the arrival of Europeans in southern California, dwarf mistletoes were abundant, at least in patches.

True mistletoes, *Phoradendron* spp., infect hardwoods, white fir, incense-cedar, and junipers in southern California. Unlike dwarf mistletoes, these species photosynthesize and are primarily water parasites and thus are far less damaging to their hosts. The berries are eaten by birds, which then disperse the seeds. True mistletoes can be serious pests where individual trees are of high value, such as in campgrounds. Heavily infected trees have reduced growth rates, are weakened, and are sometimes killed outright. Weakened trees may be attacked and killed by insects or may succumb in times of drought. There is no evidence that general management activities have increased the frequency of infection by these species, except perhaps in the case of white fir, where fire suppression is thought to have increased the occurrence of the host and thus, too, of the parasite. Mistletoe infections in white fir contribute, with annosus root and butt rot, to general decline of trees, leading to topkill or whole tree mortality when insects (particularly bark beetles and roundheaded borers) attack.

Bark Beetles

Beetles in the family Scolytidae are best known for delivering the "coup de grâce" to conifers stressed by disease, drought, or other factors. When populations of some species build up during droughts, even vigorously growing trees may be successfully attacked and killed. Two genera are primarily responsible for pine mortality in southern California, *Dendroctonus* and *Ips.* The former includes species such as the western pine beetle, *D. brevicomis,* which has several generations per year and can build up rapidly in stressed trees. This species has been associated with widespread Coulter pine mortality on the western slopes of the San Jacinto Mountains and portions of Palomar Mountain in the early 1990s (Merrill, pers. obs.; Merrill 1991), as well as historically in Lost Valley and the northern slope of Hot Springs Mountain in San Diego County (Hall 1958). Other species in the genus—including the Jeffrey and mountain pine beetles, *D. jeffreyi* and *D. ponderosae*, respectively—have one generation per year. Like *D. brevicomis,* these species can attack and kill otherwise vigorous trees when beetle populations are high. In southern California these beetles are most often found in Jeffrey pine *(D. jeffreyi)*, and ponderosa and sugar pines *(D. ponderosae)*. For unknown reasons both species have patchy distributions among the mountains of the Transverse and Peninsular ranges in southern and Baja California. *D. valens,* the red turpentine beetle, infests freshly cut stumps and roots and lower bole of living trees, particularly those damaged by fire or root disease. This species rarely causes tree mortality but does contribute to the decline of trees which are then attacked by more aggressive species (Furniss and Carolin 1977).

Ips species are commonly called engraver beetles for their habit of feeding on (engraving) the cambial surface of the xylem as well as the phloem of pines. These beetles are usually not considered as aggressive as *Dendroctonus* spp., although they are responsible for much tree mortality, particularly of pinyon pines with black stain root disease (the pinyon ips, *I. confusus)* and smaller diameter trees or portions of trees. For example, *I. paraconfusus* and *I. pini* commonly kill tops of large pines. *I. emarginatus* can kill Jeffrey, ponderosa, sugar, and lodgepole pine in southern California. All of these species of *Ips* have several generations per year. *Ips* beetle populations may build up in slash to levels where small diameter trees and tops of mature trees in the vicinity are at risk for attack. Thus proper sanitation is believed to be essential to the management of these beetles (Furniss and Carolin 1977).

Scolytus ventralis, the fir engraver, is the most commonly found bark beetle in white fir. This nonaggressive scolytid may kill patches of the phloem, which may heal over; tops of trees; and whole trees; depending upon the size of the trees and the relative level of stress to the trees from pathogens and other agents (Furniss and Carolin 1977).

Preventing losses to bark beetles requires keeping stressors—such as root disease and dwarf mistletoe—at low levels. Thinning to reduce stocking density should be used to reduce the risk of drought stress, but shortages of personnel and Timber Stand Improvement (TSI) dollars have reduced the number of acres thinned in recent years. Forest Pest Management pest prevention and suppression dollars can be used, when available, to thin stands at risk of bark beetle-caused mortality, and to suppress dwarf mistletoe and other pests.

Round and Flatheaded Borers

Round and flatheaded beetles are sometimes important mortality agents. Two species are of particular importance in southern California, the California flatheaded borer, *Melanophila californica* (Buprestidae), and the roundheaded fir borer, *Tetropium abietis* (Cerambycidae). *M. californica* infests and kills mature to decadent trees and is usually found in dying trees in the largest diameter classes, e.g., the large old Jeffrey pines which were once common on Laguna Mountain in San Diego County. *T. abietis* is a common mortality agent of white fir stressed by other pests, drought, or poor growing conditions (Pronos et al. 1999). Other cerambycids and buprestids feed in dead and dying trees, returning nutrients to the soil and serving themselves as food for birds. These insects are sometimes considered pests because their feeding decreases the value of lumber (Furniss and Carolin 1977). Fire suppression is thought to have increased the proportion of white fir in stands that were formerly primarily pine, increasing the abundance of *T. abietis* and other pests on the off-site firs.

The Influence of Recreation Activities

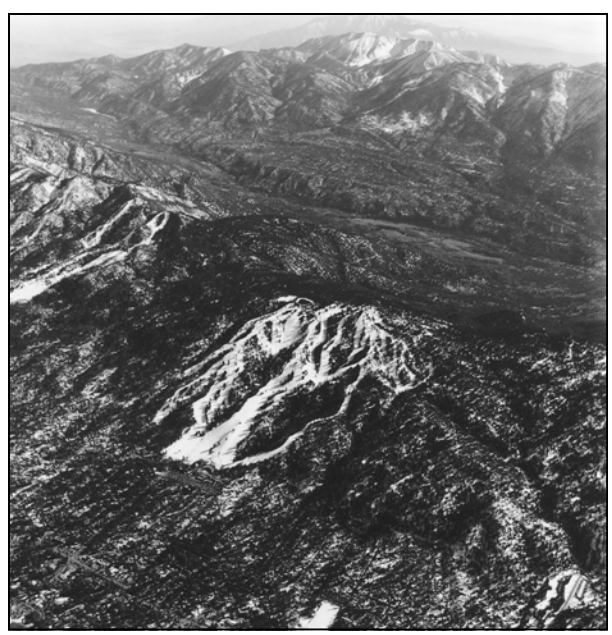
Public lands in the southern California mountains and foothills are popular outdoor recreation areas. Recreation is the principal land use activity in the region's state and county parks and it is also the most common activity in the national forests. With a rapidly growing urban population nearby, the number of recreationists visiting the assessment area is steadily increasing. Some go in search of calm and serenity, while others pursue adventure, excitement, or simply escape from the urban environment. Activities that fall into the category of outdoor recreation include, although are by no means limited to, camping, picnicking, driving, hiking, site-seeing, wildlife viewing, hunting, fishing, target shooting, off-highway vehicle (OHV) driving, horseback riding, mountain bike riding, skiing, and mountain climbing.

The land management agencies do a variety of things to accommodate and enhance these outdoor recreation experiences. A vast network of roads and trails is maintained. Picnic areas and campgrounds (both developed and remote) are established and maintained. Information centers and interpretive programs are provided. Through special use permits, sites are leased to private entities for downhill ski area developments (fig. 3.8), organizational youth camps, recreation residences, and shooting ranges. Habitat improvement projects are undertaken to enhance game and sport fish populations, and the California Department of Fish and Game stocks many lakes and streams with catchable fish. These developments and services are popular and there is a steady demand for improvements and additions.

While some level of recreation activity occurs almost everywhere, the vast majority is concentrated in a relatively small number of popular areas (fig 3.9). These areas are often associated with developed facilities and easily accessible by road. Developed sites provide a measure of environmental protection by keeping impacts localized and by providing facilities such as toilets and trash cans. However, concentration of activity also tends to cause ecological impacts (Boyle and Samson 1985). Frequent traffic in an area causes reductions in vegetative cover, with the rate of reduction being highly influenced by the type of activity (e.g., motorized vehicle or horse traffic reduces ground cover more rapidly than foot traffic)(Liddle 1997). Concentrated human activity is also more likely to cause incidental animal mortality (e.g., trampling of nests or egg masses) and can cause disturbance-sensitive species to avoid areas that would otherwise by suitable habitat (e.g., bighorn sheep).

Localized impacts from recreation activities can be relatively benign. Problems arise when high-use recreation areas overlap with sensitive habitats or rare species populations (table 3.14). In southern California, the potential for overlap is heightened by the fact that areas rich in rare habitats and species—riparian areas, montane meadows, and conifer forests—also tend to be popular locations for recreationists. In some of these areas, normally harmless activities become serious threats because of the extreme rarity or vulnerability of a species occurring in the vicinity.

Figure 3.8. An aerial view of ski area developments near Big Bear Lake on the San Bernardino National Forest. JOHN STEPHENSON



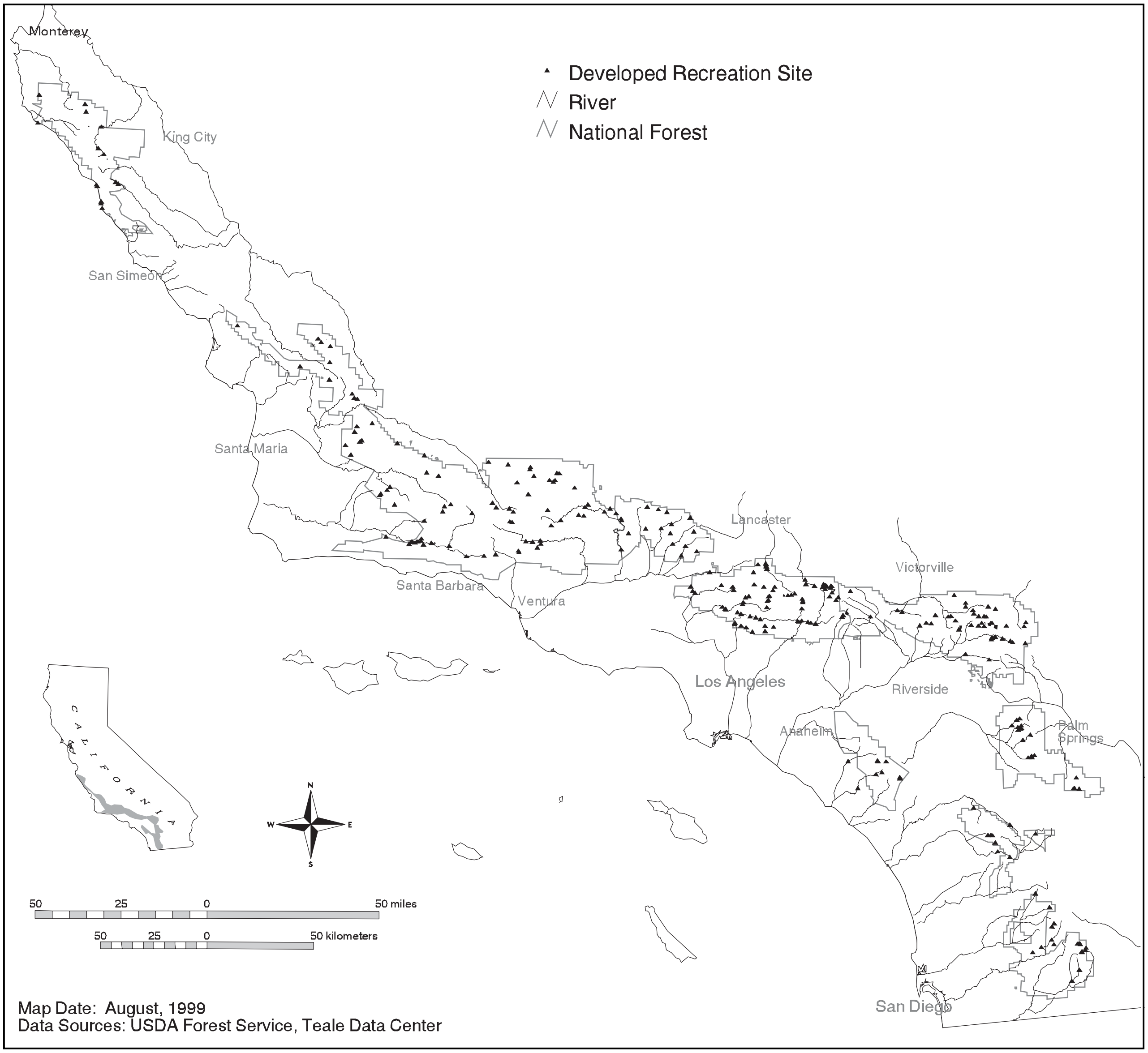


Figure 3.9. Developed recreation sites and other areas that receive concentrated recreation use in the assessment area.

For example, people walking in a creek is a normally harmless activity, but at certain times of the year in the few remaining areas where arroyo toads or mountain yellow-legged frogs still occur, it can greatly affect the survival of these imperiled species (Jennings 1998; Sweet 1992).

Our scientific understanding of the effects of recreation activities on wildlife is rudimentary at best (Knight and Cole 1995). Numerous studies on the ecological effects of recreation have been conducted, but the knowledge gained is disparate and seldom definitive (see reviews in Boyle and Sampson 1985; Hammitt and Cole 1987; Pomerantz et al. 1988; Gutzwiller 1991; Knight and Gutzwiller 1995; Liddle 1997). Making matters worse is the lack of scientific studies on the ecological effects of recreation activities in the southern California mountains and foothills. All of the local information we could find on this subject was based on anecdotal observations. There is a real need for formal scientific studies to assess the effects of recreation activities on rare species and habitats and to evaluate the efficacy of management actions currently being taken to avoid or mitigate those effects.

Table 3.14. Key ecological issues that are influenced by recreation activities.

Key Issues	Habitats/Species Most Affected	Effects Associated with Recreational Activities	Current Trends and Areas Most Affected
Declines in condition of sensitive habitats or direct mortality of rare species.	• Riparian habitat • Arroyo toad • Meadows • Pebble plains • Alpine plants	• Reductions in vegetative cover are common in areas that receive frequent recreation use • Direct mortality occurs primarily from vehicular traffic, but also is caused by trampling, pollution, or harassment (e.g., capturing or plinking slow moving animals) • Impacts are localized but can be significant; the level of impact is strongly related to the amount of use an area receives • Facilities operated by private entities under special use permit (e.g., ski areas, organizational camps, recreation residences) are sometimes located in sensitive habitats or near rare species.	• Recreation use is believed to be increasing in most areas; there is a high demand for additional recreation facilities • Popular recreation areas that also contain many rare species include Laguna Mtn., Big Bear Valley, Holcomb Valley, San Gabriel River, Little Rock Ck, Big Tujunga Ck, Sespe Ck, and Santa Ynez River • Popular trails to the summits of Mt. San Gorgonio, Mt. San Jacinto, Mt. San Antonio (Baldy) and Mt. Baden-Powell cause some impacts to alpine habitats
Indirect impacts to disturbance-sensitive species.	• Bighorn sheep • Mule deer fawning habitat (meadows) • Bat roosts (abandoned mines and buildings	• Bighorn sheep are extremely sensitive to human activity and move to avoid it; this has caused them to retreat from some of their most suitable habitat areas. • Mule deer will avoid suitable fawning habitat if there is a lot of human activity • Bats will abandon roost sites if there is a a high level of human activity	• Bighorn sheep are being affected in the eastern San Jacinto Mts near Palm Springs and in the San Gabriel Mts in Lytle Creek and around Mt. Baldy • Some of the best fawning habitat in the upper Santa Ana River watershed is avoided by deer due to high levels of recreation use (Nicholson 1995)

Many of the anecdotal reports of negative recreation impacts pertain to riparian and aquatic habitats. Foothill river corridors are cool, pleasant places that are often only a short drive from urban areas. They attract recreationists in large numbers (fig. 3.10), and over the years that demand has been accommodated through the establishment of campgrounds and picnic areas in popular areas. Only recently has it been recognized that many of these same areas are also important habitats for imperiled species.

Developed recreation sites are particularly prevalent near low-gradient stream and terrace habitats occupied by the endangered arroyo toad (Sweet 1992; USFWS 1998a). Human activities in and around these sites (e.g., driving, biking, walking through the stream, and picking up animals) are reportedly causing significant adult mortality and declines in reproductive success (Sweet 1992; USFWS 1998a). Similar adverse effects resulting from recreational activity have been reported for pond turtles (Holland 1991), red-legged frogs (Jennings and Hayes 1994), and mountain yellow-legged frogs (Jennings 1995a, 1998).

Management efforts to avoid or mitigate these impacts include seasonal closures of some roads and recreation areas and restrictions on vehicle access in some areas (e.g., walk-in campgrounds). Most of these measures have only recently been instituted. Much could be learned by careful monitoring of their effectiveness, both in terms of controlling recreationists and reducing impacts to the target species.

Organizational camps, recreation areas, and public campgrounds are numerous in conifer forests and montane meadows (e.g., Laguna Mountain, Cuyamaca, Idyllwild, Barton Flats, Big Bear/Holcomb Valley, Lake Arrowhead, Big Pines, Crystal Lake, Mount Pinos/Cuddy Valley, and Pine Mountain). The facilities and interpretive programs provided in these areas offer important opportunities for young people from southern California's cities to learn about the natural environment. The organizational camps in particular tend to have strong environmental education programs and are conscientious about minimizing human impacts. However, in some areas these facilities overlap with highly sensitive ecological areas and can cause declines in habitat capability. Sensitive plants are particularly common in montane meadows and, in dense conifer forests, some recreation facilities are in close proximity to spotted owl nest sites. Nicholson (1995) reported that mule deer largely avoided areas regularly occupied by humans (e.g., campgrounds and summer cabins), to the extent that they did not utilize meadow habitats that would otherwise be high quality foraging and fawning areas.

Figure 3.10. Recreation use in and along the San Gabriel River, Angeles National Forest. ROBERT GOODMAN JR

Table 3.15. Key ecological issues that are influenced by the presence or density of roads.

Key Issues	Habitats/Species Most Affected	Effects Associated with Roads	Current Trends and Areas Most Affected
Declines in survival and recruitment rates of some species.	• Riparian habitats • Arroyo toad • Spadefoot toad	Animal mortality caused by vehicle traffic on roads can be substantial. Stream crossings and roads adjacent to riparian habitats pose particular concerns for slow-moving species (e.g. toads, frogs).	Roads on stream terraces and crossings in low-gradient foothill and desert streams are affecting the endangered arroyo toad. Seasonal closures and modifications to crossings are being done to reduce impacts.
Illegal collecting or poaching of animals.	• Mtn. kingsnakes • Rosy boas • Pond turtles • CA newts • Mule deer	Can cause substantial declines in species abundance in heavily collected areas. Roads facilitate this activity because collecting is almost invariably done along or near them.	It is difficult to determine trends in this activity.
Barriers to animal dispersal.	Mountain lions	Busy highways (particularly interstate highways) can be very difficult for some animals to cross, and may be resulting in population fragmentation.	Interstates 8 and 15 cross the Cleveland NF; I-10 and I-15 separate portions of the San Bernardino NF; I-5 runs between the Angeles and Los Padres NFs.
Declines in condition of sensitive habitats.	• Pebble plains • Riparian habitats	• Illegal or unauthorized activities are more likely to occur in roaded areas and are difficult to prevent; this includes pollution, vandalism, driving in unauthorized areas. • Increased flow of sediment into streams	There is little new road construction on public lands and some problem roads are being obliterated.

The Influence of Roads

Roads are the primary means by which people access the outdoors. Thus, the amount of human use in a area is highly correlated with an area's road accessibility. There are many benefits to having areas accessible by road: it improves firefighting effectiveness, increases opportunities for habitat management work, and provides basic access to the public lands. However, the presence of roads also leads to impacts associated with vehicular traffic and increased human use (table 3.15).

Roads in and adjacent to riparian areas can cause substantial impacts. Roads located on stream terraces, or that frequently cross streams, can be a major source of mortality to slow-moving animals such as the arroyo toad. These nocturnal toads actually move onto dirt roads at night to feed and many individuals can be killed by a few vehicles (USFWS 1998a). This is a particular problem in and around campgrounds that are located on stream terraces near arroyo toad breeding habitat (Sweet 1992). Similar problems of high mortality rates where a road runs close to breeding habitat have been observed for the spadefoot toad (E. Ervin, San Diego State University, pers. comm.).

Roads tend to cross streams in low-gradient reaches where the current slows. Unfortunately, those areas are also where sandy pools form, the primarily breeding habitat for arroyo toads. Vehicle traffic on roads that cross through, or adjacent to, breeding pools cause mortality of eggs and juvenile toads. Efforts are underway in several areas, particularly on the Los Padres and Cleveland national forests where this problem is most common, to modify stream crossings to reduce impacts to arroyo toads.

Unlawful activities tend to be a chronic problem in some road-accessible areas. Illegal collecting of reptiles, unauthorized woodcutting, illegal OHV activity, poaching, vandalism, and dumping of hazardous materials: all of these are difficult law enforcement issues that occur almost exclusively along or near roads. Non-native species introductions (both purposeful and inadvertent ones) also occur predominately in areas that are accessible by road. All of these things cause significant declines in habitat capability in localized areas. The inherent difficulty in preventing these impacts from occurring in roaded areas is a compelling reason for maintaining some areas in a roadless condition.

The increased flow of sediment into streams is one of the most commonly cited environmental effects of unpaved roads. Roads reportedly contribute more sediment to streams than any other land management activity (Gibbons and Salo 1973; Lee et al. 1997). Old roads that were not designed using current "Best Management Practices" (BMP) standards often have the greatest environmental impact, particularly if located in steep terrain (fig 3.11). Sediment production from logging roads in steep terrain in Idaho was 770 times higher than in undisturbed areas; approximately 71 percent of the increased sediment production was due to mass erosion and 29 percent was due to surface erosion (Megahan and Kidd 1972). Increases in mass erosion due to plugged culverts and fill slope failures are especially common on abandoned or unmaintained roads (Weaver et al. 1987).

Figure 3.11. Gully erosion caused by runoff from a culvert on Gator Road, Laguna Mountain, Cleveland National Forest. Restoration efforts have since been implemented and the area is recovering. DEVEREE VOLGARINO

As part of our watershed-scale analysis we looked at "roadedness" in several different ways. First, we identified all existing roadless areas that are larger than 1,000 acres (fig 3.12). Second, we looked separately at each watershed, calculating the percentage of the watershed that falls within 250 meters of an active road (table 3.16). Not surprisingly, many of these "least-roaded" watersheds also show up in table 2.15 (chapter 2) in the list of drainages that have high potential for maintaining aquatic ecological integrity due to low land use intensity and low numbers of exotic species.

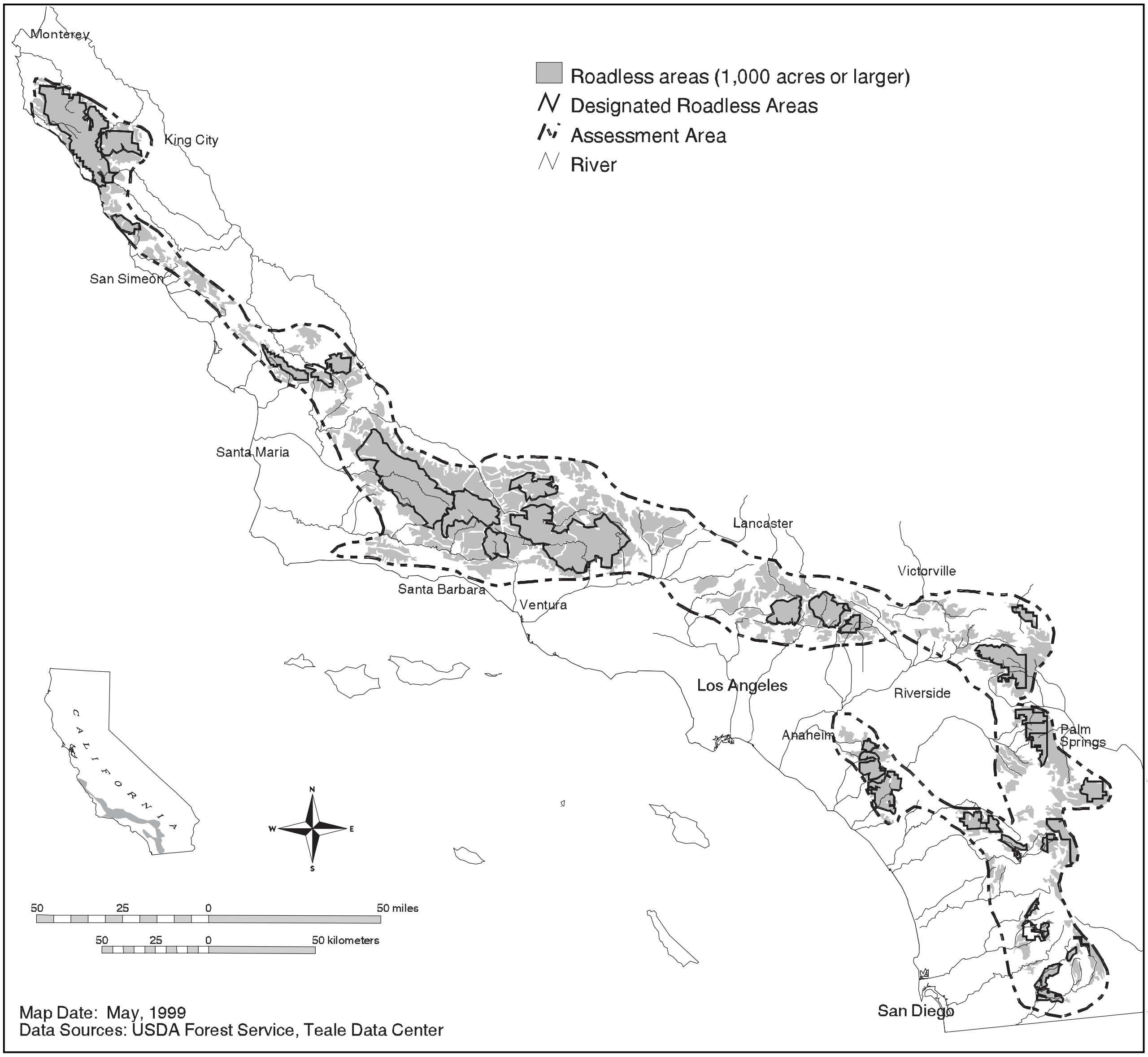


Figure 3.12. Roadless areas of 1,000 acres or more are shaded. The black lines outline the boundaries of formally designated roadless areas (i.e., designated wilderness areas or areas specified as unroaded in the Forest Plan).

Table 3.16. The fifteen least-roaded watersheds in the assessment area based on the percent of the watershed that lies within 250 meters of an existing road.

Watershed	Mountain Range Subarea	Percent of watershed that lies within 250 meters of a road	Percent public land in watershed
Sisquoc River (above Cuyama confl.)	So. Los Padres	10%	87%
Big Sur River	No. Santa Lucia	11%	84%
Upper Sespe Ck (above Timber Ck)	So. Los Padres	14%	96%
Upper San Gabriel R. (East Fork)	San Gabriel Mts	12%	98%
West Fk, San Gabriel R.	San Gabriel Mts	16%	
Little Rock Creek	San Gabriel Mts	15%	97%
Santa Cruz Creek	So. Los Padres	14%	72%
Upper Ventura River	So. Los Padres	14%	94%
Little Sur River	No. Santa Lucia	17%	56%
Up. Arroyo Grande (above Lopez Res.)	So. Santa Lucia	18%	
Up. Santa Ynez (above Gibraltar Res.)	So. Los Padres	18%	98%
Lower Sespe Ck (below Timber Ck)	So. Los Padres	19%	84%
Castaic Creek	Castaic Ranges	20%	93%
Palm Canyon	San Jacinto Mts	20%	30%
Deep Canyon	San Jacinto Mts	21%	37%

The Influence of Timber and Fuelwood Harvest

Most of the land base suitable for commercial timber harvest in southern California is within the San Bernardino National Forest. An active timber program was sustained on that forest from the late 1940s (post World War II) through the mid-1980s (fig 3.13). Harvest levels peaked in the 1960s, with 27.4 million board feet (MMBF) harvested on the San Bernardino National Forest in 1963 alone (McKelvey and Johnston 1992). Volume data from the California Department of Forestry and Fire Protection (1947 to 1978) and the California State Board of Equalization (1979 to 1990) for San Bernardino and Los Angeles counties show that 362.3 MMBF of timber were removed from those counties between 1947 and 1990 (McKelvey and Johnston 1992). Some of that would have come from the San Gabriel Mountains within the Angeles National Forest, but most was from the more densely forested San Bernardino Mountains.

Some commercial timber harvesting was done in the Cleveland and Los Padres national forests during peak years in the 1960s and 1970s, but it was short lived. The small volumes produced in these areas were not sufficient to support viable sawmill operations;

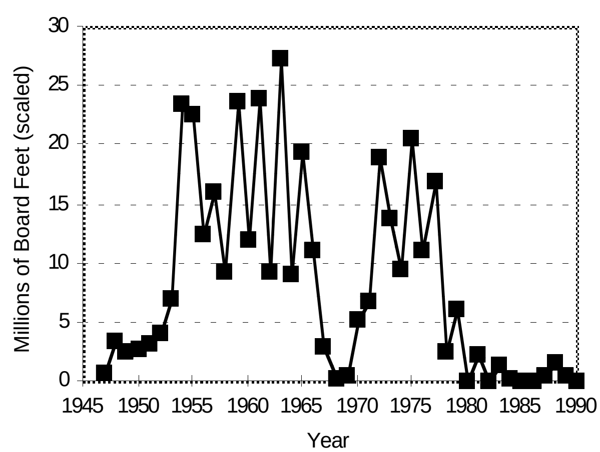


Figure 3.13. Logging intensity in San Bernardino and Los Angeles counties, 1947 to 1990. Most of this timber came off the San Bernardino National Forest (from McKelvey and Johnston 1992).

thus, timber had to be trucked long distances to the nearest mill. This same problem ultimately affected the San Bernardino National Forest timber program when dropping harvest levels in the late 1970s led to closure of the last mill in the area.

For the past decade (much longer in some areas), small timber programs on the southern forests have focused on (1) forest health issues (e.g., treatment of insect and disease centers, understory thinning, and fuels reduction); (2) administering individual permits to accommodate local demand for fuelwood; and (3) identifying and removing hazard trees. Small-scale salvage operations to remove trees killed by wildfire or bark beetles are also occasionally done.

When evaluating the influence of timber harvesting on southern California ecosystems, we must separately consider historic effects from current effects. Past timber harvesting, particularly in the San Bernardino and San Jacinto mountains, has probably resulted in a substantial reduction in the number of large trees, with ponderosa and Jeffrey pines incurring the greatest reductions. It may also have contributed to the increased dominance of white fir.

The Influence of Livestock Grazing

Livestock grazing has been a traditional activity on both public and private land in the southern California mountains and foothills since at least the early 1800s (Lockmann 1981). When assessing the effect of this activity on ecosystems and species, it is important to distinguish the impact of historic grazing from that which can be attributed to grazing levels occurring today. Abusive grazing practices in the late 1800s and early 1900s caused environmental changes that are orders of magnitude greater than anything seen in recent times.

Livestock numbers reached their peak in this region from approximately 1860 to 1900, when sheep grazing was in its heyday. Use was particularly high in the montane meadows of the San Bernardino and San Jacinto mountains; it is reported that 30,000 sheep were herded into Big Bear Valley in the late 1860s (Lockmann 1981). There are numerous accounts of extensive devegetation and erosion damage occurring during this period (Lockmann 1981; Minnich 1988) and, although sheep grazing was discontinued in the mountains in the early 1900s, the damage done was evident long afterwards (Pillsbury 1933).

Table 3.17. Key ecological issues that are influenced by fuelwood harvesting.

Key Issues	Habitats/Species Most Affected	Effects Associated with Fuelwood Harvest Activities	Current Trends and Areas Most Affected
Retention and recruitment of large diameter trees, snags (standing dead trees), and downed logs.	Cavity nesters, snag-dependent species.	Large snags that are reachable by roads can be difficult to retain because of unauthorized cutting. The same is true of large downed logs.	Snag retention requirements in existing Forest Plans are adequate, but enforcement is difficult in popular woodcutting areas.
Increases in small-diameter trees in the forest understory.	Mesic mixed conifer forests.	If fuelwood demand can be met through harvesting small trees, this activity could help control the problem.	Problem is most acute in the western San Bernardino Mtns. but is occurring in many montane conifer areas.

Since 1900, cattle have been the principal livestock animal on southern California rangelands. Grazing can occur year-round in foothill savannas and grasslands and during the summer months in montane meadows and forests (fig. 3.14). Over the years there has been a gradual decline in the intensity and extent of cattle grazing in this region. Once the dominant use of meadows in the San Bernardino and San Jacinto mountains, grazing has been greatly reduced in these ranges as ranching in the surrounding valleys has declined and other land use activities, particularly recreation, have received greater emphasis.

Today, grazing within the assessment area is concentrated in and adjacent to the Los Padres National Forest and, to a lesser extent, in the San Diego County foothills within and adjacent to the Cleveland National Forest (table 3.18) (fig. 3.15). Rangelands in these areas are predominantly oak savannas, grasslands, montane meadows, and openings in chaparral and scrub.

Ecological changes most commonly attributed to overgrazing by cattle involve declines in the condition of riparian, oak woodland, grassland, and meadow habitats. More specifically, livestock grazing has been implicated in reduced tree regeneration, substantial reductions in vegetative cover, streambank destablization, water quality degradation, and the spread of non-native weeds (table 3.19).

A comprehensive review of studies assessing the impact of livestock on California ecosystems, with particular emphasis on the Sierra Nevada, was recently conducted by a group of scientists with expertise in California rangeland issues (see Allen-Diaz et al. 1999). Their findings suggest that despite the many studies of grazing and its impact on ecosystems, there are still far more questions than answers regarding this issue. There appears to be a scarcity of studies which quantify the effects of different grazing intensities, frequencies, and seasons of use. Instead most studies simply compare the impacts of heavy

Figure 3.14. Livestock grazing at Hudson Ranch adjacent to the Los Padres National Forest. Brush Mountain can be seen in the background. DAVE CLENDENON

Table 3.18. Shows acres of national forest system land that are within grazing allotments, by mountain range and over the entire assessment area. Also, the percentage of all national forest system lands that are within these allotments. Some of the allotments are not currently being used.

Area within Forest Service Grazing Allotments	Cleveland NF		San Bernardino NF		Angeles NF		Los Padres NF			Entire Assessment Area
	San Diego Ranges	Santa Ana Mts	San Jacinto Mts	San Bernardino Mts	San Gabriel Mts	Castaic Ranges	S. Los Padres Ranges	S. Santa Lucia Rng	N. Santa Lucia Rng	
Acres	129,147	5,017	76,917	94,968	0	22,344	560,619	184,202	51,898	1,133,456
Percent of National Forest System Land	45%	4%	39%	24%		11%	44%	99%	59%	32%

Figure 3.15. Locations of current grazing allotments on national forest system lands within the assessment area.

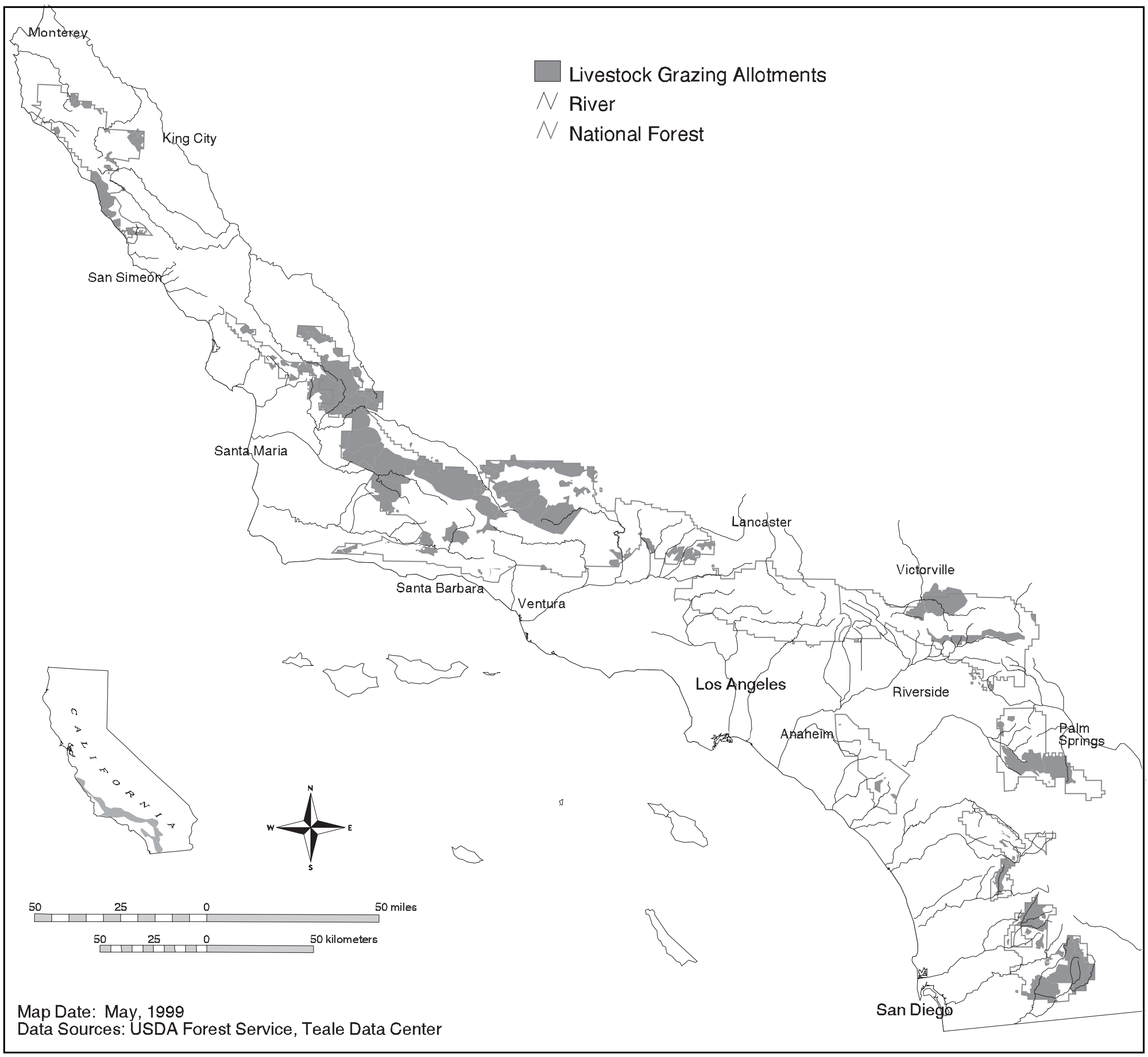


Table 3.19. Key ecological issues that are influenced by livestock grazing activities.

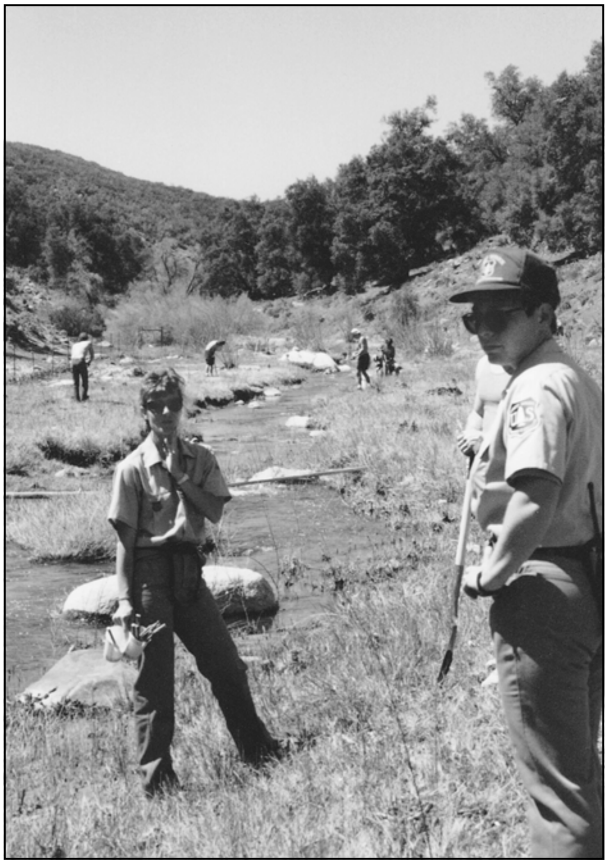
Key Issues	Habitats/Species Most Affected	Effects Associated with Livestock Grazing Activities	Current Trends and Areas Most Affected
Declines in condition of sensitive habitats or direct mortality of rare species.	• Riparian habitat • Meadows	Grazing in riparian areas can cause increased sediment yield, stream-bank degradation, reductions in vegetative cover, and direct mortality of rare species.	• Impacts have been reduced substantially in recent years due to excluding livestock from some riparian areas and improved management of stocking rates and season of use in other areas • Entrenched downcuts caused by past overgrazing still remain in some meadows
Lack of oak regeneration.	• Blue oak woodlands • Engelmann oak woodlands	Grazing can negatively affect oak regeneration through seedling removal and soil compaction.	Recent studies have shown that livestock grazing contributes to this problem but is not the sole or even the primary cause in most areas.
Spread of invasive non-native species e.g., brown-headed cowbirds, star thistle, Mediterranean grasses) .	• Riparian habitat • Grasslands • Oak woodlands • Least Bell's vireo • Willow flycatcher • CA gnatcatcher	• Studies suggest that grazing attracts cowbirds, but its influence varies based on other surrounding land uses • Overgrazing can facilitate spread of star thistle and other weeds	Grazing historically was a major factor in the spread of undesirable plants, but the continued spread of those plants today is often triggered by other factors.
Fuels reduction.	Nonspecific.	Grazing can be used as a tool for fuels reduction in grasslands and on fire breaks.	Some fuel breaks are currently maintained by livestock grazing.

grazing with no grazing (Blackburn 1984; Allen-Diaz et al. 1999). There are few solid scientific assessments of the ecological effects of management practices that fall in "the great middle ground" between abusive grazing and no grazing (Allen-Diaz et al. 1999).

Despite these limitations, some studies are pertinent to the ecological issues within our assessment area. The effect of grazing on riparian habitats and species is of interest because there are many sensitive resources in riparian areas and they are also a preferred habitat for cattle (Kie and Boroski 1996). Overgrazing by cattle was identified as a probable cause of limited cottonwood sapling establishment along much of the Nacimiento River in the northern Santa Lucia Range (Shanfield 1984). Studies on the Blitzen River in Oregon found dramatic increases in willow flycatcher and yellow warbler populations when the intensity of year-round cattle grazing was reduced and willow cutting and spraying were eliminated (Taylor 1986; Taylor and Littlefield 1986). The researchers hypothesized that the mechanism involved was that cattle grazing reduced willow nesting cover for these species.

Several studies have assessed the effect of livestock grazing on the survival of blue oak seedlings. The results have been mixed; some results suggest that grazing reduces blue oak recruitment while others show no effect (Davis et al. 1991; Allen-Diaz and Bartolome 1992). There is general consensus, however, that grazing is just one of many factors that may be affecting oak seedling survival.

Recent changes in the management of livestock grazing allotments on national forest system lands have included (1) fencing to



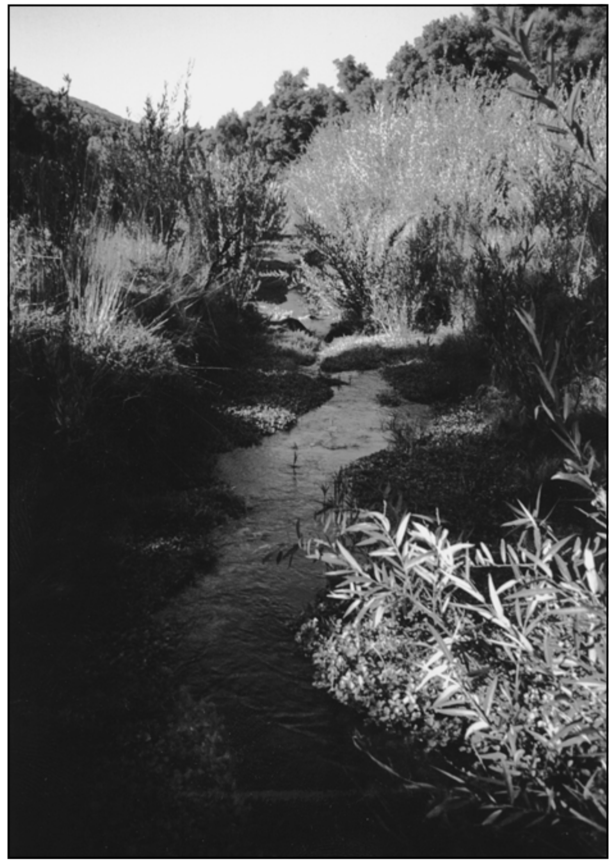


Figure 3.16. (Left) Overgrazing of cattle contributed significantly to reduced vegetative cover in the Las Bancas area of Pine Valley Creek, Cleveland National Forest in 1991. (Right) The same area along Pine Valley Creek supported dense riparian vegetation two years after cattle were excluded and native willows were planted. DEVEREE VOLGARINO

exclude cattle from some sensitive riparian and meadow habitats (figs. 3.16), (2) reductions in stocking rates, and (3) changes in the season of use, reducing the amount of summer/fall grazing in favor of a winter/early spring use regime.

The Influence of Mining

Much of the assessment area is under mining claim, with the notable exception of large portions of the San Gabriel Mountains, but commercial mining in the region is not extensive. Most claims are small, individual operations. The primary hub of mining activity is in the northeastern San Bernardino Mountains, where high-grade limestone deposits are extracted by several large companies in open-pit mines and quarries (fig. 3.17). Smaller limestone mines are also in operation at the north end of the San Rafael Mountains and in the Santa Lucia Ranges near Little Sur. There is also active exploration for oil and gas reserves occurring in southeastern portions of the Los Padres National Forest.

Ecological impacts from these operations are localized and present a significant problem mainly in areas where they overlap with

Figure 3.17. A limestone quarry in the San Bernardino Mountains. DEVEREE VOLGARINO

Table 3.20. Key ecological issues that are influenced by mining activities.

Key Issues	Habitats/Species Most Affected	Effects Associated with Mining Activities	Current Trends and Areas Most Affected
Habitat degradation or impacts to TES species from in-stream mining operations.	Aquatic and riparian habitats/species.	Suction dredging, sand and gravel mining, and some prospecting activities can cause localized habitat degradation and/or direct mortality to TES species. Of primary concern is where such activities overlap with occurrences of sensitive habitats or species.	Coordination between FS and CDFG is occurring to clarify permit process for suction dredging and identify areas for closure. Low-elevation, large-order streams are most affected. Suction dredging occurs frequently on the San Gabriel River.
Habitat degradation or impacts to TES species from hardrock mining.	Limestone outcrops and associated endemic plants.	• High-grade limestone deposits in the northeastern San Bernardino Mountains has led to the development of open-pit mines in an area where there are a large number of rare plants. • Active mining of tourmaline and other gemstones primarily on private lands in the Palomar Mountain area.	• A site-specific conservation strategy is currently being developed to address the San Bernardino Mts limestone issue. • Some localized habitat degradation is resulting from other hardrock mines, but in general the assessment area is not an active mining region.
Potential impacts to habitats or species from future development of existing mining claims.	Nonspecific, but greatest potential is in desert-montane habitats.	Much of the assessment area is under mining claims. There is potential for commercially viable deposits of low-grade gold, gemstones, or oil and gas.	Currently there are few active commercial mines outside of the San Bernardino Mountains, limestone region.

sensitive habitats or species (table 3.20). The most prominent example of such overlap is the occurrence of an entire assemblage of endemic, rare plants on high-grade limestone deposits in the San Bernardino Mountains.

A commonplace form of mining in the region's larger streams is suction dredging. Suction dredges utilize high-pressure water pumps driven by gasoline-powered motors which create suction in a flexible intake pipe. A mixture of streambed sediment and water is vacuumed into the intake pipe and passed over a sluice box mounted on a floating barge. Dense particles (including gold) are trapped in the sluice box. The remainder of the entrained material is discharged into the stream as "tailings" or "spoils," which can form large piles where dredges have remained in one location for a long period (Fredley 1995).

Suction dredging can have a number of impacts on aquatic habitats: (1) increased water turbidity, (2) disturbance of channel morphology and bottom substrates that serve as spawning areas for fish, and (3) direct mortality of fish and amphibian eggs and larvae in the sediment vacuuming process. The significance of these impacts varies by site and depends largely on the site's ecological integrity (e.g., naturalness of the hydrologic regime, other prevailing land uses, presence of rare or at risk species, and presence of exotic species).

The State of California regulates suction dredging activities. The Department of Fish and Game (CDFG) is required to issue permits to suction dredge if it determines that the operation will not be deleterious to fish. They can also institute seasonal closures to reduce impacts. The CDFG is currently conducting a statewide environmental review of its policy on suction dredging (USFWS 1998a).

Sand and gravel mining operations occur in a number of foothill drainages where there are well-developed alluvial deposits. Most of these operations are on private lands. Sand and gravel mines completely alter the drainage channel and usually result in the creation of deep pools.

The Influence of Private Land Development

Development on private lands is steadily consuming wildland habitats (fig. 3.18) and reducing connectivity between the natural areas that remain. This trend poses some significant challenges for conservation of habitats and species on public lands (table 3.21). In the southern end of the assessment area, rapid development has the potential to eliminate habitat corridors between the mountain ranges. These corridors are believed to be important for the movement of some wide-ranging animals. Mountain lions in particular are vulnerable to declines if individuals in one mountain range become cut off from the larger population (Beier 1993).

Development tends to simplify ecological communities, eliminating some species and increasing the abundance of others. Species with wide tolerances and generalized habitat requirements (common traits of exotic species) are the ones that typically thrive in developed areas. In addition, a number of plants commonly used in landscaping are on CalEPPC's list of Exotic Pest Plants of Greatest Ecological Concern, including arundo, tamarisk, ice plant, pampas grass, Russian olive, fountain grass, and Brazilian pepper tree.

Figure 3.18. Housing construction in an isolated area adjacent to the Cleveland National Forest. JOHN STEPHENSON

The Influence of Air Pollution

Long-term studies to determine the effects that air pollution is having on forest vegetation have occurred in the San Bernardino Mountains and, to a lesser extent, in the San Gabriel Mountains (Miller et al. 1996; Miller and McBride 1999). Prevailing climatic conditions transport most of the air pollution from the Los Angeles Basin into these mountains (Miller et al. 1989). The two depositional components of air pollution that have the greatest effect on ecosystems are ozone (reviewed in Miller et al. 1996) and nitrogen (reviewed in Bytnerowicz and Fenn 1996).

Ozone Deposition

Studies have determined that ponderosa and Jeffrey pine trees, and to a lesser extent bigcone Douglas-fir, are experiencing foliage injury from ozone deposition (Miller et al. 1989; Peterson et al. 1995). Other tree species in the area appear to be considerably more tolerant of ozone. Chronic ozone injury to ponderosa pines was first identified in the San Bernardino Mountains in the 1950s (Miller et al. 1963). Mortality and damage was highest in the 1970s when ozone concentrations reached their peak. Ozone concentrations steadily declined between 1976 and 1991 and a concurrent reduction in injury to the crowns of ponderosa and Jeffrey pines was observed (Miller et al. 1996).

Table 3.21. Key ecological issues that are influenced by development on private lands.

Key Issues	Habitats/Species Most Affected	Effects Associated with Private Land Development	Current Trends and Areas Most Affected
The distribution, extent, and integrity of habitats and species which occur predominantly on private lands.	• Coastal sage scrub • Engelmann oak woodland • Valley oak woodland • Grassland • Montane meadow	Development on private land is reducing the extent of native habitats and fragmenting those habitats into disjunct patches. This increases the significance of these habitats on public lands.	Development is occurring most rapidly in Orange, San Diego, Riverside, San Bernardino, Ventura, and Santa Barbara counties. Several counties are developing habitat or species conservation plans which attempt to conserve key areas and provide corridors to the surrounding public lands.
Fragmentation of animal populations caused by the loss of wildland habitat corridors between mountain ranges.	Species with large area requirements that disperse along or near the ground (e.g., mountain lions).	Buildout on private lands can eliminate habitat connections between mountain ranges unless natural habitat corridors are designated and protected.	Imperiled habitat connections include: Santa Ana Mts — Palomar Mtn; Palomar Mtn —San Jacinto Mts; San Jacinto Mts — San Bernardino Mts.
Effects associated with expansion of the urban–wildland interface.	• Peninsular bighorn sheep • Many habitats/ species affected by altered fire regime and spread of non-natives	• Drives disturbance-intolerant species away from preferred habitats • Increases the risk and difficulty of using fire as a management tool • Contributes to rise in invasive, non-native species	Urban interface is expanding rapidly on both the desert and coastal sides of the San Gabriel, San Bernardino, and San Jacinto mountains and on the coastal side of San Diego and southern Los Padres ranges.
Effects associated with increased urban infrastructure needs on public lands.	Nonspecific.	Power lines, pipelines, water storage, communication facilities, highways, landfills, sewage treatment areas, etc. can cause localized habitat degradation and habitat fragmentation and provide avenues for the spread of invasive, non-native species.	Requests for infrastructures to cross through or be located in the mountains are increasing as urban areas expand.

Pine mortality was highest during extended periods of low precipitation (droughts), when these trees are most vulnerable to bark beetles. Trees with chronic ozone injury enter a period of drought without the reserves required to mount an active defense against bark beetle attack (Miller et al. 1991).

In the San Bernardino Mountains, there is a clear west-to-east gradient in both ozone levels and tree damage. Forests on the western side of the range are exposed to much higher levels of ozone and are experiencing the most damage (Miller et al. 1989). Monitoring of study sites in the west-side forests over a fourteen-year period (1974 to 1988) found that ponderosa and Jeffrey pine are losing basal area in relation to competing species that are more tolerant to ozone, namely, white fir,

Table 3.22. Key ecological issues that are influenced by air pollution.

Key Issues	Habitats/Species Most Affected	Effects Associated with Air Pollution	Current Trends and Areas Most Affected
Vigor and longevity of forest trees, particularly of those species most sensitive to ozone damage; ramifications to structure and composition of mixed conifer forests.	• Ponderosa and Jeffrey pine • Bigcone Douglas-fir	High levels of ozone deposition is a chronic condition in some areas and is known to reduce the vigor of trees sensitive to it. This leads to increased mortality and appears to be contributing to a shift in tree species composition.	• Rates of ozone deposition have declined from 1970s peaks, but are still some of the highest in the U.S. • Western San Bernardino Mountains and eastern San Gabriel Mountains are most affected.
Shifts in the structure and composition of plant communities and reduced water quality related to excessive nitrogen inputs.	• Coastal sage scrub • Mixed conifer forests	High levels of nitrogen deposition is a chronic condition in some areas. Elevated nitrogen levels in the soil has a fertilizing effect for some species, altering community dynamics. Runoff into streams and groundwater is elevating water nitrate concentrations.	Western San Bernardino Mountains and eastern San Gabriel Mountains are highly affected, as are lowland areas on the coastal side of the mountains (e.g., western Riverside and San Bernardino counties).

incense-cedar, and black oak (Miller et al. 1996). The accumulation of more stems of ozone-tolerant species in the understory presents a fuel ladder situation that jeopardizes the remaining overstory trees in the event of a catastrophic fire.

Quantitative information on ozone damage is scarce for other mountain ranges within the assessment area. However, given the location of major pollution sources and prevailing wind patterns, it appears that areas of high potential for damage are probably confined to the eastern San Gabriel and western San Bernardino mountains (P. Miller, Riverside Fire Lab, pers. comm. 1997).

Nitrogen Deposition

The effects of nitrogen deposition on local forests and shrublands have not been studied for as long as ozone and are only beginning to become apparent. High rates of nitrogen deposition have increased soil fertility and surface litter decomposition rates in some mixed conifer forests in the San Bernardino Mountains (Fenn 1991b). However, excessive nitrogen inputs can lead to various negative effects, including nutrient deficiencies, soil acidification, altered species composition, decreases in mycorrhizal root symbiosis, and elevated concentrations of nitrate in soil, groundwater, and streams (Bytnerowicz and Fenn 1996; Padgett et al. in press). Recent studies in Riverside County indicate that high levels of nitrogen deposition may be contributing to the decline of coastal sage scrub and its conversion to Mediterranean annual grassland (Allen et al. 1997).

Spatial patterns in levels of nitrogen deposition mirror that described for ozone. Eastern Los Angeles County and western San Bernardino and Riverside counties receive the highest concentrations. In the mountains, the coastal side of the eastern San Gabriel and western San Bernardino mountains are the most polluted (Bytnerowicz and Fenn 1996). In montane conifer forests, the fertilizing effect of nitrogen may be accelerating understory development of white fir and incense-cedar, thereby elevating fuel loads and potentially increasing the risk of stand-replacing fires.

Riggan et al. (1985) reported elevated concentrations of particulate nitrate in stream water emanating from watersheds exposed to high nitrogen deposition in the San Gabriel

Mountains. Stream water particulate nitrate concentrations in watersheds heavily influenced by urban air pollution were one to three orders of magnitude greater than in watersheds which were not exposed to high concentrations of air pollution. Sharp peaks in particulate nitrate levels occur during the first winter storms when the ecosystem is loaded with nitrogen accumulated during the dry summer months. Additional information is needed on the extent of this problem and how it is affecting aquatic ecosystems.

Climate Change Considerations

The subject of long-term climate change is really beyond the scope of this report. Research on this topic is generally conducted at continental or global scales, making it difficult to determine how local landscapes might be influenced. However, several researchers have attempted to interpret predictions from global climate change models in terms of how southern California ecosystems, and in particularly local fire regimes, might be affected. Although highly speculative, some of the local climate change predictions described in those studies are worth describing.

Davis and Michaelsen (1995) and Westman and Malanson (1992) simulated the potential effects of climate change on fire regimes in southern California chaparral ecosystems. To figure out what those climate changes would be, they used predictions from three widely accepted general circulation models (GCMs) that assume a doubling of atmospheric carbon dioxide (CO_2). Under this scenario, several changes are predicted with varying levels of confidence.

The most probable climatic change occurring in the assessment area would be an increase in average daily maximum and minimum temperatures of 1 degree to 4 degrees Centigrade. There is more uncertainty associated with precipitation predictions, but the various GCM results are in general agreement that winter and spring precipitation should increase. The three GCMs predicted increases in precipitation for the months of November through March of 36, 21, and 21 percent. Predicted increases for March and April were 59, 17, and 27 percent (Davis and Michaelsen 1995).

The fire regime simulations were very sensitive to predicted increases in fire season temperatures and equally sensitive to large changes in stand productivity. Total area burned was predicted to increase and the fire-recurrence interval was predicted to significantly decrease (Davis and Michaelsen 1995). Westman and Malanson (1992) suggest that these changes could lead to potentially large changes in chaparral composition.

Chapter 2 – Mountain and Foothills Ecosystems

To understand the fashion of any life, one must know the land it is lived in and the procession of the year.

— *Mary Austin (1903)*

Key Questions

- What are the major ecological communities in the coastal mountains of southern California?
- What is known about the status and distribution of each?
- How have they changed in the last 100 to 200 years?
- What rare communities exist and what are their status and trends?

This chapter provides a large-scale overview of landscape patterns and ecological communities within the assessment area. A more detailed description of the specific ecological processes and human land uses affecting these ecosystems is presented in chapter 3. Here we focus on the extent and distribution of each type, its current condition, and its representation on public lands across the different mountain ranges. Much of this information is based on our GIS vegetation data. However, first we describe the coarse-filter analysis approach that is a major component of this assessment.

The Coarse-Filter, Habitat-Based Approach

According to the California Wildlife Habitat Relationships System (CWHR, version 5.2) and the California Flora Database (CALFLORA), the mountains and foothills of southern California are inhabited by 18 amphibian, 61 reptile, 299 bird, 104 mammal, and 2,900 vascular plants species (CDFG 1996; Dennis 1995). Added to that is an unknown multitude of invertebrate animals and nonvascular plants. We know very little about the specific habitat needs of the majority of these species. So how do we address all of this biological diversity in a feasible manner?

Until recently, wildlife management tended to focus on the needs of a few, high-profile species (mostly game animals and endangered species). Now the potential importance of all members of an ecosystem has been recognized and the focus has shifted away from single-species management and towards ecosystem-based conservation (Hansen et al. 1993; Manley et al. 1995; Haufler et al. 1996). The idea that conserving broad ecological communities may be the most efficient way to maintain species diversity has gained widespread acceptance and is implicit in the so-called coarse-filter approach (Noss 1987).

Originally developed by The Nature Conservancy, the coarse-filter approach assumes that a representative array of ecological communities will sustain the vast majority of species, including many of the ones we know little about (fig 2.1)(Hunter et al. 1988). By relying on retention of community types and providing an array of structures and compositions, we hope to "capture" most of the diversity in the system. However, we know that some species, subspecies, and rare communities have characteristics that make them "fall through the mesh" of the coarse filter and these need special attention (i.e., a finer filter). The fine-filter approach focuses on learning the specific needs of individual species and then providing for those needs, potentially through intensive management.

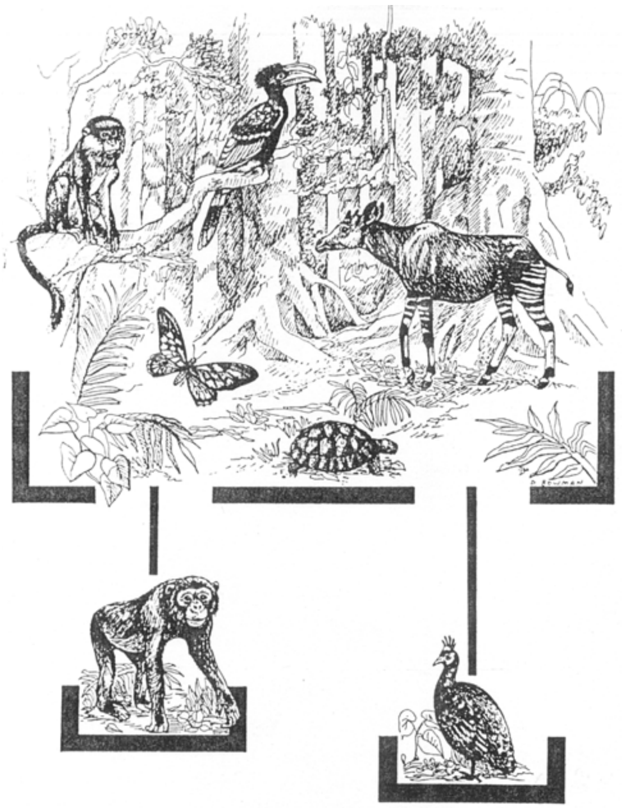


Figure 2.1. The coarse-filter approach to maintaining biological diversity focuses on protecting a representative array of communities and is based on the assumption that these communities will encompass the vast majority of species. The fine-filter approach focuses on saving individual species that slip through the coarse filter. As illustrated here, the coarse filter has been used to save a tract of Zaire's forest, while the fine-filter approach has been employed for the pygmy chimpanzee and Congo peafowl (from Hunter et al. 1988).

In this assessment we employed a combined coarse-filter/fine-filter approach. Fine-filter criteria were used to identify species that would receive individual consideration (fig 2.2). The criteria primarily target species that are rare and vulnerable. However, we also identified species that have a heightened status due to the high public interest that they generate. Thus, the fine-filter list is really divided into two distinct categories: (1) species potentially at risk and (2) species of high public interest. Each species identified in the fine-filter list does not necessarily require specific management attention. Rather, it suggests that their status and needs warrant individual consideration before deciding on a course of action.

Based on the fine-filter screening criteria, 184 animals and 256 plants made the focal species list. These species are addressed in chapters 4 and 5, "Species at Risk," and chapter 6, "Species of High Public Interest." All other plants and animals occurring within the assessment area will only be addressed indirectly, via the coarse-filter, community-level analysis.

The coarse-filter analysis procedure is quite simple: Current conditions are compared to reference conditions (based on how the landscape would look and function if people were not altering it), differences between the two are identified, the significance of the change is analyzed, and this information is fed into the decision-making process. However, the application of these ideas can be quite complicated (Sampson et al. 1997).

The reference conditions represent our best attempt to describe the ecological conditions, including their variability over space and time, under which native species evolved. If

Figure 2.2. Fine-filter criteria used to identify species that should receive individual consideration in this assessment. A species or subspecies made the list if it met one or more of the criteria.

Species Potentially at Risk:

- A Threatened, Endangered, or Proposed Species (federal and state)
- A former USFWS Candidate (C1 or C2) Species
- A Forest Service, Region 5 Sensitive Species
- A California Species of Special Concern
- A Riparian Obligate Species of Concern (as defined by California Partners in Flight)
- A species determined to have viability concerns at a local level

Species of High Public Interest:

- A major game animal
- A species that has particular public interest (e.g., mountain lion)

today's conditions are similar to the reference conditions, we are confident that adequate habitat is present for most species. The greater the deviation from the reference conditions, the more species may be at risk. (Sampson et al. 1997).

An inherent difficulty with this approach is that it is usually difficult to determine the "true" reference conditions and the natural range of variability. They must be inferred based on our knowledge of historic habitat conditions and on our understanding of key ecological processes such as fire, succession, and flooding. Since the historic record is frequently sketchy and inconclusive, there are usually several plausible theories on how the historic landscape might have looked and functioned.

These problems are compounded by the fact that we will often be managing outside the range of conditions that native species encountered in the past. In some places, the ecological systems are so altered that we will typically be outside the range of conditions that occurred historically (e.g., in dammed river systems or in grasslands that are now dominated by non-native species). Social considerations (e.g., reducing fire hazards near towns) and economic factors also affect our ability to remain in (or move toward) more "natural" landscapes. The farther we move from those conditions, the less successful we can expect the coarse-filter approach to be (Sampson et al. 1997).

Despite these difficulties, the coarse filter can be an effective approach for (1) retaining biological diversity in its broadest sense, (2) retaining critical but little understood processes (such as roles played by soil microbes), and (3) sustaining species that we currently know little about.

Broad-Scale Landscape Mosaics

From an airplane, land usually appears as a mosaic of patches, corridors, and matrix (Forman 1995). Woodlands, fields, and housing tracts often stand out as conspicuous patches. Rivers form equally striking corridors. In between the patches and corridors is the surrounding matrix — a dominant vegetation or land type, such as chaparral in the foothills or urbanized land in the Los Angeles Basin.

Across the southern California mountains and foothills region there are a few broad-scale landscape mosaics that are clearly recognizable and repeatedly encountered. In the coastal foothills the matrix is coastal scrub and chaparral interspersed with riparian corridors, oak woodlands, and grasslands. Above the foothills on often-steep lower mountain slopes, the mosaic shifts to patches of mixed hardwood/conifer forest scattered between large expanses of chaparral. As you move into the upper mountain region, pine and fir forests dominate the landscape and are punctuated with patches of black oak woodland, montane meadows, and chaparral. On the desert side of the mountain crest is another distinct landscape, dominated by sparse pinyon forests, juniper woodlands, desert scrub, and extensive areas of bare rock.

Key physical factors that seem to trigger broad-scale changes in the vegetation mosaic are elevation, distance from the coast, topography, and position on either the coastal or desert side of the mountain crest. These factors have a strong influence on precipitation amounts and temperature regimes, which in turn greatly influence the type of vegetation that grows. Today, human land use also plays a key role in shaping these land mosaics.

Below we describe and present a map (fig. 2.3) of the six large-scale vegetation mosaics that characterize the mountains and foothills of southern California. In reality these mosaics, or "landscapes" as we refer to them here, do not have distinct boundaries but rather have broad transition zones where different vegetation assemblages intergrade. However, each landscape has unifying characteristics that have important implications for resource management. These characteristics transcend the particulars of which mountain range or watershed the landscape may be found in. There are clear differences in the way each landscape type has historically been affected and shaped by fire, human habitation (both Native American and early European), and other natural processes. There are also differences in the way each landscape has been affected by recent activities, such as the last eighty to one hundred years of active fire suppression and rapid human population growth. Because of the unique vegetation patterns in each landscape there are also clear distinctions in the land use activities that take place today in each of them.

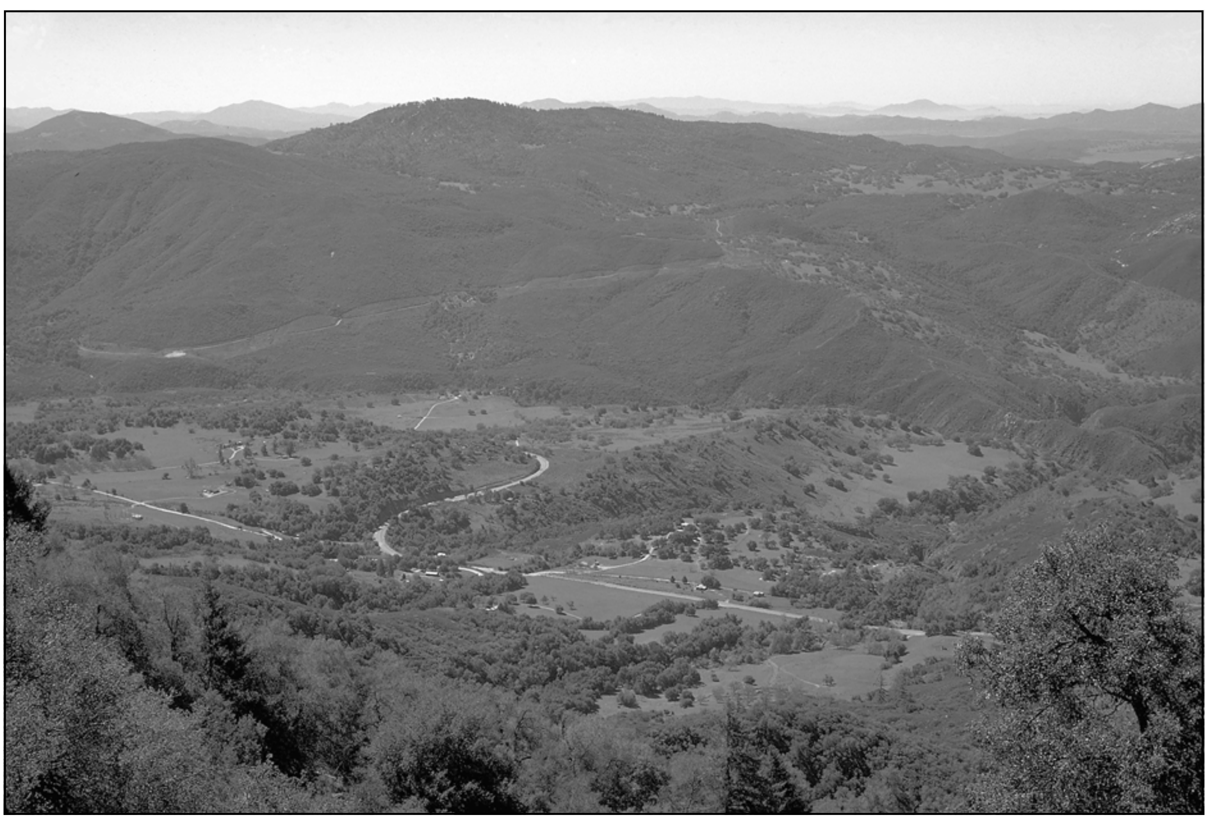
Coastal Foothills Landscape

The foothills range from approximately 800 to 3,000 feet in elevation on the coastal side of the mountains. In San Diego County, foothill vegetation patterns extend up to 4,000 feet in some places. Although topographically varied, the foothills are distinguished by many miles of relatively gentle hilly terrain. Rolling hills, plateaus, and broad valleys are common. Chaparral is the most common vegetation, but the foothills are also characterized by oak savannas and woodlands (fig. 2.4), coastal sage scrub, and corridors of riparian hardwood forest (table 2.1). Oak woodlands and savannas become increasingly abundant in the foothills as you move north. This landscape is most extensive in the Coast Ranges (southern Santa Lucia Range, southern Los Padres region), and the southern Peninsular Ranges (Santa Ana Mountains, San Diego region).

Table 2.1. The mix of dominant vegetation types in the foothills landscape.

Vegetation Type	Acres	% of Foothills
Chaparral	1,407,079	55%
Grassland/ oak savanna	351,930	14%
Coastal scrub	323,250	13%
Oak woodland	268,542	11%
Development/ agriculture	112,099	4%
Other	81,890	3%
Total:	2,544,790	

Figure 2.4. Looking south from Palomar Mountain, Cleveland National Forest, you see a typical foothill landscape: oak woodlands and savannas surrounded by chaparral-covered hills. CNF FILE PHOTO



Lower Montane Landscape

The lower montane landscape encompasses mountain slopes from approximately 3,000 to 5,000 feet elevation on the coastal side of the ranges. This mosaic is characterized by frequently steep and rugged topography. Chaparral dominates the hillsides but is interspersed with patches of forest, primarily in canyons and on north-facing slopes (table 2.2). Forest types are typically a conifer/hardwood mix. The most prevalent conifers are bigcone Douglas-fir, Coulter pine (fig 2.5), and incense-cedar, all of which occur primarily in mixed stands with canyon or coast live oak. Stands of black oak also occur, particularly at the upper elevations. Most of the conifer trees in this landscape are endemic to southern California and northern Baja (i.e., Coulter pine, bigcone Douglas-fir, Tecate cypress, Cuyamaca cypress and Sargent cypress).

Table 2.2. The mix of dominant vegetation types in the lower montane landscape.

Vegetation Type	Acres	% of Lower Montane
Chaparral or scrub	1,181,995	72%
Bigcone Douglas-fir/ Coulter pine/ canyon oak	272,649	17%
Oak woodland	102,979	6%
Grassland/savanna	35,159	2%
Mixed conifer	28,966	2%
Other	25,560	2%
Total:	1,647,308	

Figure 2.5. The Agua Tibia Wilderness, Cleveland National Forest, is a typical lower montane landscape. Dense patches of bigcone Douglas-fir occupy steep canyons surrounded by chaparral. CNF FILE PHOTO

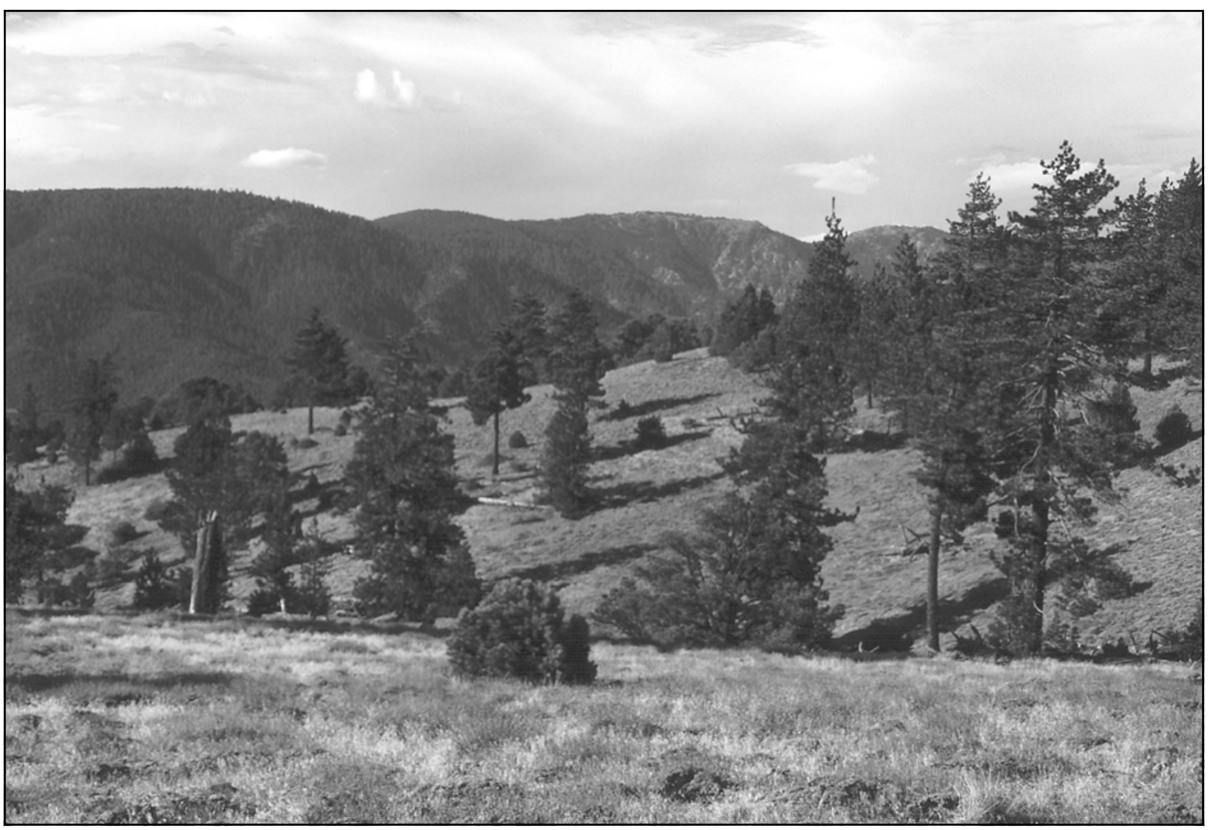
Montane Conifer Landscape

The montane conifer landscape (fig. 2.6) extends from approximately 5,000 to 8,500 feet in elevation and is dominated by pine and fir forests (table 2.3). Stands of black oak are also interspersed. In some areas near the lower elevational limit, oaks are as abundant as conifers. As the elevation rises, dominance in the conifer overstory shifts from ponderosa pine to Jeffrey pine to white fir. Black oak declines in abundance as elevation increases and as you move from the coastal side to the desert side of the mountains. Sugar pine and incense-cedar are secondary components in many stands. Montane meadows and chaparral are also interspersed. Towards the desert side of the mountains, western juniper becomes a component of pine and mixed conifer stands all the way up to 8,500 feet.

Table 2.3. The mix of dominant vegetation types in the montane conifer landscape.

Vegetation Type	Acres	% of Montane Conifer
Pine or fir forest	379,304	76%
Montane chaparral	77,338	16%
Oak woodland	20,919	4%
Meadows/sagebrush	15,434	3%
Other	6,121	1%
Total:	499,116	

Figure 2.6. This view from Brush Mountain looking towards Mount Abel, Los Padres National Forest, shows several types of montane conifer forest. The open Jeffrey pine stand on Brush Mountain is typical of arid, high-country forests on the desert side of the mountains. The dense forest blanketing the north slope of Mount Abel is typical of upper elevation mixed conifer. J.D. BITTNER



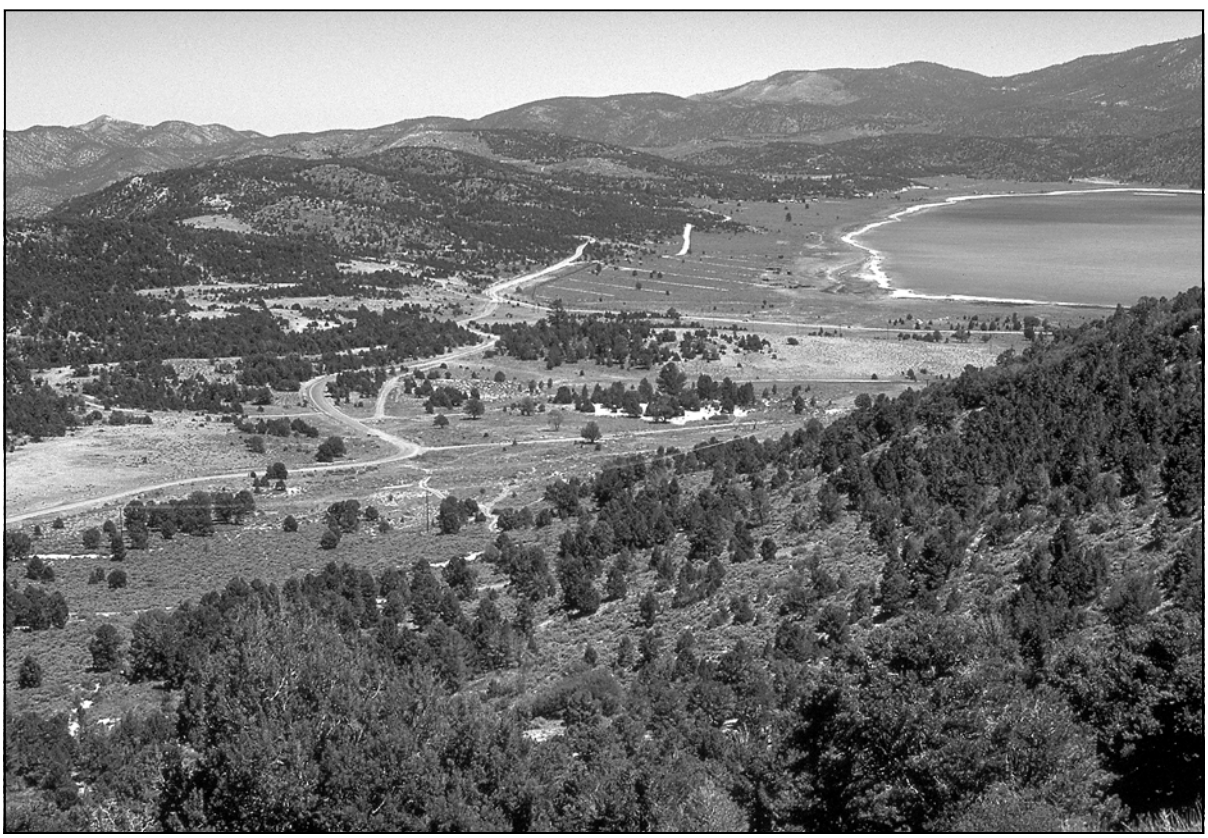
Desert Montane Landscape

The desert montane landscape covers a wide elevation range (approximately 3,000 to 7,000 feet) but is often a narrow transition zone between the mountains and the desert. Pinyon pine and juniper woodlands (fig. 2.7), scrub oak chaparral (e.g., Tucker oak), red shank chaparral, and desert scrub are the predominant vegetation types (table 2.4). In this arid landscape, plant communities generally provide sparse cover with a lot of bare ground in between. This mosaic is most extensive in the lower elevations surrounding Mount Pinos, along the northern slopes of the San Gabriel and San Bernardino mountains, and along the eastern slopes of the San Jacinto Mountains.

Table 2.4. The mix of dominant vegetation types in the desert montane landscape.

Vegetation Type	Acres	% of Desert Montane
Pinyon or juniper woodland	346,594	36%
Semi-desert chaparral/scrub	219,658	23%
Mixed and red shank chaparral	130,391	14%
Buckwheat, grass, barren	122,926	13%
Conifer or oak forest	29,904	3%
Other	27,709	3%
Total:	955,592	

Figure 2.7. This view to the northeast of Baldwin Lake, San Bernardino National Forest, shows pinyon pine woodlands and sagebrush flats that are characteristic of the desert-side montane landscape. LYNN LOZIER



Subalpine/Alpine Landscape

The subalpine/alpine landscape occurs at elevations above 8,500 feet. It covers a very small portion of the southern California mountains found only on the summit of Mount Pinos and in the highest reaches of the San Gabriel, San Bernardino, and San Jacinto ranges. Subalpine and alpine habitats are most extensive on the high slopes of Mount San Gorgonio and Mount San Jacinto (fig. 2.8). The primary plant community is subalpine forest (table 2.5) that consists of white fir, lodgepole pine, and limber pine. These are often relatively sparse forests characterized by small diameter trees. A rare and fragile alpine cushion plant community occurs above treeline.

Figure 2.8. Sparse stands of limber pine on the upper slopes of Mount Baden-Powell, Angeles National Forest, are characteristic of subalpine forests near timberline. ANF FILE PHOTO

Table 2.5. The mix of dominant vegetation types in the subalpine/alpine landscape.

Vegetation Type	Acres	% of Subalpine
Subalpine conifer forest	8,229	53%
Mixed conifer–fir	2,504	16%
Montane chaparral/ scrub	2,890	19%
Alpine or barren	1,913	12%
Other	68	0%
Total:	15,604	

Monterey Coast Landscape

The Monterey coast landscape (fig. 2.9) occurs only along the coastal slopes of the northern Santa Lucia Range. It is characterized by the southernmost occurrence of coastal redwood forest, and the southernmost concentrations of Douglas-fir and Pacific madrone (table 2.6). Santa Lucia fir is also endemic to this region. These are low-elevation (sea level to 4,500 feet), mesic forests similar in composition and structure to forests along the northern California coast. They are distinctly different from the montane conifer forests found at higher elevations in the rest of the assessment area.

Table 2.6. The mix of dominant vegetation types in the Monterey coast landscape.

Vegetation Type	Acres	% of Monterey Coast
Chaparral/scrub	35,264	35%
Redwood/ conifer forest	32,369	32%
Oak or bay forest	25,466	25%
Grassland/ savanna	6,751	7%
Other	22	<1%
Total:	99,872	

Figure 2.9. The northern Santa Lucia Range rises dramatically above terraces along the Monterey coast. The coastal slopes of these mountains support the southernmost stands of coast redwood forest. JEFF KWASNY

Major Ecological Communities

Many different vegetation types occur along the southern and central California coast (table 2.7). Most of these extend into the mountains and foothills to some degree. In this section, we describe the distribution, characteristics, and status of the dominant vegetation communities.

Foothill Oak Woodlands

Foothill woodlands tend to occur in two distinct forms: as closed-canopy stands in canyons or along streams, and as open savannas in broad valleys and rolling hills. Closed-canopy stands have a dense overstory of trees with little space between the crowns (fig. 2.10). Coast live oak is usually the dominant tree in these dense woodlands. Closed-canopy coast live oak woodlands are widely distributed in the foothills and better represented on public lands than the open savanna woodlands (table 2.8).

Savanna woodlands are characterized by widely scattered trees with grass or coastal scrub in between (fig. 2.11). These savannas contain coast live oak but are more typified by blue or valley oak in the north and Engelmann oak in the south. Savanna woodland types are less extensive and more concentrated on private lands (table 2.8). Engelmann oak, valley oak, and California walnut woodlands are considered rare communities in our assessment area because of limited distribution and poor representation on public lands (Scott 1990).

Livestock production has long been the principal economic activity in foothill woodlands (Pavlik et al. 1991). Most of the private land is consolidated in ranches that vary in size from less than a hundred to many thousands of acres. Grazing allotments have been in place for many years on national forest system lands and are particularly common in oak savanna types. On national forest system lands, 60 percent of Engelmann oak woodlands and

Table 2.7. The vegetation types occurring along the southern and central California coast and associated series-level plant communities as described and numbered in Sawyer and Keeler-Wolf (1995). The primary types are crosswalked from CWHR and CALVEG calssifications.

Vegetation types

Series

(from Sawyer & Keeler-Wolf 1995)

Hardwood Forests and Woodlands

Valley–foothill woodlands

From sea-level to ~3,600 ft.

Oak woodland

Usually open, savanna-like woodlands with grass below. Or along streams or north slopes.

Blue oak	230
Coast live oak	241
Engelmann oak	253
Valley oak	312
Walnut woodland	
California walnut	238

Valley–foothill riparian

From sea-level to ~4,500 ft. in canyons and flood plains. Stands usually denser than upland woodlands, but narrow.

Riparian forest

Black cottonwood	226
Black willow	229
California bay	234
California sycamore	237
Coast live oak	241
Fremont cottonwood	259
Mixed oak	277
Red willow	299
Red alder (north central coast only)	295
White alder	319

Riparian scrub

Arroyo willow	219
Buttonbush	119
Mexican elderberry	171
Mixed willow	279
Mulefat	179
Narrowleaf willow	180
Pacific willow	287
Sitka willow	307
Tamarisk	203

Montane upland hardwoods

From ~3,000-8,000 ft. Occur in pure stands, but more often associated with conifers. Upland live oak stands often consist of low, shrubby trees.

Black oak	227
California buckeye	235
Canyon live oak	239
Interior live oak	264
Mixed oak	277

Montane riparian hardwoods

From ~3,600-8,000 ft. In canyons and along streams. Riparian live oak stands consist of tall trees with spreading crowns.

Aspen (1 grove, San Bernardino Mts)	220
California bay	234
Canyon live oak	239
Interior live oak	264
White alder	319

Conifer and Conifer/ Hardwood Forests

North Central Coast Range forests

These occur only in the northern portion of the Central Coast Ecoregion, including the Monterey District of Los Padres NF.

Douglas-fir	246
Douglas-fir/ponderosa pine	249
Douglas-fir/tan oak	250
Redwood	300
Santa Lucia fir	302

Cypress and coastal pine

From sea-level to 5,500 ft. Uncommon, localized habitats.

Cypress forest

Cuyamaca cypress	333
Gowen cypress	337
Monterey cypress	340
Sargent cypress	303
Tecate cypress	345

Coastal pine forest

Bishop pine	225
Monterey pine	280
Torrey pine	346

Lower montane conifer/hardwood

From ~3,000 to 5,500 ft. Stands frequently patchy and surrounded by chaparral. They intermix with montane conifer at upper elevations. Live oak understory is common.

Foothill pine/oak forest

Usually open stands, conifers even-aged, shrubs or grass below.

Coulter pine	243
Coulter pine/canyon live oak	244
Foothill pine (grey, foothill,digger)	257
Knobcone pine	269

Bigcone Douglas-fir forest

Usually dense, multi-layered stands on steep slopes in canyons.

Bigcone Douglas-fir	222
Bigcone Douglas-fir/canyon live oak	223

Montane conifer

From ~5,000 to 8,500 ft.

Mixed conifer – pine/oak phase

Jeffrey/ponderosa/sugar pines, live oak, black oak and incense cedar. White fir present, but seldom dominant. Oaks common in most of this type and are the dominant stand component in some areas (e.g. the southern Peninsular ranges).

Jeffrey pine/ponderosa pine	268
Incense-cedar	263
Mixed conifer	275

Jeffrey pine

Open Jeffrey pine stands with few associated species. Black oak, white fir and western juniper can be present. In cold, dry, high-elevation sites. Mostly eastern slopes.

Jeffrey pine	266

Mixed conifer – white fir phase

White fir codominate with sugar and Jeffrey pine. Black oak or live oak common in some stands. Occurs in mesic, high-elevation sites.

Mixed conifer	275
White fir	321

Subalpine conifer forests

From 8,500 to >10,000 ft.

Limber pine	270
Lodgepole pine	271
Mixed subalpine forest	278

Pinyon/juniper woodlands

From ~3,000 to 8,500 ft. on arid desert-facing slopes.

California juniper	236
Mountain juniper	283
Parry pinyon (four needle)	288
Singleleaf pinyon	304
Western juniper	316

Shrublands and Chaparral

Coastal scrub

From sea-level to ~3,600 ft. “Soft chaparral.” Shrubs not very woody and stands more open than in chaparral types.

Chaparral

From sea-level to 5,000 ft. Woody shrubs in stands that usually become very dense when mature (>10 yrs old).

Montane chaparral

From 4,000 to 10,000 ft. Characterized by absence of chamise and presence of species found only in the mountains. Usually dense and woody.

Interior/desert scrub

From ~3,000 to 7,000 feet on desert-side of the mountains. These shrublands are generally sparser than those on coastal slopes.

Grasslands, Meadows & Herbaceous Types

Grasslands

Meadows

Alpine

Seeps/bogs/marsh/vernal pools

Figure 2.10. This coast live oak stand in the San Mateo Wilderness, Cleveland National Forest, is characteristic of dense foothill woodlands frequently found in canyons and along streams. ANNE FEGE

87 percent of blue oak woodlands are within grazing allotments.

Over the past twenty years, an increasing number of large foothill ranches have been subdivided and converted into ranchette-style housing developments. This trend is expected to continue and perhaps intensify in the coming decade, particularly in the southern counties where demand is greatest (i.e., San Diego, Riverside, Ventura, and Santa Barbara counties).

The trend towards increased development of foothill woodlands has several clear implications for public land management. As the urban interface expands and increasingly surrounds public wildlands, demand for recreation and other facilities increase and the ability to manage fire on the landscape becomes more constrained. Second, the decline of high-quality oak woodlands on private lands increases the significance of such habitats on public lands. Finally, the decline of ranching in this region, particularly in the southern counties, is gradually reducing the amount of livestock grazing on public land.

Figure 2.11. This blue oak stand on the Los Padres National Forest is characteristic of the oak savannas and woodlands found in broad valleys, rolling hills and mesa tops. MARK BORCHERT

Other factors affecting ecosystem condition in foothill savanna woodlands include the spread of non-native species (particularly Mediterranean annual grasses) and oak regeneration problems. Introduced annual grasses grow rapidly during spring and deplete surface water much earlier in the season than the displaced native perennial grasses (Pavlik et al. 1991). This diminishes water supplies to oak seedlings. Blue, valley, and Engelmann oak are not regenerating well in many savanna woodlands (Holland 1976; Scott 1990). This does not appear to be the result of one single factor but rather the combined effect of non-native grasses, grazing, and an unnatural abundance of acorn-eating animals such as gophers and ground squirrels (Borchert et al. 1989; Schoenherr 1992).

The closed-canopy coast live oak woodlands are less threatened. Regeneration does not appear to be a problem and coast live oak is a vigorous crown sprouter after fires.

Cismontane Scrub and Chaparral

Coastal scrub and chaparral are the dominant ecological communities on the coastal side of the mountains below 5,000 feet. Coastal sage scrub occurs primarily at elevations below 2,500 feet and is most widespread in coastal valleys and plains west of the foothills. Chaparral occurs across a broad elevational range but is particularly abundant in lower montane and foothill areas.

Coastal sage scrub consists of drought-deciduous, soft-leaved shrubs, frequently dominated by California sagebrush, buckwheat, and several sage species (fig 2.12) (Mooney 1977). The extent of coastal sage scrub has been greatly reduced by conversion to agricultural, industrial, and residential land

Table 2.8. Acres of foothill oak woodland by mountain range. Values in parentheses are the percentage of those acres occurring on public lands. These figures represent land area where the specified vegetation type is dominant. They are derived from a large-scale GIS vegetation layer that combines data from several different mapping efforts (see "Information Sources" section, chapter 1.)

Acres of Foothill Woodland Vegetation Types	Cleveland NF		San Bernardino NF		Angeles NF		Los Padres NF			TOTAL
	San Diego Ranges	Santa Ana Mts	San Jacinto Mts	San Bernar-dino Mts	San Gabriel Mts	Castaic Ranges	S. Los Padres Ranges	S. Santa Lucia Rng	N. Santa Lucia Rng	
Coast live oak woodland	44,243 (30%)	10,181 (56%)	2,153 (52%)	18	11,177 (66%)	4,178 (62%)	86,073 (51%)	88,384 (30%)	76,976 (89%)	**323,476 (52%)**
Blue oak woodland						1,483 (22%)	31,487 (45%)	88,409 (33%)	9,104 (63%)	**130,483 (38%)**
Engelmann oak woodland	17,054 (5%)	4,029 (45%)								**21,083 (12%)**
Valley oak woodland						410 (3%)	388 (8%)	7,699 (8%)		**8,497 (8%)**
CA walnut woodland					30 (100%)			3,896		**3,926 (1%)**
Alvord oak woodland									1,617 (4%)	**1,617 (4%)**
TOTAL	**61,297 (23%)**	**14,210 (53%)**	**2,313 (52%)**	**18**	**11,207 (66%)**	**6,071 (48%)**	**121,844 (48%)**	**184,492 (31%)**	**87,697 (84%)**	**489,082 (45%)**

use (Davis et al. 1994; O'Leary 1990). It is now found in only about 15 percent of its former range in southern California (Westman 1981; O'Leary 1990). The remnant stands of coastal sage scrub are habitat for a growing number of endangered taxa such as the California gnatcatcher (Davis et al. 1994). However, our assessment area encompasses only the upper elevational limits of coastal scrub where some of the associated rare species, including the gnatcatcher, are less abundant or absent.

Figure 2.12. Coastal sage scrub, like this area in Riverside County, is dominated by soft-leaved shrubs. JAN BEYERS

A major factor affecting ecosystem health in coastal sage scrub is fire frequency. This type of vegetation burns easily and is capable of reburning only one or two years after a previous fire. Frequent reburns result in the conversion of these shrublands to annual, nonnative grasslands (Zedler et al. 1983) (fig 2.13). Since this ecosystem is increasingly adjacent to or surrounded by the urban interface, it is becoming more difficult to prevent frequent fires and subsequent habitat degradation.

Chaparral consists of evergreen, woody shrubs (e.g., chamise, manzanita and ceanothus) (fig. 2.14). There are many types of chaparral (table 2.7) and they vary widely in species composition (Gordon and White 1994). In general, chaparral is abundant in the assessment area and well represented on public lands (table 2.9). Only a few chaparral associations are considered relatively rare and poorly represented on public lands: southern mixed chaparral, ceanothus chaparral, and serpentine chaparral.

Fire regimes are the primary ecosystem health issue in chaparral and much has been written on the subject (see Keeley and Scott 1995). The frequency, seasonality, size, and intensity of fires are all important. There are a variety of different life history strategies that shrub species use to survive in a fire-prone environment. Some species are short-lived, others long-lived. Some rely primarily on resprouting after fire; others regenerate primarily from seed (Keeley 1986; Zedler 1995). These strategies affect a species' resilience to changing fire regimes. However, studies suggest that most chaparral shrubs appear to be resilient to fire-return intervals of anywhere from twenty-five to one hundred years (Keeley 1986; Zedler 1995).

The natural fire-return interval in chaparral is a widely debated issue, but recent research

Table 2.9. Acres of cismontane chaparral and scrub by mountain range. Values in parentheses are the percent of those acres occurring on public lands. These figures represent land area where the specified vegetation type is dominant. They are derived from a large-scale GIS vegetation layer that combines data from several different mapping efforts (see "Information Sources" section, chapter 1.)

Acres of Cismontane Chaparral and Scrub Vegetation	Cleveland NF		San Bernardino NF		Angeles NF		Los Padres NF			**TOTAL**
	San Diego Ranges	Santa Ana Mts	San Jacinto Mts	San Bernar-dino Mts	San Gabriel Mts	Castaic Ranges	S. Los Padres Ranges	S. Santa Lucia Rng	N. Santa Lucia Rng	
Coastal sage scrub	32,960 (25%)	28,174 (33%)	2,664 (2%)	18,091 (14%)	31,397 (51%)	65,714 (19%)	91,028 (52%)	21,181 (37%)	22,418 (58%)	**313,627 (38%)**
Buckwheat/white sage	28,267 (52%)	5,891 (90%)	7,706 (58%)	23.044 (55%)	5,058 (69%)	33,707 (68%)	105,082 (78%)	353 (84%)		**209,108 (69%)**
Northern mixed chaparral	217,080 (60%)	103,172 (80%)	41,092 (80%)	81,654 (79%)	253,302 (90%)	136,663 (86%)	635,929 (89%)	132,205 (78%)	184,195 (88%)	**1,785,649 (83%)**
Southern mixed chaparral	71,550 (38%)	5,994 (15%)								**77,544 (36%)**
Chamise chaparral	130,146 (49%)	54,112 (61%)	39,979 (51%)	33,735 (54%)	32,183 (84%)	57,994 (63%)	64,040 (66%)	68,286 (42%)	53,988 (63%)	**534,463 (57%)**
Scrub oak chaparral	33,446 (67%)	7,016 (89%)	384 (92%)	15,999 (62%)	443 (86%)	5,317 (9%)	18,003 (84%)	5,482 (89%)	3,267 (55%)	**89,357 (69%)**
Montane chaparral	13,252 (52%)	121 (100%)	3,928 (73%)	28,163 (90%)	23,416 (99%)		17,944 (99%)			**86,824 (88%)**
Redshank chaparral	107,078 (66%)		106,576 (61%)							**213,654 (63%)**
Ceanothus chaparral				1,147	409	333	14,932 (18%)	3,830	2,583 (52%)	**23,234 (18%)**
Serpentine chaparral									7,473 (17%)	**7,473 (17%)**
TOTAL	**633,779 (54%)**	**204,480 (68%)**	**202,329 (62%)**	**201,903 (66%)**	**346,316 (86%)**	**299,728 (63%)**	**946,958 (82%)**	**231,337 (62%)**	**273,924 (78%)**	**3,340,754 (71%)**

Figure 2.13. Coastal sage scrub that reburns several times in rapid succession becomes degraded and dominated by non-native, annual grasses. JAN BEYERS

suggests a typical interval of fifty to seventy years (Minnich 1995; Zedler 1995; Conard and Weise 1998). Across most of the landscape, current fire-return patterns in chaparral appear to be either within or near this fifty to seventy year interval. Only in fire-prone areas adjacent to the urban interface are burns occurring more frequently.

Another widely debated issue is whether the average size and intensity of chaparral fires have increased as a result of fire suppression. Some evidence suggests it has (Minnich 1989, 1995), while other evidence suggests that large conflagrations have always dominated chaparral fire regimes (Byrne et al. 1977; Moritz 1997). This subject is addressed in detail in the chapter 3 section on fire. Whether they represent a change from historic conditions or not, large fires tend to create a homogeneous vegetation pattern, with large tracts of brush in a single age class. This simplified age-class mosaic, while not a problem for the shrubs themselves, reduces habitat diversity, which generally leads to a reduction in wildlife diversity. Game animals like quail and deer, which tend to be habitat edge species, generally avoid large, unbroken tracts of chaparral. The continuous fuels also may make large fires more likely to recur.

Figure 2.14. Northern mixed chaparral along the upper San Diego River, Cleveland National Forest. Chaparral is much denser than coastal scrub and the shrubs have hard, woody stems. ANNE FEGE

Lower Montane Forests

Bigcone Douglas-fir, Coulter pine, canyon and coast live oak, and black oak are the primary tree species on lower mountain slopes between 3,000 and 5,500 feet elevation in central and southern portions of the assessment area (table 2.10). In the northern ranges, lower montane forests can extend down to 1,000 feet elevation and contain California bay, Pacific madrone, gray pine, and knobcone pine (Griffin and Critchfield 1976). Often described as mixed evergreen forests (Munz and Keck 1973), they are typically found in small, scattered patches (roughly 50 to 800 acres in size) surrounded by large expanses of chaparral (fig 2.15). Thus, they are highly influenced by chaparral fire regimes.

Bigcone Douglas-fir and Coulter pine are essentially endemic to the coastal mountains of central and southern California (Coulter pine extends a ways into Baja California, Mexico) (Minnich 1987; Griffin and Critchfield 1976). These conifer species are rarely found together, but both are frequently associated with canyon live oak. Both are highly influenced by chaparral fire regimes, but their life history strategies for responding to fire are very different.

Bigcone Douglas-fir/canyon live oak forests frequently occur near streams in moist, shaded canyons and draws, where aspects are mostly north and east. At the upper end of their elevation range these forests appear on other aspects and become less restricted to canyons (McDonald and Littrell 1976). They

Table 2.10. Acres of lower montane forest types by mountain range. Values in parentheses are the percentage of those acres occurring on public lands. These figures represent land area where the specified vegetation type is dominant. They are derived from a large-scale GIS vegetation layer that combines data from several different mapping efforts (see "Infromation Sources" section, chapter 1).

Acres of Lower Montane Forest Types	Cleveland NF		San Bernardino NF		Angeles NF		Los Padres NF			
	San Diego Ranges	Santa Ana Mts	San Jacinto Mts	San Bernar-dino Mts	San Gabriel Mts	Castaic Ranges	S. Los Padres Ranges	S. Santa Lucia Rng	N. Santa Lucia Rng	**TOTAL**
Bigcone Douglas-fir/ canyon live oak	8,339 (59%)	2,650 (95%)	1.115 (95%)	12,931 (85%)	46,882 (98%)	1,872 (97%)	14,274 (98%)			**88,063 (92%)**
Coulter pine/ canyon live oak	12,084 (23%)	68 (100%)	12,416 (81%)		562 (100%)		19,459 (91%)	1,446 (100%)	37,200 (86%)	**83,235 (77%)**
Canyon live oak woodland	12	2,940 (45%)	2,425 (80%)	14,346 (77%)	38,728 (95%)	15,395 (91%)	45,669 (92%)			**119,515 (91%)**
Foothill and knobcone pine woodland						710 (63%)	170 (73%)	12,961 (18%)	10,690 (20%)	**24,624 (21%)**
California bay forest							197 (76%)		23,072 (77%)	**23,269 (77%)**
Broadleaved upland forest	7,532 (1%)	91	161	45			1,596	5,332 (2%)	22,117 (7%)	**36,874 (5%)**
TOTAL	**27,967 (28%)**	**5,749 (95%)**	**16,117 (81%)**	**27,415 (81%)**	**86,172 (97%)**	**17,977 (90%)**	**81,365 (91%)**	**19,739 (19%)**	**93,079 (57%)**	**375,580 (74%)**

are evidently not well adapted to withstanding fires and persist primarily by clinging to steep, fire-resistant terrain (Minnich 1988; McDonald 1990). Their ability to escape fires sweeping through the surrounding chaparral is due to their occurrence on precipitous slopes and the formation of a dense, arboreal canopy that limits understory fuel accumulation. These stands typically have few understory shrubs or flammable ground cover.

Figure 2.15. Scattered patches of Coulter pine surrounded by chaparral in American Canyon, Los Padres National Forest. MARK BORCHERT

Bigcone Douglas-fir forests are believed to be negatively affected by changing fire patterns (Minnich 1988). Although there has not been a rangewide quantitative evaluation of habitat losses, it is widely believed that bigcone Douglas-fir has declined significantly over the last ninety years as a result of crown fires and poor post-fire recovery. Minnich (1999) has documented an 18 percent decline in the extent of bigcone Douglas-fir in the San Bernardino Mountains since 1938.

The increase in crown fires is attributed to higher fire intensities in the surrounding chaparral, although there is little data to substantiate this possibility (see discussion in chapter 3 section on "Fire"). The most vulnerable stands are those on gentler slopes: Minnich (1980) observed 37 percent survival of bigcone Douglas-fir following wildfires on slopes less than 20 degrees, but more than 90 percent survival on slopes greater than 40 degrees.

Coulter pine persists in a chaparral-dominated environment by being adapted for rapid regeneration after fires. It has adapted to periodic crown fires by having a relatively short life span (fifty to one hundred years) and semi-serotinous cones that favor its re-establishment after fire (Vale 1979; Borchert 1985). As a result it appears to be more resilient to today's fire regime than bigcone Douglas-fir.

The biggest threat to Coulter pine is multiple fires in short succession (e.g., less than twenty-five years), that kill overstory trees before an adequate seed crop has developed. In such cases stands can fail to regenerate and convert to chaparral. Extreme insect or disease outbreaks can also threaten Coulter pine. During the height of the drought in the late 1980s, a major bark beetle epidemic killed approximately 70 percent of overstory Coulter pines on Palomar Mountain (T.White, Cleveland NF, pers. comm.). Re-establishment has been poor in some areas, due to brush cover. Coulter pines need openings for successful regeneration. When overstory trees die without an accompanying fire to clear a seed bed, seedling establishment can be impaired.

Montane and Subalpine Conifer Forests

Montane conifer forests consist of varying combinations of ponderosa pine, Jeffrey pine, white fir, black oak, canyon live oak, sugar pine, incense-cedar, and western juniper (table 2.11). These forests are the dominant land cover type between the elevations of 5,000 and 8,500 feet in the southern California mountains and above 3,000 feet along the Monterey coast. Subalpine conifer forests occur above 8,000 feet and consist of lodgepole pine, limber pine, white fir, and western juniper (fig. 2.16).

Table 2.11. Acres of montane and subalpine conifer forest types by mountain range. Values in parentheses are the percentage of those acres occurring on public land. These figures represent land area where the specified vegetation type is dominant. They are derived from a large-scale GIS vegetation layer that combines data from several different mapping efforts (see "Information Sources" section, chapter 1).

Acres of Montane Conifer Forest Types	Cleveland NF		San Bernardino NF		Angeles NF		Los Padres NF			**TOTAL**
	San Diego Ranges	Santa Ana Mts	San Jacinto Mts	San Bernardino Mts	San Gabriel Mts	Castaic Ranges	S. Los Padres Ranges	S. Santa Lucia Rng	N. Santa Lucia Rng	
Mixed conifer–pine			40,082 (78%)	98,062 (76%)	20,494 (99%)	852 (99%)				**159,490 (80%)**
Mixed conifer–fir	35,383 (26%)			26,590 (85%)	53,889 (96%)		37,001 (95%)			**152,863 (78%)**
Jeffrey/ponderosa pine	15,485 (75%)		2,351 (43%)	58,526 (81%)	5,515 (96%)		43,507 (96%)		16,210 (68%)	**141,604 (84%)**
Black oak	8,580 (46%)		3,771 (88%)	4,550 (70%)	369 (96%)	1,248 (89%)		1,538 (1%)	1,014 (78%)	**21,070 (60%)**
Redwood/Santa Lucia fir									16,658 (69%)	**16,658 (69%)**
Subalpine conifer			2,090 (100%)	5,916 (100%)	10 (100%)		234 (100%)			**8,250 (100%)**
TOTAL	**59,448 (42%)**	**0**	**48,304 (78%)**	**193,644 (79%)**	**80,277 (97%)**	**2,100 (93%)**	**80,742 (96%)**	**1,538 (1%)**	**33,882 (69%)**	**499,935 (79%)**

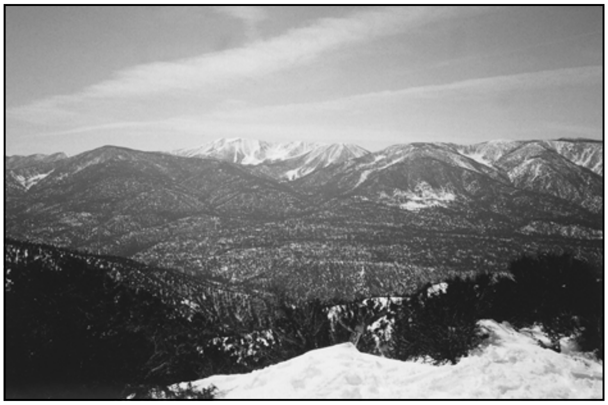


Figure 2.16. Continuous stands of mixed conifer forest give way to alpine habitats on Mount San Gorgonio, San Bernardino National Forest. JOHN STEPHENSON

Some montane conifer stands have changed dramatically since the early 1900s, largely due to long-term fire exclusion (Minnich et al. 1995). Fire suppression has been extremely effective in upper mountain forests. Low- to moderate-intensity understory fires, which were historically frequent occurrences in these forests (i.e., every fifteen to thirty years) (McBride and Lavin 1976), have been virtually eliminated over the last sixty to eighty years. Resulting problems include (1) a large increase in the number of understory trees (particularly shade-tolerant white fir and incense-cedar); (2) increased risk of stand-replacing crown fires due to fuel buildup; and (3) increased mortality and reduced recruitment of large trees (due to increased understory competition).

These problems are occurring primarily in mesic forests where understory trees develop rapidly. Stand densities in arid, desert-side forests do not appear to be experiencing significant change. To estimate the spatial extent of the problem, we developed a GIS-based model to predictively map areas likely to be experiencing overcrowded forest conditions and associated crown fire risk. Spatial data on vegetation type, canopy cover, annual precipitation, elevation, and slope were used to predict potential problem areas (table 2.12) (fig. 2.17).

To validate these predictions we examined existing and newly collected data on vegetation changes at plot locations established during the Vegetation Type Map (VTM) Survey (Weislander 1935). Approximately 18,000 VTM plots were initially surveyed from 1929 to 1934 as part of a project to map the vegetation of California (Minnich et al. 1995). They provide a valuable record of what the vegetation structure and composition was over sixty years ago.

Minnich et al. (1995) revisited sixty-eight VTM plots located in montane conifer forests in the San Bernardino Mountains. Using different methods, Savage (1994) studied this same issue in the San Jacinto Mountains. To obtain data from additional mountain ranges, we revisited thirty-two VTM plots in the Mount Pinos/Mount Abel area, the San Gabriel Mountains, and the mountains of San Diego County.

The results from each area were very similar: Mid-elevation mixed conifer forests have experienced (1) substantial increases in the number of small diameter trees (fig. 2.18), (2) reductions in the number of large trees, and (3) shifts in species composition towards more white fir and incense-cedar and fewer Jeffrey/ponderosa pine and black oak. In contrast, plots in Jeffrey pine forests on the more arid, desert side of the mountains showed little change.

Subalpine forests in southern California occur only in the highest ranges: the San Jacinto, San Bernardino, and San Gabriel mountains and small patches on the summit of Mount Pinos and Mount Abel. Most of these areas are within designated wilderness areas, including the largest stands on the slopes of Mount San Gorgonio. In general, these small subalpine/alpine ecosystems are intact, stable, and little disturbed (with the exception of some heavy recreation use in the vicinity of mountaintop trails). Trees grow very slowly in these upper elevation forests and stands tend to be open.

Fires are naturally infrequent in subalpine forests and thus return intervals have not been significantly altered by suppression activities. When they do burn, it is usually in a stand-replacing crown fire during severe weather

Table 2.12. Description of the model conditions used to predict areas of montane conifer forest with overcrowded stand conditions. The map of predicted areas is shown in figure 2.17.

Areas predicted to be experiencing high stand densification meet *all* of the following conditions:

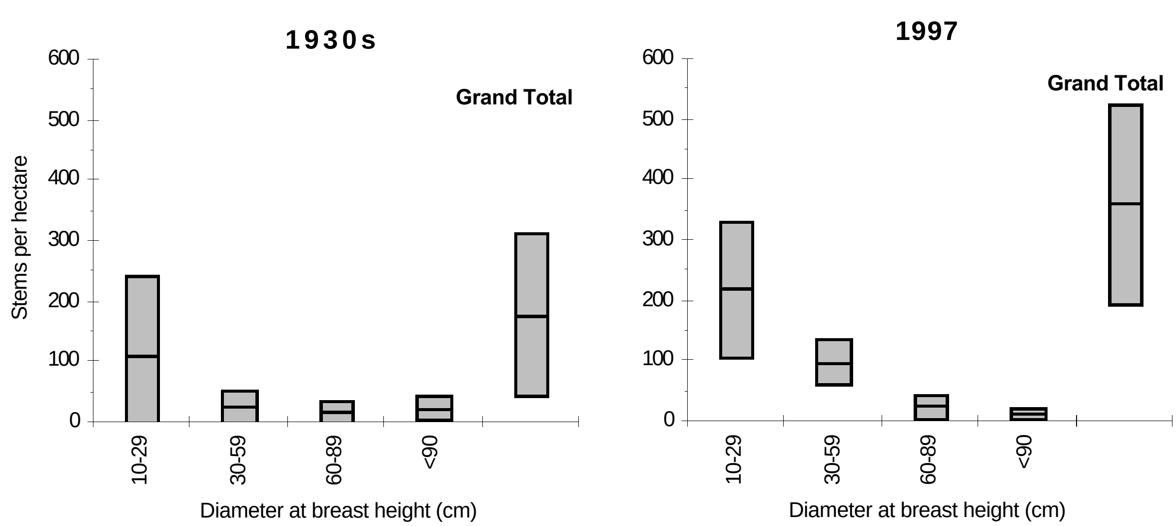
1. Vegetation type is a conifer forest (but not bigcone Douglas-fir or pinyon/juniper)
2. Elevation is at or below 7,500 feet
3. Average annual precipitation is greater than 65 centimeters (25.6 inches)
4. Canopy cover is greater than 60 percent
5. Slope is less than 60 percent

conditions (Minnich 1988). Several crown fires have occurred in recent decades in subalpine forests in the San Gabriel Mountains. While the result of human-caused ignitions, it is unclear if these fires were abnormally severe or frequent. The extremely steep terrain in the San Gabriels may make these forests more vulnerable as human-caused fire ignitions increase.

Desert Montane Communities

Arid slopes on the desert side of the mountains are occupied by sparse pinyon-juniper woodlands, semi-desert chaparral, sagebrush, and desert scrub (table 2.13). Single-leaf pinyon pine generally dominates the higher elevation slopes, while California juniper is prevalent at lower elevations, often on gentle slopes or alluvium. Parry or four-needle pinyon pine occurs in the San Jacinto Mountain region's desert transition zone near Thomas Mountain.

Figure 2.18. A look at how stem densities by size class have changed in mixed conifer stands over the last sixty years. The left graph comes from VTM plots done in the early 1930s and the right graph comes from those same locations in 1997 (n = 7). Each bar represents +/- one standard deviation from the mean; the mean is indicated by the horizontal line through each bar. Pronounced increases in stem densities have occurred in the small diameter size classes, while the number of large diameter (>90 cm) trees has slightly declined. These results are from the mountains of San Diego County, but the same trend is seen in plot data from the San Bernardino Mountains (Minnich et al. 1995), the San Gabriel Mountains and Mount Pinos.



Pinyon-juniper woodlands are generally open-canopy stands with sparse understory vegetation. It is not a vegetation structure that carries fire well and pinyon pine is not adapted to frequent fire. Fire-return intervals of several hundred years are considered typical in these woodlands (Minnich 1988).

There have recently been several large fires in pinyon stands in the San Bernardino Mountains. One area even reburned several years after a crown fire (S. Loe, San Bernardino NF, pers. comm.), which is very unusual in such sparsely vegetated habitat. This has raised concern about whether the spread of introduced grasses (primarily cheatgrass) is providing the fuels needed for fire to carry more effectively and frequently in these stands. If this is occurring, it would only be in years of high precipitation when there is sufficient moisture for the grass to become widespread. It is unclear if this is actually happening, but the issue warrants further study because pinyon-juniper woodlands are extremely slow to recover from fire and would be negatively affected by shortened fire-return intervals. Black stain root disease is also a significant problem for pinyon pine, particularly in portions of the San Bernardino Mountains (Fenn 1991a; Merrill et al. 1992).

Semi-desert chaparral is more open than chaparral found on coastal slopes and has a different mix of species. Flannel bush, bitterbrush, Tucker or Miller scrub oak, birchleaf mountain mahogany, and cupleaf ceanothus are characteristic components of semi-desert chaparral (Sawyer and Keeler-Wolf 1995). Basin sagebrush is common in dry alluvial fans, meadows, and washes. Basin sagebrush is particularly prevalent in the low elevations surrounding Mount Pinos and in the Garner Valley region south of Mount San Jacinto. There is no evidence that fire regimes in these vegetation types are outside the range of natural variability.

Common land uses in desert-side habitats are mining, off-highway vehicle (OHV) recreation, and target shooting. Large limestone deposits in the northeastern portion of the San Bernardino Mountains have resulted in the development of several major open-pit mines. Exploratory drilling for oil and gas deposits is a major activity in the southern Los Padres. These activities have caused habitat losses and are affecting sensitive resources in some

Table 2.13. Acres of desert-side montane vegetation types by mountain range. Values in parentheses are the percentage of those acres occurring on public lands. These figures represent land area where the specified vegetation type is dominant. They are derived from a large-scale GIS vegetation layer that combines data from several different mapping efforts (see "Information Sources section, chapter 1).

Acres of Desert-side Montane Vegetation Types	Cleveland NF		San Bernardino NF		Angeles NF		Los Padres NF			TOTAL
	San Diego Ranges	Santa Ana Mts	San Jacinto Mts	San Bernar-dino Mts	San Gabriel Mts	Castaic Ranges	S. Los Padres Ranges	S. Santa Lucia Rng	N. Santa Lucia Rng	
Pinyon woodland	444 (91%)		13,225 (83%)	57,776 (89%)	26,065 (79%)	17,029 (12%)	236,780 (86%)			**351,337 (82%)**
Semi-desert chaparral and Tucker scrub oak	27,114 (83%)		37,354 (67%)	50,021 (83%)	48,569 (70%)	5,332 (20%)	78,632 (86%)	160 (57%)		**247,182 (78%)**
Basin sagebrush	6,861 (25%)		15,416 (30%)	8,282 (76%)	2,856 (37%)	1,678	15,373 (54%)			**50,466 (43%)**
Desert scrub	4,968 (100%)		26,170 (52%)	4,466 (47%)	54					**35,658 (58%)**
TOTAL	**39,387 (75%)**	**0**	**92,165 (59%)**	**120,545 (84%)**	**77,544 (72%)**	**24,039 (13%)**	**330,785 (85%)**	**160 (57%)**	**0**	**684, 643 (77%)**

locations, but from a broad ecosystem perspective they are relatively localized.

Target shooters and OHV enthusiasts tend to concentrate in desert-side habitats because the sparsely vegetated terrain is conducive to these activities. Uncontrolled target shooting has raised safety and pollution (particularly from lead accumulation) concerns and several of the national forests are currently reviewing their policies on this activity.

Monterey Coast Communities

The northern Santa Lucia Range along the Monterey coast receives substantially higher amounts of precipitation than the rest of the assessment area and thus contain plant communities that are more similar to those found in northern California. Along the immediate coast, narrow stands of redwood trees occur in deep canyons surrounded by coastal scrub, chaparral, and grassland.

On the inland side of the mountain crest, stands of ponderosa pine, the endemic Santa Lucia fir, and true Douglas-fir (a different species than bigcone Douglas-fir) occur at the highest elevations. Below the conifer belt on the inland side of the mountains is a mosaic of chaparral, mixed evergreen forest, and oak woodland. California bay, Pacific madrone, and live oak are common components of the evergreen forest. This is the only place in the assessment area where Douglas-fir and madrone are common trees.

Although fires are generally smaller and less frequent in this mesic area, a single event (the approximately 180,000-acre Marble Cone fire) burned much of the region in the late 1970s (Griffin 1982; Moritz 1997). It is unclear if this is a typical historic pattern, but there is little evidence to suggest that the area is experiencing vegetation changes as a result of shifting fire regimes.

Rugged terrain in the area historically limited road development and led to the establishment of the Ventana Wilderness, which encompasses the majority of the northern Santa Lucia Range. Land use in this region is relatively limited and strongly recreation oriented. The Big Sur coastline receives most of the recreation activity.

Aquatic and Riparian Communities

Freshwater aquatic habitats are uncommon in coastal southern California and most have been substantially modifed by altered stream flow regimes. Essentially all the large rivers are to some extent dammed or diverted (figs. 2.19–20), thereby significantly altering the extent and character of riverine habitats (see section on “The Influence of Water Regulation and Withdrawal” in chapter 3). Deep-water reservoirs formed by dams are a new and entirely different type of aquatic habitat that didn’t exist historically in the region. The aquatic fauna found in these reservoirs tends to be dominated by non-native species.

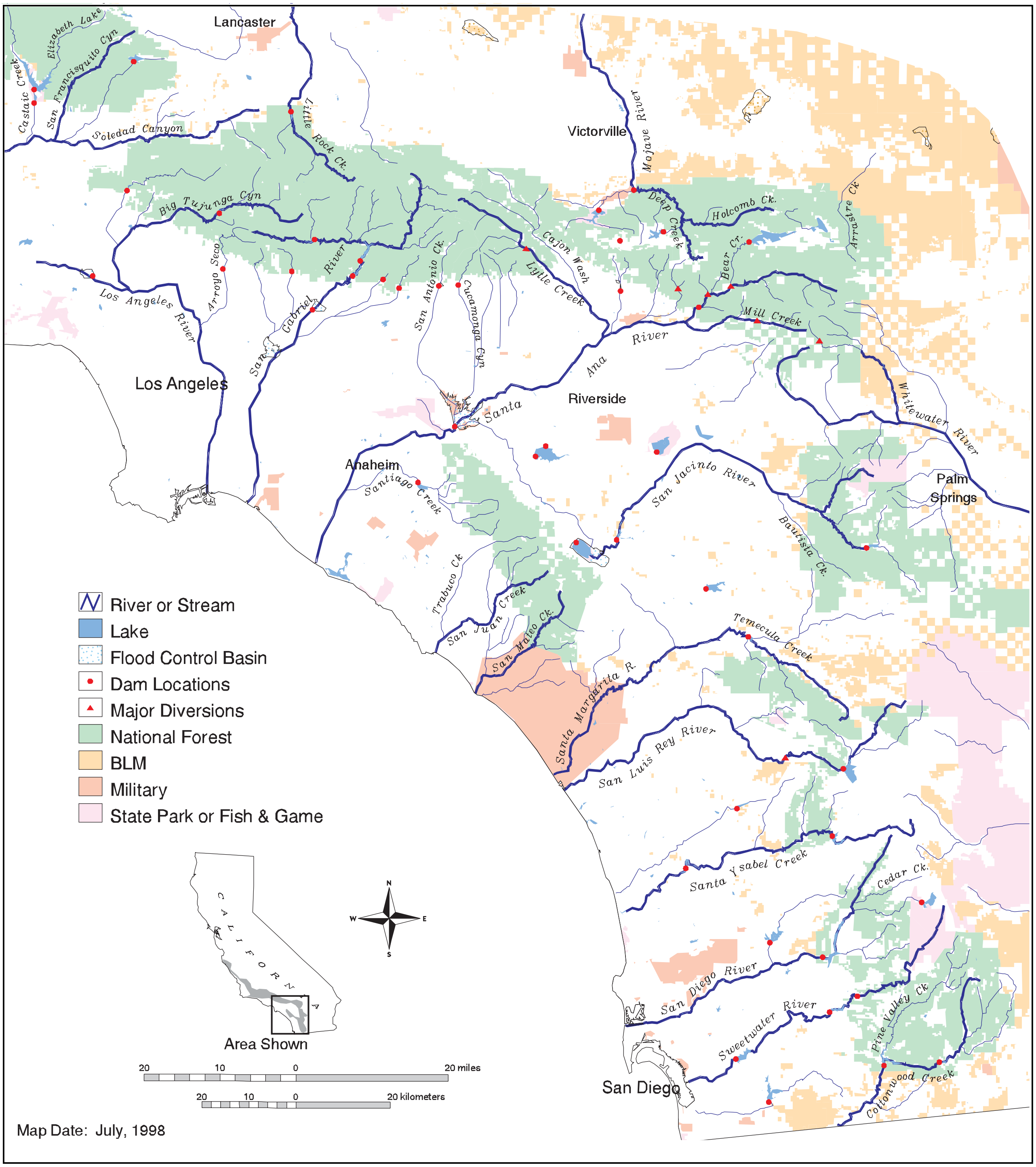
Given the dominant role that impoundments have in determining a drainage’s habitat potential, we partitioned streams into analysis watersheds based on whether they occurred above or below major impoundments. A database was developed that provides baseline information on each analysis watershed and the major streams occurring within them. Information compiled for each stream includes linear miles by elevation intervals, percent on public land, occurrence of roads along the stream corridor, land use intensity, degree of stream flow alteration, and level of non-native species infestation. Information on each watershed includes the percent of the entire watershed that is on public land, road densities in the watershed, and occurrences of both species of concern and invasive non-native species. A complete table of the data compiled for each watershed and stream is provided in appendix C.

Streams and Rivers

Most streams in southern California have very low flow during the summer months and in many cases dry up in the lower and uppermost portions. However, streams that flow through rock canyons often have perennial flow because deep pools are fed by groundwater recharge. This pattern of low flow in summer, which reflects the Mediterranean climate, results in an interesting situation in which the headward parts of streams may be dry, the middle portion wet, and the low portion dry during the summer months (Faber et al. 1989).

The middle and lower portions of these streams, typically found at elevations below 3,000 feet, support a higher number of aquatic and riparian species. Perhaps because habitat loss has been so extensive there, low-elevation streams also have a much higher number of

Figure 2.19. The primary rivers and streams in the southern portion of the assessment area with the underlying public lands. Shown in red are locations of dams (circles) and major diversions (triangles). Baldwin Lake, the only large natural lake in the region, can be seen in the upper right, just west of Arraste Creek.



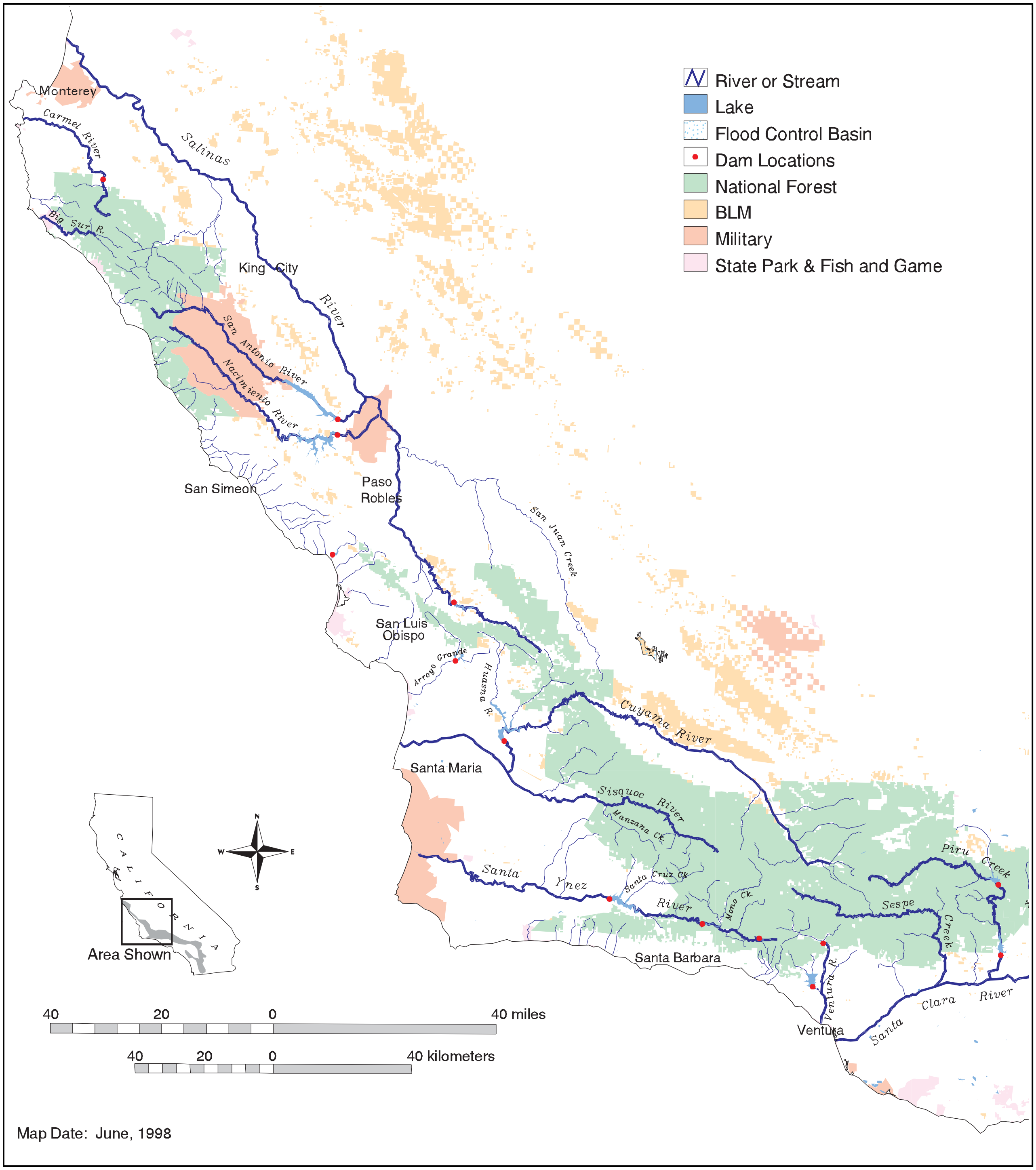


Figure 2.20. The primary rivers and streams in the northern portion of the assessment area with the underlying public lands. Shown in red are locations of dams (circles) and major diversions (triangles).

associated threatened, endangered, and sensitive (TES) animal species (table 2.14).

Landownership patterns and threat factors also differ dramatically by elevation. Seventy-four percent of stream miles above 3,000 feet elevation are on public lands, but this proportion drops to 50 percent between 1,000 and 3,000 feet, and down to 17 percent below 1,000 feet (fig 2.21). The low-elevation rivers also face greater threats. Water flows are much more likely to be diverted or altered, the adjacent terraces are commonly farmed or developed, and there is a greater abundance of invasive non-native species.

Given the significance and rarity of hydrologically intact low-elevation streams, those occurring on public lands should be given special attention. Of particular import are the sections of these streams that are in a relatively unmodified state. These are the areas where historic disturbance regimes and the natural range of variability may still be possible to maintain. To identify these areas we used GIS data to select the low-elevation streams best represented on public lands and the sections of them that do not contain upstream dams or diversions. Then we considered information on land use intensity, invasive species, and landownership patterns in the upstream watershed (table 2.15).

The streams listed in table 2.15 are not necessarily the most important ones in terms of TES species populations. However, the hydrologically unregulated sections of these streams are likely to be the best remaining examples of intact low-elevation aquatic ecosystems in the central and southern California coastal region. Thus, they represent our best opportunities for maintaining intact aquatic ecosystems.

Next to alteration of stream flow, the biggest factor threatening the health of native aquatic ecosystems is the spread of invasive non-native species. Invasive aquatic animals that are causing problems in many streams include green sunfish, bluegill, bullfrogs, crayfish, mosquitofish, brown trout, bass, bullheads, red-eared sliders, and African clawed frogs. The invasive plants arundo and tamarisk are also spreading, displacing native vegetation and causing a decline in surface

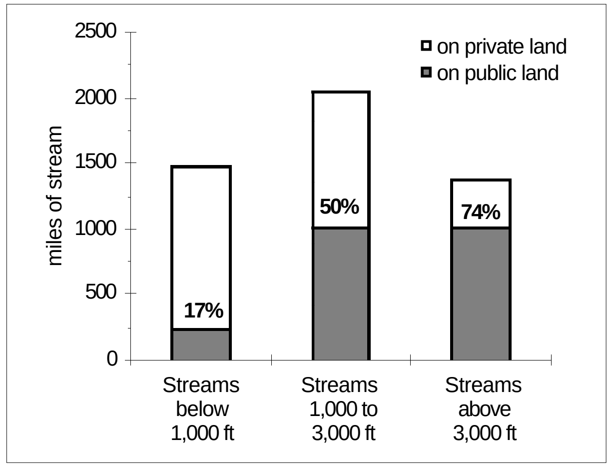


Figure 2.21. Bars show the miles of all streams along the central and southern California coast by elevation group. The shaded portion is the proportion that occurs on public land, with the percent value shown above it. The occurrence of streams on public lands increases dramatically with elevation.

Table 2.14. Threatened, endangered, and sensitive (TES) aquatic and semi-aquatic animal species that are associated with either low- or high-elevation streams.

Aquatic TES animals found primarily in low-elevation streams (<3,000 ft)	Aquatic TES animals found primarily in high-elevation streams (>3,000 ft)
California red-legged frog	Mountain yellow-legged frog
Foothill yellow-legged frog	Shay Creek stickleback
Coast range newt	
Southwestern arroyo toad	
Santa Ana sucker	
Santa Ana speckled dace	
Arroyo chub	
Southern steelhead	
Unarmored threespine stickleback	
California red-sided garter snake	
Southwestern pond turtle	

Table 2.15. The most significant low-elevation (below 3,000 feet) streams from the standpoint of linear miles on public lands. Those in bold are identified as having relatively high potential for maintaining aquatic ecological integrity, due to a high amount of unregulated streamflow (i.e., not dammed or diverted).

Stream	Mountain Range Subarea	Stream Miles below 3,000ft: On Public Land (Total mi)	Stream Miles below 3,000ft: Flow Undiverted on Public Land	% Public Land in Watershed	Land Use Intensity	Invasive Species Infestation
San Antonio River*	No. Santa Lucia	56.0	**47.7**	64%	Mod	?
Nacimiento River*	No. Santa Lucia	34.6	**25.1**	48%	Mod	?
Piru Creek	So. Los Padres	26.6	7.3	80%	High	High
Sisquoc River	So. Los Padres	26.4	**26.4**	87%	Low	Low
Santa Ynez River	So. Los Padres	26.1	0		High	High
Big Sur River (S & N fks)	No. Santa Lucia	25.7	**25.7**	93%	Low	Low
Sespe Creek	So. Los Padres	23.9	**23.9**	91%	Mod	Mod
San Mateo Creek	Santa Ana Mts.	22.8	**22.8**	92%	Low	Mod
Santa Margarita River**	San Diego Ranges	21.4	21.1**	38%	Mod	High
Santa Ana River	San Bernardino Mts.	17.6	0	87%	Mod	High
San Gabriel River	San Gabriel Mts.	17.6	**12.5**	95%	High	Mod
Arroyo Seco	No. Santa Lucia	16.5	**16.5**	60%	Mod	Mod
West Fk, San Gabriel R.	San Gabriel Mts.	15.7	6.0	100%	Mod	Mod
Cuyama River	So. Los Padres	14.8	4.5	70%	Mod	?
Manzana Creek	So. Los Padres	14.3	**14.3**	100%	Low	Low
Carmel River	No. Santa Lucia	14.0	5.0	49%	Mod	Low
Elizabeth Lake	Liebre Mtn. Area	13.4	**13.4**	84%	High	Mod
Salinas River	N&S Santa Lucia	13.1	2.2	22%	High	High
San Diego River	San Diego Ranges	13.0	7.9	42%	Low/Mod	Mod
Mono Creek	So. Los Padres	13.0	**13.0**	96%	Low	Low
San Juan Creek	Santa Ana Mts.	12.2	**12.2**	52%	High	Mod
Big Tujunga Creek	San Gabriel Mts.	11.4	0	87%	High	High
Pine Valley Creek	San Diego Ranges	10.3	**10.3**	81%	Low	Mod
Indian Creek	So. Los Padres	9.5	9.5	100%	Low	Low
Santa Cruz Creek	So. Los Padres	9.4	9.4	58%	Mod	?

* These streams are predominately on military lands.

** The flow on the Santa Margarita is partially diverted by a dam on Temecula Creek.

water availability in some streams (Rieger and Kreager 1989). Collectively, these introduced species are causing a serious decline in the capability of aquatic habitats to support native species.

Lakes

Almost all lakes in the assessment area are man-made reservoirs formed by dams. However, a few small natural basins exist that hold water all or most of the time. The majority of these straddle the San Andreas Fault: Jackson

Lake, Elizabeth Lake, Lake Hughes, and Lost Lake. In addition, Crystal Lake in the San Gabriel Mountains, Dollar Lake in the San Bernardino Mountains, and Hidden Lake in the San Jacinto Mountains are small natural lakes.

There is one large natural, ephemeral lake in the mountains: Baldwin Lake in the eastern San Bernardino Mountains. This large shallow basin fills with water during wet periods. It can retain water year-round for several years when conditions are right. When full, its shallow waters attract large numbers of waterfowl and also provide habitat for the rare Shay Creek stickleback fish. The watershed that feeds Baldwin Lake is also the primary water supply for the community of Big Bear City. This may be resulting in reduced flows into the lake.

The large, man-made lakes are essentially distinct ecosystems, with an aquatic fauna that bears little resemblance to what naturally occurs in the streams that formed them. Almost all support fisheries and are stocked with various species of bass, trout, catfish, and sunfish. Fishing is a very popular recreational activity at many of these lakes, attracting far more anglers than do the streams. The lakes have also attracted species such as bald eagle and osprey that were formerly very rare in these mountains. These lakes also facilitate the introduction of a wide variety of invasive nonnative species into the surrounding streams (see "Invasive Species" section, chapter 3).

Low-Elevation Riparian Habitats

Riparian habitats reach their peak as distinct ecological communities along mid- to large-order streams below 4,000 feet in the foothills and valleys. There are many different riparian plant associations (table 2.7), but foothill riparian woodlands generally fall into one of three broad categories: (1) Fremont cottonwood/willow, (2) California sycamore/coast live oak and (3) white alder (Borchert unpubl. manuscript). They are extremely productive and important habitats for wildlife (see Faber et al. 1989 for an excellent overview of southern California riparian habitats).

Riparian ecosystems are linear and often narrow features on the landscape (fig. 2.22). For that reason, they are difficult to accurately map across large areas using air photos or satellite imagery. Our existing vegetation maps do not fully capture the distribution of riparian habitats; thus, we have not attempted to provide acreages for them. A detailed map of riparian plant communities would be extremely useful for management purposes. Related information on the extent of rivers and streams in the region is provided in the section on aquatic ecosystems.

Riparian habitats have declined dramatically at low elevations, where they historically were most extensive. It is estimated that channelization and diversion of streams in the last century have reduced the extent of riparian habitats in southern California by over 90 percent (Faber et al. 1989). More recently, strong regulatory policies on "no net loss" of wetlands have helped to check this decline.

The extent of riparian habitats on public lands is relatively stable. So too is the structural condition of these habitats. Livestock grazing in riparian areas within the national forests has been substantially reduced, resulting in some dramatic improvements in vegetation condition. Concentrated recreation use is causing localized habitat damage in some areas. Foothill riparian areas are cool, pleasant places in the vicinity of large urban populations so recreation pressure is inevitable.

Figure 2.22. Linear riparian woodlands like this one in San Francisquito Canyon, Angeles National Forest, contrast sharply with the surrounding arid shrublands. SHAWNA BAUTISTA

However, habitat degradation tends to be localized in a few popular, easily accessible areas.

A more insidious and widespread problem is the spread of invasive, non-native species. The brown-headed cowbird, which parasitizes the nests of native birds, and European starlings, which displace native cavity-nesting birds, are causing declines in habitat capability in many areas. Bullfrogs, African clawed frogs, and green sunfish are spreading in many drainages, causing large impacts on native amphibians, aquatic reptiles, and fish. Arundo (giant cane) and tamarisk are invasive plants that are outcompeting native riparian vegetation in some areas. Arundo in particular is spreading rapidly in low-elevation riparian areas.

Rare Communities

Twelve rare ecological communities were identified in the assessment area. Communities fall into this category if there is some concern over their ability to persist in the region. Four are defined by unusual soils and eight are plant communities either narrowly distributed within the assessment area or threatened in a portion of their natural range. Acreage estimates for the twelve communities are summarized in table 2.16 and brief descriptions follow.

Valley Oak Woodlands

Valley oak *(Quercus lobata)* is endemic to California, occurring in areas with relatively mild winters west of the Sierra Nevada Mountains (Axelrod 1977). The species forms extensive woodlands, some of which occur in the northern half of our assessment area.

Table 2.16. The extent and distribution of rare community types on public lands. Acreages are derived from GIS coverages of vegetation, species, and soils distributions.

Rare Communities	Total Mapped Acres in Central and South Coast Bioregions[1]	Percent within Assessment Area	Percent on Public Lands within Assessment Area (acres)	
Valley oak woodlands	unknown	<20%	8%	(680)
Engelmann oak woodlands	53,810[2]	82%	12%	(6,461)[3]
Black walnut woodlands	23,569[4]	17%	12%	(2,828)
Cuyamaca cypress groves	230	100%	100%	
Tecate cypress groves	6,758	15%	85%	(5,744)
Gabbro outcrops	81,680	55%	41%	(33,489)
Montane meadows	55,446	100%	38%	(21,070)
Pebble plains	379	100%	60%	(227)
Limestone/carbonate outcrops	20,893	90%	87%	(18,177)
Serpentine outcrops	unknown			(31,470)
Sargent cypress groves	1,585	100%	74%	(1,173)
Santa Lucia fir forests	7,576	100%	95%	(7,197)

[1] based on bioregions as defined by the California Bioregional Council

[2] calculated using top four cover classes (3, 4, 5, and 6) from Scott (1990)

[3] includes private reserves (e.g., portions of the Santa Rosa Plateau)

[4] from mapped polygons by Weislander (1935)

Valley oaks are most prevalent at low elevations in the Santa Lucia Ranges but also extend into portions of the southern Los Padres and Castaic regions, and the northern flank of the San Gabriel Mountains (Hickman 1993; Griffin and Critchfield 1972). The southernmost occurrences of valley oak woodland are found in Los Angeles County in the San Fernando and Santa Clarita valleys and the Santa Monica Mountains (Pavlik et al. 1991).

True to its name, this tree typically occupies valley floor and lower foothill communities where there are deep soils (fig. 2.23). Its distribution also appears to be associated with shallow water tables (Griffin 1977). Valley oaks do extend up the mountain slopes in places. They occur at 5,000 feet on Chews Ridge in the northern Santa Lucia Range and extend up to 5,600 feet in the Tehachapi Mountains.

Valley oak frequently forms open woodlands with a grass-dominated understory. These oak savannas are often the dominant plant community in broad valleys that surround the mountains of Santa Barbara, San Luis Obispo, and Monterey counties. Along drainages the species forms denser riparian forests (Holland 1986) and is often found with blue oak, black oak, coast live oak, sycamore, and black walnut (Sawyer and Keeler-Wolf 1995).

Valley oak woodlands are poorly represented on public lands, although a more detailed mapping effort is needed to better quantify the exact amount. On private lands, the rapid expansion of agriculture and urban development along the central coast is causing a serious reduction in the extent of these woodlands (R. Cowan, The Quercus Group, in litt. 1998). For example, the clearing of oak savannas for large vineyard operations is occurring in the foothills and valleys of Santa Barbara County. More than 2,500 oaks in the Santa Ynez and Los Alamos valleys have been felled during the last two years and county officials predict vineyard acreage to triple within ten years (Cannon 1998). These areas are outside the assessment area but illustrate the importance of valley oak conservation on public lands.

Figure 2.23. Valley oak woodland at Wagon Caves Candidate Research Natural Area, Los Padres National Forest. MARK BORCHERT

Tree regeneration is also considered a problem in valley oak woodlands. Many stands are reported to be especially devoid of trees established in the last 75 to 125 years (Pavlik et al. 1991). Factors cited as contributing to this lack of regeneration include consumption of acorns and seedlings by livestock, tilling of cropland around mature trees, lowering of the water table through groundwater pumping, and competition from non-native grasses and other exotic species (C. Blair, CNPS, in litt. 1998). The presence of non-native annual grasses in native grasslands has been shown to increase oak seedling mortality by limiting the availability of soil moisture (Danielsen and Halvorson 1991). Non-native annual grasses grow and utilize soil moisture faster than native perennial grasses. Oak seedlings exposed to rapid declines in soil moisture experience water stress and display reduced growth. In controlled experiments, Danielsen and Halvorson (1991) found that valley oak seedlings were significantly larger when growing in association with native purple needlegrass *(Stipa pulchra)* than when grown with wild oats *(Avena fatua)*.

Engelmann Oak Woodland

Engelmann oak *(Quercus engelmannii)* woodlands are distributed from the San Gabriel Mountains south to Baja California, Mexico; however, most occur in the foothills of San Diego and southwestern Riverside counties (fig. 2.24). Populations also occur on Santa Catalina Island. The greatest concentration of these woodlands is found in the foothills of San Diego County between Palomar Mountain and Cuyamaca Peak. Another major occurrence is located on the Santa Rosa Plateau on the southeastern flank of the Santa Ana Mountains. The species is the only representative of subtropical white oaks in California and represents the northwestern extent of their range (Scott 1990).

Engelmann oaks are found at elevations ranging from 160 to 4,500 feet on valley floors, foothill slopes, and raised stream terraces within riparian corridors (Scott 1989; Sawyer and Keeler-Wolf 1995). They commonly form open savannas (less than 10 percent canopy closure) and woodlands (greater than 10 percent canopy closure) with grassland understories (R. Cowan, The Quercus Group, in litt. 1998)(fig. 2.25). In riparian areas the species can occur in dense stands with other hardwoods (Holland 1986).

Some of the most successful stands of Engelmann oak grow on clay soils formed from a gabbro or basalt substrate (St. John 1992). In San Diego County the species is sometimes found on rocky, north-facing slopes with an understory of coastal sage scrub or chaparral. In these instances it often hybridizes with scrub oak or Muller's oak.

Figure 2.24. The distribution of Engelmann oak and black walnut in southern California.

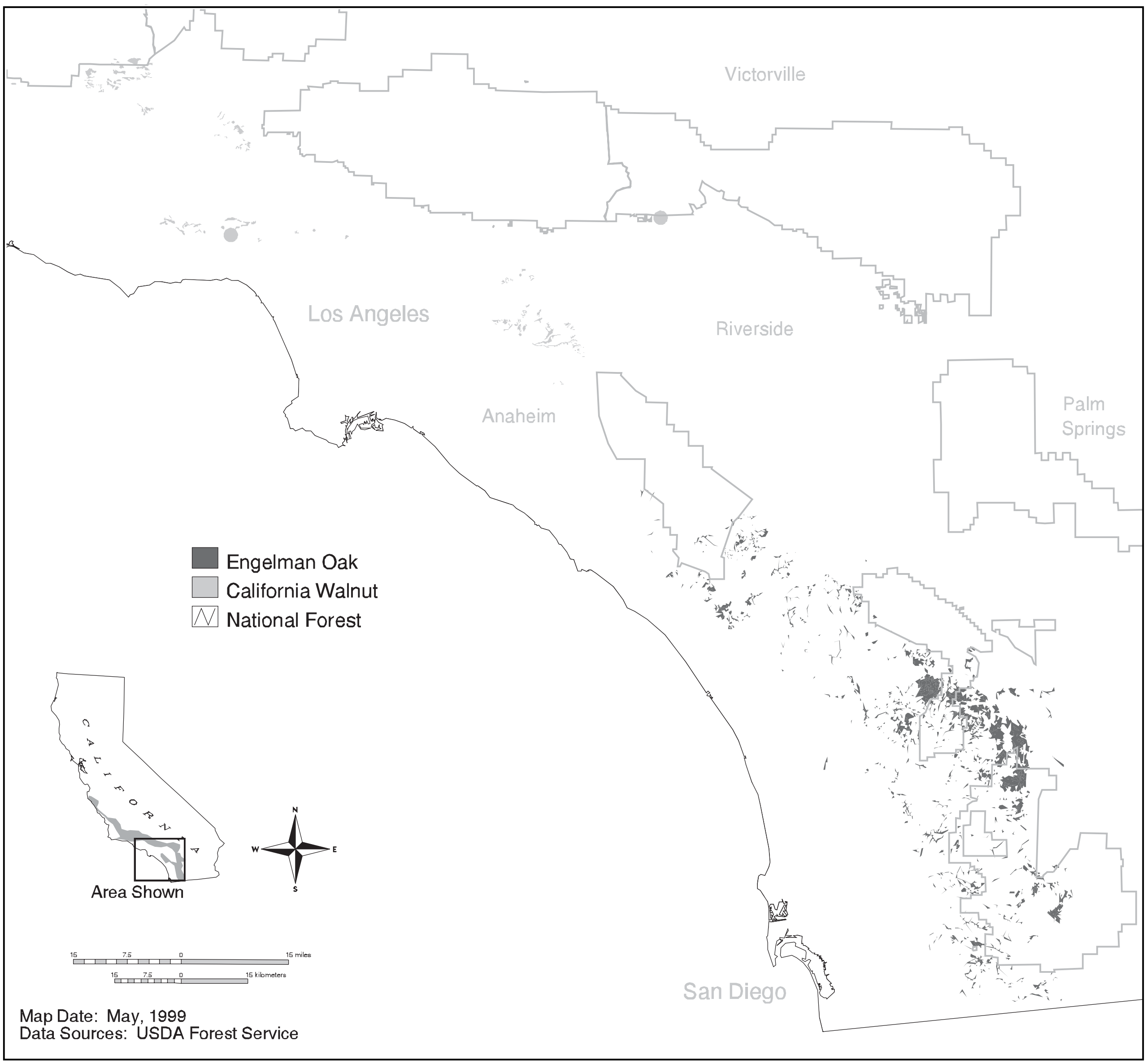


Figure 2.25. A mix of Engelmann and coast live oak form a relatively open woodland on the Rutherford Ranch, Cleveland National Forest. STAN CALHOUN

Acreage estimates for this woodland type vary depending on whether Engelmann oak is mapped everywhere it occurs or just where it is the dominant tree. Based on our GIS vegetation layer, Engelmann oak woodland is the dominant vegetation type over an estimated 21,083 acres—17,054 acres in San Diego County and 4,029 acres in the Santa Rosa Plateau region. In contrast, Tom Scott used aerial photographs and ground-truthing to map approximately 78,000 acres that contain at least some Engelmann oak (it was subdominant to coast live oak in over half of this area)(Scott 1989). Rarely does the species occur in pure stands (over less than 1,300 acres based on Scott's map). Seventy-eight percent of the Engelmann oak mapped by Scott occurs within the assessment area, with the remaining acres located to the west in more coastal areas of San Diego County.

Engelmann oak woodlands are declining primarily due to habitat loss on private lands. Eighty-eight percent of Engelmann oak habitat in the assessment area is located on private land (Scott 1989). The tree inhabits the smallest natural range of any oak species in California and is located next to the fastest growing urban landscape in the country (Scott 1990). Encouraging private landholders to protect this species on their properties is key to conserving Engelmann oak (T. Scott, UC Riverside, in litt. 1998). In addition, it is important for public land management agencies to pursue acquisition of lands containing Engelmann oak when they come up for sale. In recent years, major progress has been made in conserving this species through the purchase of key areas by Riverside County (on the Santa Rosa Plateau), San Diego County (on Volcan Mountain), CalTrans, and the Cleveland National Forest (Roberts and Rutherford ranches).

The primary management concern for Engelmann oak woodlands on public lands is maintaining sufficient regeneration. The long-term viability of Engelmann oak appears to be hampered by sporadic regeneration combined with unnatural rates of disturbance. Livestock grazing and competition for soil moisture from introduced annual grasses both appear to cause low recruitment rates for the species and there is a noticeable absence of young trees in many woodlands (Lathrop and Osborne 1990; Pavlik et al. 1991).

Walnut Woodland

Black walnut *(Juglans californica var. californica)* woodlands are an uncommon foothill habitat that is distributed from Santa Barbara County south to northern San Diego County (fig. 2.24). The easternmost stands occur in southwestern San Bernardino County in Day, Etiwanda, and San Sevaine canyons at the foot of the San Gabriel Mountains. Large stands also occur in Ventura, Los Angeles, and northern Orange counties (Quinn 1989; Keeley 1990). Woodlands are scattered in low foothills surrounding the Santa Clara River drainage (including the Santa Susana and Sulphur mountains), in the Santa Ynez Mountains, along the north side of the Santa Monica Mountains, along the base of the San Gabriel Mountains, and in the Simi, San Jose, Puente, and Chino hills. Other stands occur within the lower foothills of the southern Los Padres and Castaic regions.

Black walnut can be the dominant tree in the canopy or occur in mixed stands with other hardwoods such as coast live oak (fig. 2.26). At Los Pinetos Spring in the western San Gabriel Mountains, walnut grows with bigcone Douglas-fir and canyon live oak

(S. Boyd, Rancho Santa Ana Botanic Garden, pers. comm.). Some isolated stands occur within chaparral and coastal sage scrub (Esser 1993). Walnut usually occupies mesic areas (i.e., riparian corridors, floodplains, and north-facing slopes) and prefers soils with a high clay content.

Walnut woodlands are considered a declining plant community due to habitat loss on private lands and low representation on public lands. Small populations are located on the Angeles, San Bernardino, and Los Padres national forests but quantitative data is available only for the Los Padres National Forest. This data is based on Weislander maps developed in the 1930s and probably represent rough acreage estimates (Weislander 1935). A better determination of the current distribution of this community is needed. Of the 23,569 acres mapped in southern California, only 12 percent are located on public lands.

The great majority of walnut woodlands are found in urban interface areas. Devegetation of private lands for development appears to be the primary threat to this community. The tree has high horticultural potential, however, sometimes being incorporated into urban forestry projects, and private landowners are being encouraged to retain these woodlands as part of their landscaping.

Lack of sufficient regeneration is another problem observed in some walnut woodlands. It is unclear whether the regeneration problem is caused by livestock grazing, invasion of non-native annual grasses, seedling predation, or disease, and it may prove to be a combination of factors. Intensive livestock grazing in walnut woodlands has been shown under certain conditions to lower the survival rates of walnut seedlings by direct herbivory and by the introduction of non-native taxa into the understory (Esser 1993). Conversion from a native perennial grass understory to one dominated by non-native annual grasses is believed to be a primary cause of low regeneration in walnut woodlands much the same way it has affected oak woodlands (L. Merrill, San Bernardino NF, in litt.). A walnut woodland at Hopper Mountain on the Los Padres National Forest contains a large amount of *Avena* but very little if any walnut seedlings.

The effects of existing fire regimes on walnut are poorly understood. The variety is top-killed by most fires but reproduces vegetatively from the root crown and trunk after burning (Esser 1993).

Figure 2.26. Southern California black walnut woodland at California State Polytechnic University, Pomona. JANET NICKERMAN

Cuyamaca Cypress Groves

In the strict sense, Cuyamaca cypress *(Cupressus stephensonii)* is known only from the Cuyamaca Mountains of San Diego County and is the most narrowly distributed cypress in California. Some taxonomists believe, however, that the tree is really an Arizona cypress variant *(C. arizonica* ssp. *arizonica).* This variant also occurs in the southern Sierra Juarez east of Santa Catarina (R. Minnich, UC Riverside, in litt. 1998). In this sense Cuyamaca cypress may be part of a larger species range that includes occurrences in Arizona, neighboring Sonora, and the Sierra Juarez.

Cuyamaca cypress forms several groves in the Cuyamaca Peak/King Creek area in the mountains of San Diego County (fig. 2.27). The groves represent a single population that occurs naturally over an estimated 230 acres on both the Cleveland National Forest and Cuyamaca Rancho State Park (Winter 1994). In 1991 the Cleveland National Forest established the King Creek Research Natural Area to protect the cypress and its habitat. An apparently introduced population occurs in the Agua Tibia Wilderness near Palomar Mountain.

The tree usually grows in gabbro-derived clay soils, on steep slopes along drainages. It can be dominant in the canopy or co-dominant with Coulter pine. Groves are typically surrounded by chaparral vegetation composed of chamise, manzanita, and scrub oak (fig. 2.28). Two other rare plants, Dunn's mariposa lily *(Calochortus dunnii)* and Orcutt's brodiaea *(Brodiaea orcuttii)*, are found with Cuyamaca cypress.

Like all native cypress in California, Cuyamaca is adapted to fire and produces serotinous or closed cones at maturity (Zedler 1986). These cones require the intense heat generated by fire to open and disperse their seed as well as to prepare the soil for enhancement of germination. While periodic fires are therefore necessary for regeneration, short fire-return intervals (e.g., less than every forty years) appear to gradually decrease stand densities by preventing trees from reaching maturity and producing seed (Winter 1994). The species has relatively thin, exfoliating bark that provides little protection from fire and is usually killed in wildfire events (Sullivan 1993b). Since trees typically reach maturity and begin to produce viable seed at approximately forty years, a fire-free interval of greater than forty years is needed to maintain the seed pool/bank.

Figure 2.27. The distribution of gabbro soils, Cuyamaca cypress, and Tecate cypress in southern California.

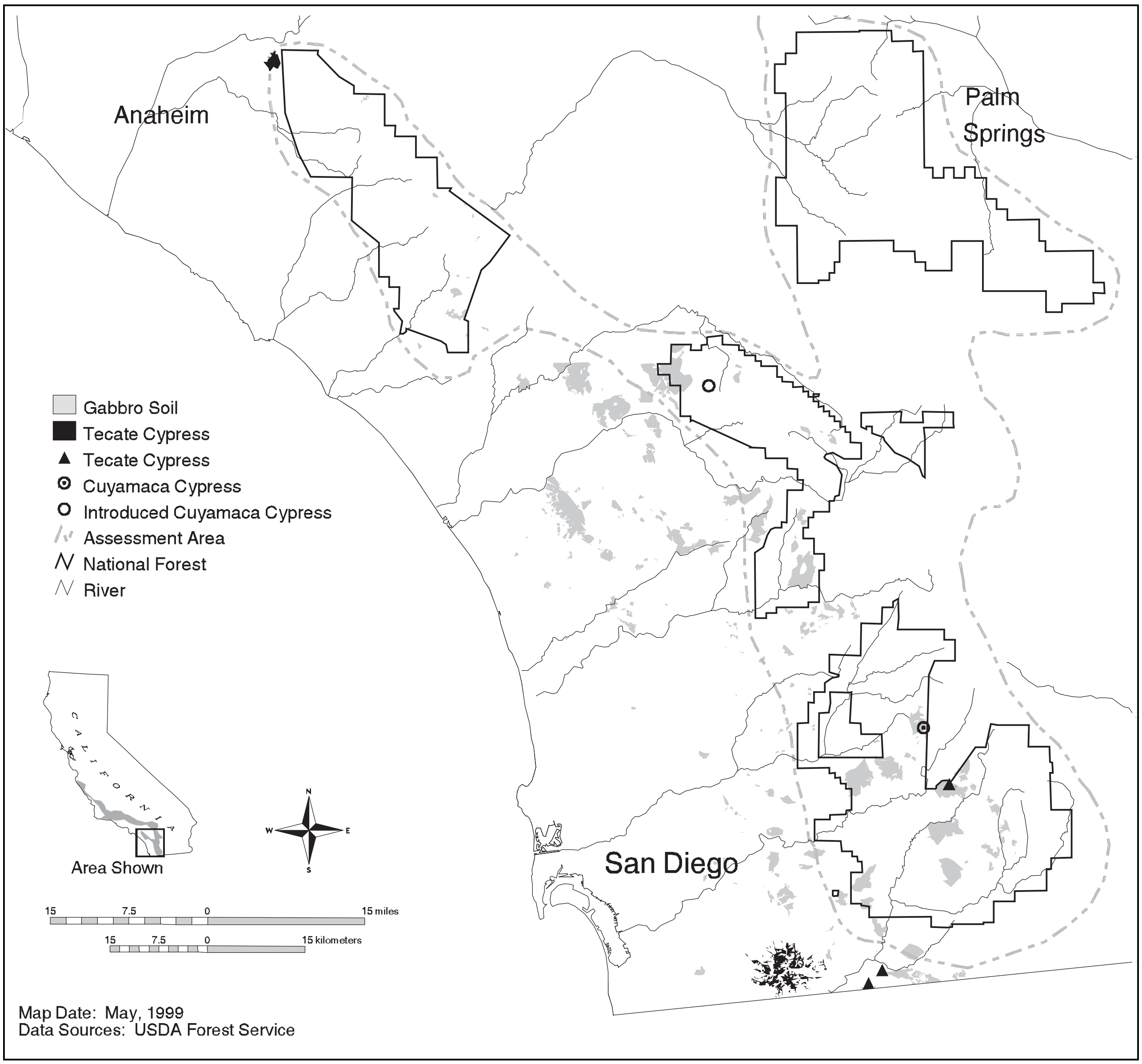


Figure 2.28. Cuyamaca cypress and chaparral at King Creek, Cleveland National Forest. These young trees germinated after the 1970 Boulder Fire. MOZE MOSSAY

Cuyamaca cypress is an increasingly rare species within the assessment area. The Cleveland National Forest has developed a species management guide that summarizes approaches to fire management and provides guidelines for the use of fire in enhancing cypress stands on the forest (Winter 1994).

Tecate Cypress Groves

Tecate cypress *(Cupressus forbesii)* occurs at elevations as low as 65 feet in Baja California, Mexico, and up to 4,200 feet in the San Diego and Santa Ana mountains (J. Gibson, San Diego Natural History Museum, pers. comm.). Its distribution is centered in Baja; however, some significant colonies are found north of the border. A 50-acre grove on Guatay Mountain in San Diego County and a 960-acre occurrence in the Sierra Peak/Coal Canyon area of the northern Santa Ana Mountains are located in the assessment area (fig. 2.27). Groves in the Sierra Peak/Coal Canyon area represent the northern limit of Tecate cypress distribution and its only Orange County locality (White 1990). The largest stand of Tecate cypress in California (over 5,000 acres) is south of the assessment area at Otay Mountain along the border with Mexico. Most of that occurrence is situated on land managed by the BLM. Numerous groves of Tecate cypress occur on the Mexico side of Otay and Tecate peaks and in the coastal mountains of Baja California, extending about 150 miles down the peninsula (Esser 1994a; R. Minnich, UC Riverside, in litt. 1998).

Usually found on mesic east- or north-facing slopes, Tecate cypress grows in alkaline, clay soils derived from ultramafic gabbroic rocks or metavolcanics (Zedler 1981)(fig. 2.29). The tree was once more widespread but is now restricted to these unusual soils where it lacks competition (Schoenherr 1992). Like Cuyamaca cypress, Tecate can be the defining component of southern interior cypress forest—a dense, fire-maintained low forest that forms even-aged stands surrounded by chaparral (Esser 1994a). Ceanothus, scrub oak, and chamise species are commonly found with Tecate cypress, and the trees may also be viewed as a phase of chaparral vegetation (Zedler 1981).

Tecate cypress is strongly influenced by fire; seeds remain in the cones until fire causes them to be dispersed and the trees themselves are killed. Environmental conditions present after fire induce the seeds to germinate and re-establish the population. Despite this adaptation to fire, the species is vulnerable to either excessively short or long fire-return intervals (Zedler 1981). Under current conditions, overly frequent fire is the much greater threat. Tecate cypress trees begin to produce cones after about ten years but take about fifty years to reach maximum cone production (Zedler 1977). If they reburn at intervals less than fifty years, reduced amounts of viable seed for regeneration would be expected.

Eighty-five percent of Tecate cypress within the United States is located on public lands yet the species is becoming increasingly rare in these areas (K. Winter, Cleveland NF, unpubl. notes). Reduced stand densities are attributed mainly to increases in fire frequency. Data collected at both Tecate Peak and Otay Mountain suggests that some of the groves there are diminishing in size. Using fire history records, ring counts, and aerial photographs, Paul Zedler was able to determine the burn intervals at Tecate Peak from approximately 1800 through 1975, and at Otay Mountain from 1943 to 1976 (Zedler

Figure 2.29. Mature Tecate cypress on Otay Mountain, San Diego County. MILAN MITROVICH

1981). Sampling after the most recent (i.e., 1975 and 1976) fires showed that stands at least fifty-two years old at the time of a fire produced a greater number of seedlings per pre-burn tree, and that these stands reestablished at densities several times higher than pre-fire densities (Zedler 1981). Conversely, stands thirty-three years old or younger at the time of a fire established fewer seedlings than there were mature trees before the fire and experienced significant decreases in stand densities.

Mining activities have also adversely affected Tecate cypress in the assessment area. Strip mining of underlying clay deposits destroyed some groves on private lands in the Sierra Peak/Coal Canyon area of the Santa Ana Mountains (Esser 1994a).

A species management guide for Tecate cypress was developed by the Cleveland National Forest that summarizes approaches to fire management and provides guidelines for the use of fire in enhancing cypress stands on the forest (Winter 1991a). The Guatay Mountain occurrence is proposed for designation as a Research Natural Area (RNA). An estimated 64,000 trees occur at this site (Winter 1991a). A large portion of the Coal Canyon population (540 acres) was recently purchased by the CDFG and designated as an ecological reserve.

Two federally listed plants, Braunton's milk-vetch *(Astragalus brauntonii)* and Mexican flannelbush *(Fremontodendron mexicanum)*, are found with Tecate cypress. Larvae of the rare Thorn's hairstreak butterfly *(Mitoura thornei)* are found exclusively with Tecate cypress; however, the butterflies have only been observed in the grove on Otay Mountain, outside the assessment area (Murphy 1990).

Gabbro Outcrops

Gabbroic rock exposures are found in the foothills and mountains of San Diego County and the Santa Ana Mountains (fig. 2.27). In the San Diego region the substrate is known from Cuyamaca, Guatay, McGinty, Potrero, Viejas, Poser, Los Pinos, Corte Madera, and Iron mountains (Beauchamp 1986). An estimated 81,680 acres of gabbro-derived soils occur in southern California. Forty-one percent of those acres are found on public lands, most within the Cleveland National Forest.

Commonly called gabbro, the igneous rock is highly erodable and weathers into a dark reddish, iron- and magnesium-rich soil (Schoenherr 1992)(fig. 2.30). The soil is sometimes characterized as a poorly draining clay. Soil series formed from gabbro include Las Posas, Boomer, and Auld. They form ecological islands within more common substrates, such as granodiorite, and support unique plant communities including Cuyamaca and Tecate cypress groves (Gordon and White 1994). Several herbaceous plants are also endemic to gabbro-derived soils, including two federally listed species: San Diego thorn-mint *(Acanthomintha ilicifolia)* and Mexican flannelbush.

A potential threat to gabbro habitat on national forest system lands is the construction of communication sites on mountaintops. Impacts to the habitat in other areas are largely unknown. Strip mining of gabbro-derived clay deposits has occurred on private lands in the northern and eastern Santa Ana Mountains (Esser 1994a) and there is potential for increased mining to occur.

Montane Meadows

Montane meadows are found throughout the assessment area, typically at elevations above 3,200 feet, and are represented on all

Figure 2.30. Rocky gabbro soil and chaparral at King Creek, Cleveland National Forest. The soil is rich in iron and recognized by its reddish color. MOZE MOSSAY

four of the southern California national forests (fig. 2.31) (fig 2.32). The habitat type covers an estimated 55,446 acres in southern California, 38 percent (21,070 acres) occurring on public lands.

Meadows can be characterized as wet, dry, or alkaline but are usually mesic, even in late summer. Due to rainfall patterns they tend to occur at lower elevations in the northern parts of California and shift to higher elevations in the southern areas of the state (Holland 1986). Two physical conditions characterize meadows: 1) a shallow water table usually within two feet of the soil surface in mid-summer and 2) surface soil material that is fine-textured (i.e., a clay) and richly organic (Wood 1975). Meadow soils are poorly draining relative to the coarser soils of adjacent forest vegetation (Holland 1986).

Meadows tend to form where there are gentle gradients and relatively impervious bedrock occurring in combination with appropriately sized upstream drainage basins. Where basins are large and produce high volumes of water, fine soil materials are washed away, preventing the establishment of meadow habitat. Stable meadows are those with shallow slopes and smaller drainage basins where fine materials are allowed to accumulate. Meadows that occur narrowly along streams and creeks are referred to as "stringer meadows." Meadows often form on or in close proximity to fault zones. The availability of subsurface waters may be locally increased by these subterranean impoundments (H. Gordon, Remote Sensing Lab, in litt. 1998).

A mix of hardwood and conifer species typically encompasses meadows at lower elevations. At higher elevations the surrounding forest shifts to mixed conifer and fir species. Jeffrey pine, white fir, incense-cedar, and black oak are frequent components of surrounding vegetation in the mountains of San Diego County (Winter 1991b). Montane meadows are dominated floristically by sedges and rushes, with perennial herbs and grasses also well represented. Four federally listed plants, San Bernardino blue grass *(Poa atropurpurea)*, bird-footed checkerbloom *(Sidalcea pedata)*, slender-petaled mustard *(Thelypodium stenopetalum)*, and California dandelion *(Taraxacum californicum)*, are found in meadow habitat in the San Bernardino Mountains. The San Bernardino blue grass also occurs in montane meadows within San Diego County.

A survey of sixty-two meadows on the Cleveland, San Bernardino, and Angeles national forests and three state parks was conducted in 1994 and 1995 (H. Gordon, Remote Sensing Lab, unpubl.data). Some of the meadows sampled are shown in table 2.17.

The largest meadows in the assessment area are found in the mountains of San Diego County, but the majority of these are located on private lands (e.g., Cuyamaca, Mendenhall, French, and Dyche meadows). Other expansive

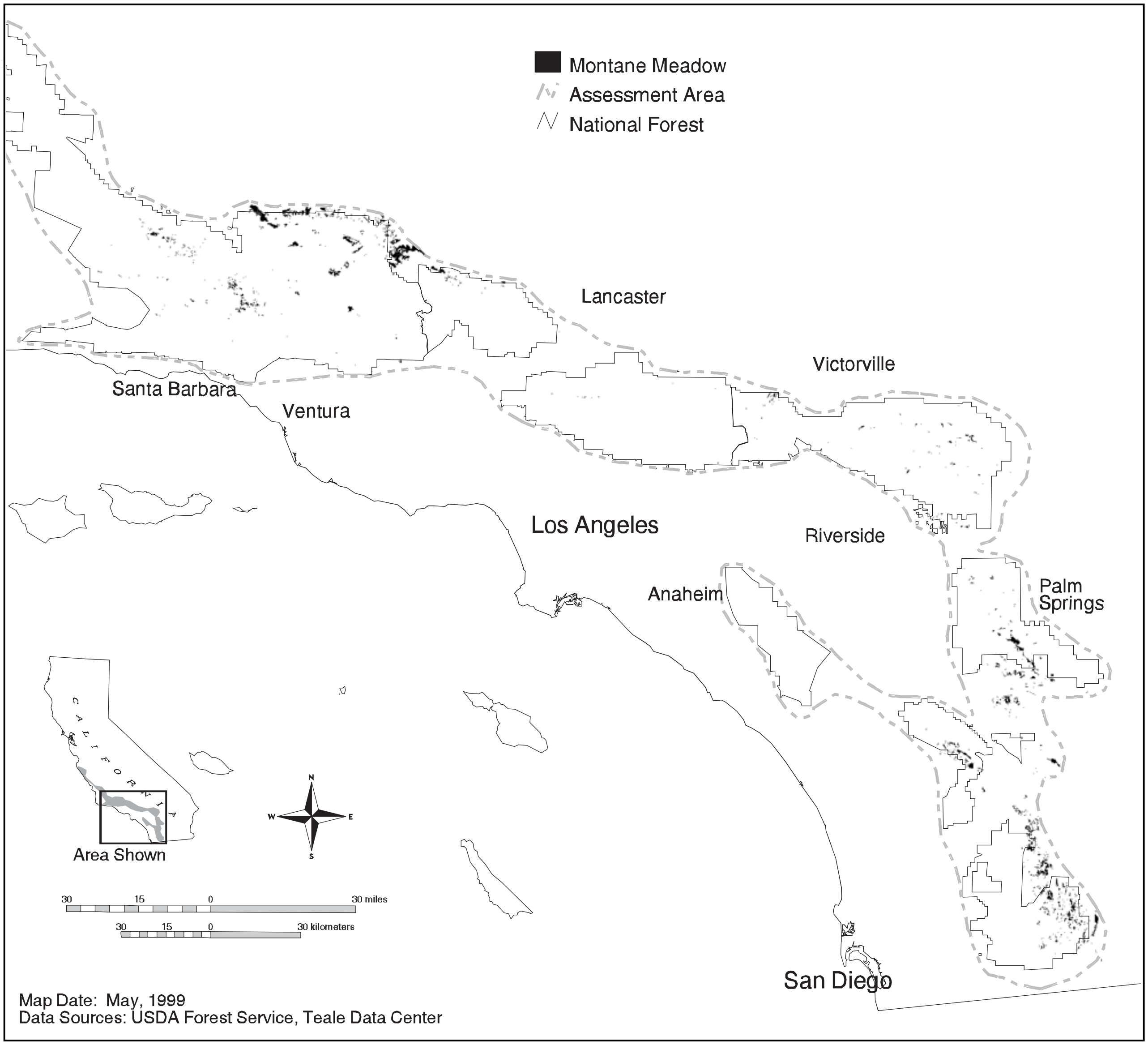


Figure 2.31. The distribution of montane meadows in southern California.

meadow systems are found in the San Jacinto Mountains, with the largest located in Garner Valley. There are many meadows in the San Bernardino Mountains, but most are small in size. The San Gabriel Mountains contain very few meadows due to their steep topography, although Big Pines Meadow is significant as the primary location for the San Gabriel Mountains blue butterfly *(Plejebus saepiolus aureolus)*. In the Castaic region, Knapp Ranch Meadow is estimated to cover almost two hundred acres.

Montane meadows on the Los Padres National Forest include Toad Springs, Thorn, and Chula Vista meadows, Yellow Jacket Creek (a series of stringer meadows), and several unnamed meadows near Lockwood, Grade, and Cuddy valleys, Mount Abel, and the San Emigdio Mesa area (J. O'Hare, Angeles NF, in litt. 1998).

All meadow habitats are sensitive to activities and disturbances that affect stability of the surface soil, especially during the winter and spring when the ground is most saturated. Meadow systems, particularly those on steeper slopes, can develop gullies in response to disturbance. The best examples of this are associated with road and trail systems that increase the amount of runoff a meadow receives and cause soil erosion. Eroded areas convey water at a higher rate, eventually leading to the formation of gullies, which in turn

Figure 2.32. Montane meadow habitat at Bluff Lake, adjacent to the San Bernardino National Forest. An endangered plant, the bird-footed checkerbloom, is found here. LYNN LOZIER

channel water away from the meadow, effectively lowering the water table and removing increasing amounts of topsoil (J. O'Hare, Angeles NF, in litt. 1998; M. Bearmar, Cleveland NF, pers. comm.).

When the water table of a meadow is lowered, it allows for the steady encroachment and establishment of nonmeadow flora. Runoff from road and trail systems appears to be one of the greatest impacts to meadow habitats within the assessment area. Recurrent trampling by livestock, vehicles, or people can also introduce soil erosion and cause gullying. Over time gully systems may become stabilized and form riparian habitat, much like what has occurred at Knapp Ranch on the Angeles National Forest and Thorne Meadow on the Los Padres National Forest (J. O'Hare, Angeles NF, in litt. 1998).

Many montane meadows on national forest system lands have historically been impacted by the overgrazing of livestock (Krantz 1983; M. Borchert, Los Padres NF, pers. comm; J. O'Hare, Angeles NF, pers. comm.). Excessive grazing is believed to shift floral composition from native perennials to non-native annual species (Winter 1991b) and the current trend on national forest system lands has been to reduce the number of cattle in these areas or remove them completely from especially sensitive locations. However, the invasion of alien taxa appears to be a greater problem in lower elevation meadows rather than at higher elevations, where the habitat seems to be in better condition overall (R. Minnich, UC Riverside, in litt. 1998).

The Cleveland National Forest has developed a habitat management guide for four sensitive plants that grow in riparian montane meadows: Cuyamaca larkspur (*Delphinium hesperium* ssp. *cuyamacae)*, lemon lily *(Lilium parryi)*, Parish's meadowfoam *(Limnanthes gracilis* var. *parishi)* and San Bernardino blue grass (Winter 1991b).

Pebble Plains

Pebble plains have a very limited distribution in the northeastern San Bernardino Mountains, occurring between elevations of 6,000 and 7,500 feet. They are found only within a 92-square-mile area near the city of Big Bear, on the San Bernardino National Forest and on adjacent private lands (fig 2.33) (Neel and Barrows 1990). Some well-known sites include the Big Bear Lake complex, the Sawmill complex, Gold Mountain, North Baldwin Lake, Arrastre Flat/Union Flat, Holcomb Valley, south Baldwin Ridge/Erwin Lake, Onyx Ridge/Broom Flat, and Coxey Meadow. Three hundred and seventy-nine acres of pebble plain habitat are mapped in our GIS database, 60 percent located on public lands. The Pebble Plain Habitat Management Guide and Action Plan cites 546 acres of pebble plain habitat with 94 percent occurring on public lands (Neel and Barrows 1990).

The plains appear as distinct open patches within forest and woodland vegetation often dominated by Jeffrey pine, pinyon, and juniper species (fig. 2.34). Remnants of a huge ice-age lake bottom (Krantz 1983), the plains are part of the Mohave crustal block uplifted during Quaternary time (Derby and Wilson 1979). They are treeless, deep clay deposits that support a rare assemblage of plants reminiscent of an alpine flora. This flora consists of small cushion-forming plants, tiny annuals, grasses, and succulents. The plants are all well spaced, low growing, and sun tolerant, yet exact floral composition varies between sites. The substrate consists of clay soil (up to

Table 2.17. A partial list of montane meadows on the Cleveland, San Bernardino, and Angeles national forests and Palomar Mountain State Park. The assessment of meadow condition is based on notes taken by H. Gordon during her field surveys in 1994 and 1995. Acreages reported are visual estimates.

Meadow Name	Water Source	Date of Sampling	Assessment of Meadow Characteristics and Condition
Cleveland NF			
Guatay	runoff from Guatay Mtn.	5/95	upper area type converted?, drainage channel, structures; 10-50 acres
Laguna	Big and Little Laguna lakes, Boiling Springs, Escondido, Chico, and Los Rasalies ravines, Agua Dulce Creek	7/95	some erosion in the channeled area of the check dam, Prado area has cattle; 500-600 acres
Lost Valley	Caliente Creek, spring	5/95	horses, portion of meadow in private ownership, dispersed camping; 50-100 acres
Love Valley	upland runoff	7/94	50-100 acres
Mendenhall	Iron Springs Creek	6/95	historic and recent cattle grazing; 100-200 acres
Organ Valley	spring-fed	6/95	RNA for Engelmann oak; 5-10 acres
Roberts Ranch	upland runoff	5/95	gullies caused by runoff from I-8, cattle, recent acquisition; 100-200 acres
Tenaja	upland runoff, springs	5/95	type conversion from chaparral? 100-200 acres
San Bernardino NF			
Baldy Mountain	unknown	7/95	jeep trail, horse-holding structures, cattle, adjacent to fire break; 50-100 acres
Big Meadow	Santa Ana River	8/95	lower portion of meadow affected by upstream gullying, the encroachment of Great Basin sagebrush, and non-native species; 50-100 acres
Broom Flat	Arrastre Creek, runoff	7/95	cattle; 50-100 acres
Coxey	springs, Coxey Creek	8/95	non-native species in northern area of meadow; 10-50 acres
Garner Valley	South Fork of San Jacinto River	7/95	some soil erosion, cattle; >300 acres
Holcomb Valley	Holcomb and Caribou creeks	8/95	historic gold mining and ranching in the Belleville area; 50-100 acres
South Fork	South Fork of Santa Ana River	9/95	irrigation ditch in upper meadow area; 10-50 acres
Tahquitz	Tahquitz Creek	9/95	Jeffrey pine encroaching on lower meadow, trail; 10-50 acres
Angeles NF			
Big Pines	seasonal Mescal Creek system	6/95	wet meadow easily accessible, retreating due to expansion of Mountain High Ski area parking lots, presence of San Gabriel Mtns. blue butterfly; <5 acres
Brown's Flat	overland flow	6/95	in the San Dimas Experimental Forest; 50-100 acres
Knapp Ranch	seasonal Castaic Crk system	5/95	100-200 acres
Palomar State Park			
Lower French	French Creek	5/95	some channelization, adjacent forest burned
Upper Doane	Doane Creek	6/95	not grazed regularly since 1940s, some erosion, small channel; 50-100 acres

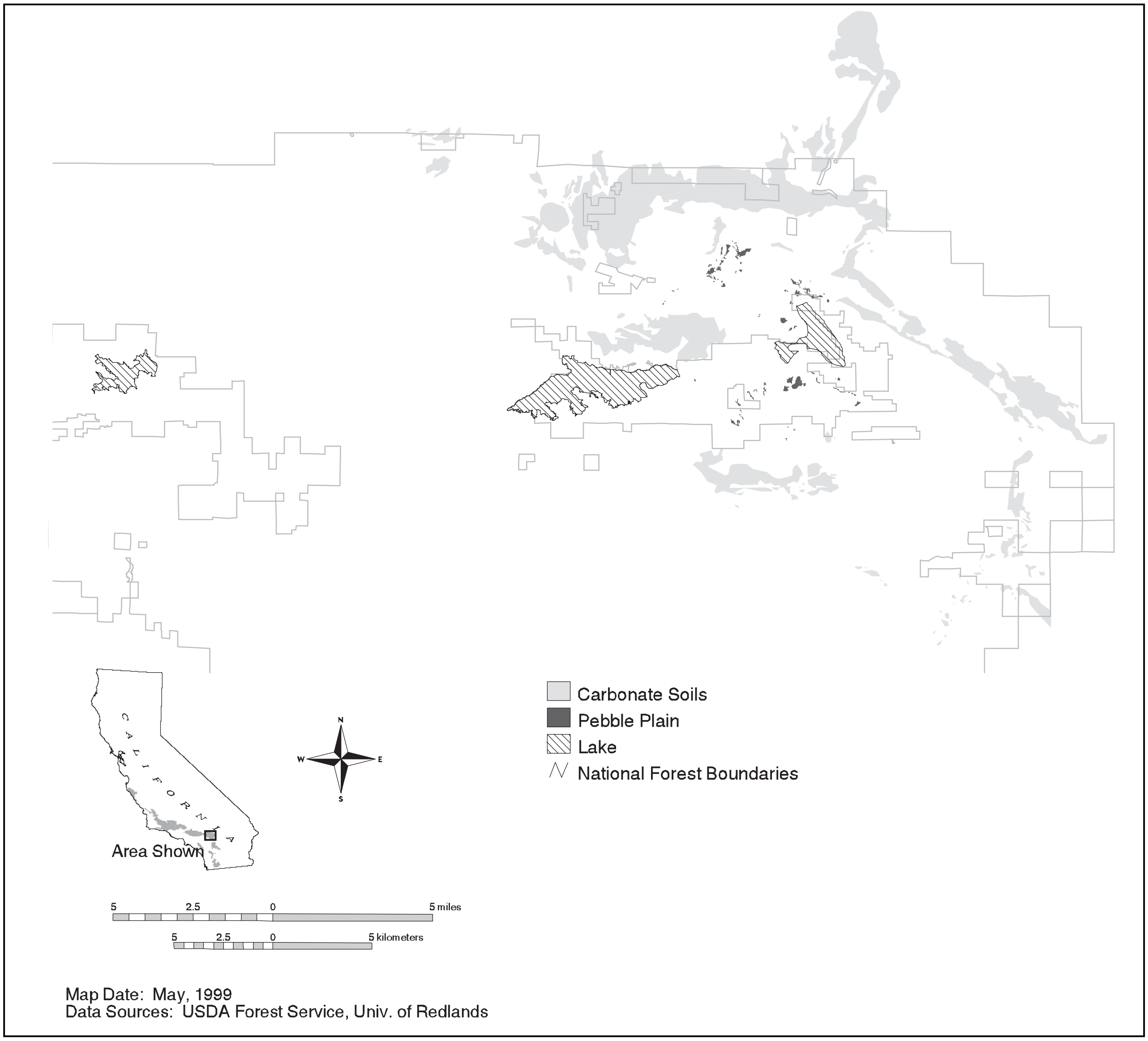


Figure 2.33. Occurrences of pebble plains and carbonate outcrops in the eastern San Bernardino Mountains.

53 percent) mixed with quartzite pebbles and gravel that are continually pushed to the surface through frost action (Holland 1986; Neel and Barrows 1990). The combination of clay soil, frost heaving, extreme annual and daily temperature fluctuations, high light intensity, and dessicating winds is thought to prevent the establishment of tree species onto the plains (Derby and Wilson 1979). Three federally listed plants, Big Bear Valley sandwort *(Arenaria ursina)*, ash-gray Indian paintbrush *(Castilleja cinerea)*, and southern mountain buckwheat *(Eriogonum kennedyi* var. *austromontanum)*, are found on pebble plains.

An estimated 150 acres of pebble plain habitat are believed to have been lost by creation of the Big Bear Lake reservoir in the 1800s. More recently the habitat has declined in amount and quality primarily from vehicle activity on the sites (Neel and Barrows 1990). Some pebble plains have been completely devegetated (e.g., upper Sugarloaf). The habitat is especially vulnerable to damage from vehicles when the ground is saturated. Deep ruts are created in the soil that directly affect the vegetation and alter the surface hydrology of the plains.

The Pebble Plain Habitat Management Guide and Action Plan was developed by the San Bernardino National Forest to provide management direction for long-term conservation of pebble plains and the rare plants

Figure 2.34. Pebble plain habitat at Gold Mountain, San Bernardino National Forest. Plants in this habitat type are diminutive and alpine-like. Despite their appearance, pebble plains have high floral diversity. MAILE NEEL

assocated with them. Closure of unauthorized vehicle routes through pebble plain habitat (including walk-throughs that discourage motorcycle access and barriers to prevent vehicle access), signage, increased patrol, mineral withdrawal, habitat acquisition, removal of non-native grasses, and public education are actions being taken to protect and enhance the habitat. Conserving pebble plain habitat over a broad geographic range, reducing fragmention, and encouraging compatible uses are Forest Service goals for this habitat.

Limestone/Carbonate Outcrops

Carbonate outcrops are found along the desert-facing slopes of the San Bernardino Mountains. Located mainly within the San Bernardino National Forest, these soil deposits extend for approximately twenty miles along an east-west axis and occupy an estimated 21,000 acres. Over 18,000 acres of these unique soils are within the assessment area, of which 87 percent are on public lands (fig. 2.33). Disjunct outcrops occur just south of Sugarlump Ridge and to the east as far as the Sawtooth Hills (USFWS 1997b). The U.S. Fish and Wildlife Service Draft Recovery Plan reports a higher amount of total carbonate habitat (32,620 acres) though subsurface deposits may account for the additional acres (USFWS 1997b).

Carbonate is named for its primary constituent, calcium carbonate. The substrate is an alkaline, sedimentary rock type that weathers into limestone and dolomite soils. A number of plants are endemic to these carbonate soils (see carbonate plant group, chapter 5). On a broader scale, carbonate outcrops support desert montane plant communities such as blackbush scrub, pinyon-juniper woodlands, Jeffrey pine-western juniper woodlands, and Joshua tree woodlands (USFWS 1997b) (fig. 2.35).

High-grade carbonate deposits in the San Bernardino Mountains are mined for commercial use; the carbonate in these mountains is one of just three high-quality deposits in the western United States (Krantz 1983, 1990). Limestone is used in a number of commercial applications and almost all of the habitat on public land is under mining claims. Mining activities such as the direct removal of soil, road development, and dumping of overburden rock, have led to an overall decline in the amount and quality of carbonate habitat. Plant communitites associated with this habitat are slow to recover from disturbance due to the low productivity, thin soils, and very dry climate on the desert side of these mountains (Rowlands 1980).

The high levels of ground disturbance associated with mining, the potential for additional claims to become active, and insufficient protection mechanisms necessitated

Figure 2.35. Carbonate habitat north of Holcomb Valley in the San Bernardino Mountains. A low-growing plant, the endangered cushenbury buckwheat, can be seen in the foreground. TIM KRANTZ

the federal listing in 1994 of five rare plants endemic to carbonate (Neel 1997). This law created a rare situation where two very prominent laws (the 1872 Mining Law and the 1973 Endangered Species Act) appear to conflict with one another.

To resolve this issue, a collaborative effort has been initiated among the San Bernardino National Forest, the Bureau of Land Management, the U.S. Fish and Wildlife Service, mine operators, researchers, and other affected parties, to design a reserve system for these plants and their habitat (G. Zimmerman, San Bernardino NF, in litt. 1998). The Carbonate Endemic Plant Conservation Strategy is being designed to incorporate many large occurrences of the five listed plants over a wide range of habitat mosaics throughout their geographic ranges. Buffers to minimize conflicts and to ensure defensible areas, connections between populations and habitats, and inclusion of sites that contain more than one listed species are other important elements being considered in the reserve design. Genetic research through patterns of isozyme variation (Neel 1997), results of soil sampling, and a detailed vegetation classification combined with field studies of individual plant occurrences are being completed and will provide information necessary for the reserve design. GIS coverages of plant locations, carbonate rock locations, proposed and approved future mining activities, land use conflicts, and other resource values have been developed in the *Conservation Study for Five Carbonate Plant Species: a study of land use conflict in the San Bernardino National Forest* (USDA Forest Service 1996).

Serpentine Outcrops

Serpentinite rock outcrops occur within the assessment area in the Santa Lucia Ranges, the southern Los Padres region, and at one locality in the Santa Ana Mountains. Within the boundaries of the Los Padres Natonal Forest are an estimated 31,470 acres of serpentinite-derived soil (fig. 2.36).

This soil, commonly called serpentine, is recognized by its waxy texture and colors that range from green to blue to red. Generally high in magnesium (consisting mainly of hydrated magnesium silicate) and low in calcium, nitrogen, and phosphorous, the soil is considered impoverished and supports only those plants adapted to or tolerant of its unique chemistry. It contains varying amounts of heavy metals (e.g., cobalt, nickel, and iron) that contribute to its color (J. O'Hare, Angeles NF, pers. comm.).

In its favor, serpentine often has a higher water-holding capacity than adjacent soils (i.e., it forms clay soils). Grassland, chaparral, oak woodland, and conifer forest may all form on a serpentine substrate, but species richness and density is always much lower than on adjacent nonserpentine soils (Kruckeberg 1984). Extreme serpentine habitats are referred to as "barrens" because they support little or no vegetation. Less toxic sites can support up to 215 species and varieties of plants and at least nine species and subspecies of butterflies (Schoenherr 1992). Sargent cypress and knobcone pine are reliable indicators of a serpentine soil. Twelve of the plant species addressed in this assessment are indicators of or endemic to serpentine soils. Of these, ten are classified by the regional forester as forest service sensitive on the Los Padres National Forest (see serpentine plant group in chapter 5).

The Cachuma Saddle area and Figueroa Mountain, both in the San Rafael Range, contain serpentine chaparral and woodland, including groves of Sargent cypress. Serpentine woodland and Sargent cypress occur again at Cuesta Pass and West Cuesta Ridge in the southern Santa Lucia Range. Further north, the Chew's Ridge area in the Santa Lucia Ranges contains good examples of serpentine grassland and woodland. Serpentine grassland is also found in the Pine Ridge area of the Santa Lucia Ranges (Kruckeberg 1984).

Serpentine is an indicator of economic metals; quicksilver (mercury), chromium, nickel, magnesite, asbestos, talc, soapstone, and jadeite are all found in association with serpentine and other ultramafic outcrops. A number of historic and active mines occur in

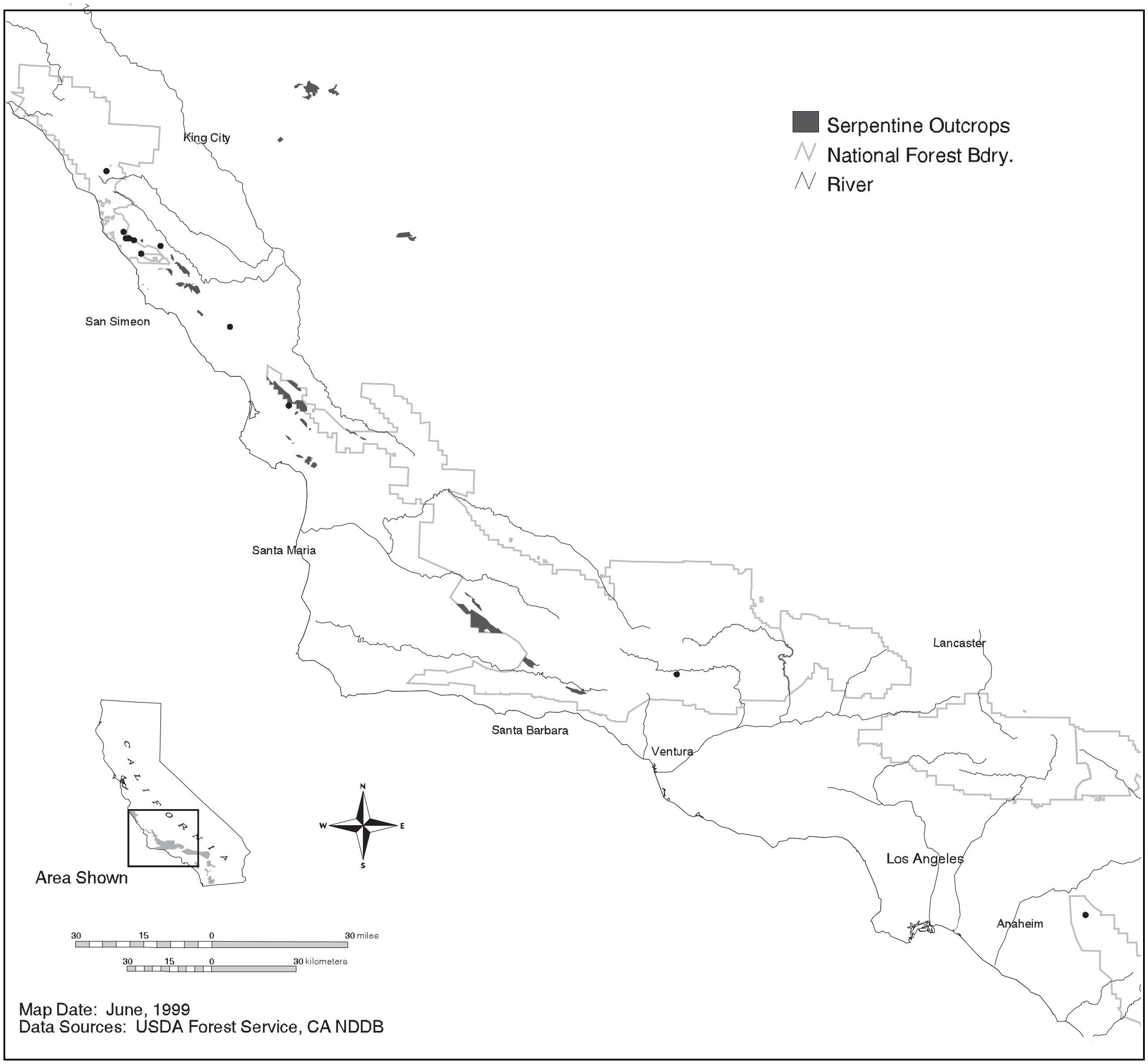


Figure 2.36. The distribution of serpentine outcrops on the Los Padres National Forest.

the Santa Lucia Ranges and potential exists for mining activities to adversely impact serpentine habitat on the forest (Kruckeberg 1984).

Sargent Cypress Groves

Sargent cypress *(Cupressus sargentii)* groves are scattered within the assessment area in the Santa Lucia Ranges and southern Los Padres region. Groves are distributed from 650 to 3,300 feet elevation. The species is considered the most wide-ranging cypress in California (fig. 2.37). Based on Clare Hardham's mapping effort, an estimated 1,585 acres of Sargent cypress habitat occur in central and southern California, with 74 percent located on public lands (Hardham 1962). A small amount is found on U.S. Army Fort Hunter Liggett Military Reservation and 880 acres are reported on the Los Padres National Forest (Los Padres NF 1988a).

Three substantial groves occur on the forest at Zaca and Alder peaks and in the Cuesta Ridge Botanical Area (fig. 2.38). At least six additional sites are also located in the Santa Lucia Ranges (D. Wilken, Santa Barbara Botanic Garden, in litt. 1998).The grove at Cuesta Ridge in the southern Santa Lucias is the southernmost large occurrence and one of several isolated groves ranging from northern Mendocino County south to Zaca Peak in

Santa Barbara County. The Zaca Peak site, located near the San Rafael Wilderness Area, is much smaller than the occurrence at Cuesta Ridge (Jenkins 1981). In the Santa Lucia Ranges, the majority of groves are located along the main ridgeline at about 2,500 feet. The tree may be more prevalent at these sites due to heavy fog occurrence (Hardham 1962). Sargent cypress is also located along a ridge formed by the King City Fault near Bryson and at lower elevations in the Los Burros Creek drainage.

Sargent cypress is an indicator of serpentine soils and tends to occur with other sensitive plant species (Los Padres NF 1988a). Factors other than soil affect the distribution of Sargent cypress, however, as it occupies less than three percent of serpentine habitat on the forest. The tree grows on rocky slopes, ridges, and raised stream benches and terraces (Sawyer and Keeler-Wolf 1995). Throughout most of its range Sargent cypress occurs with gray pine, Coulter pine, scrub oak, leather oak, and buck brush (Johnston 1994). It also frequently grows with California bay, interior live oak, and knobcone pine. Muir's hairstreak butterfly is strongly allied with Sargent cypress.

Like other cypress, Sargent is adapted to and dependent on fire for seed dispersal and enhancement of germination. Fires that are

Figure 2.37. The distribution of Santa Lucia fir forest and Sargent cypress groves in central and southern California.

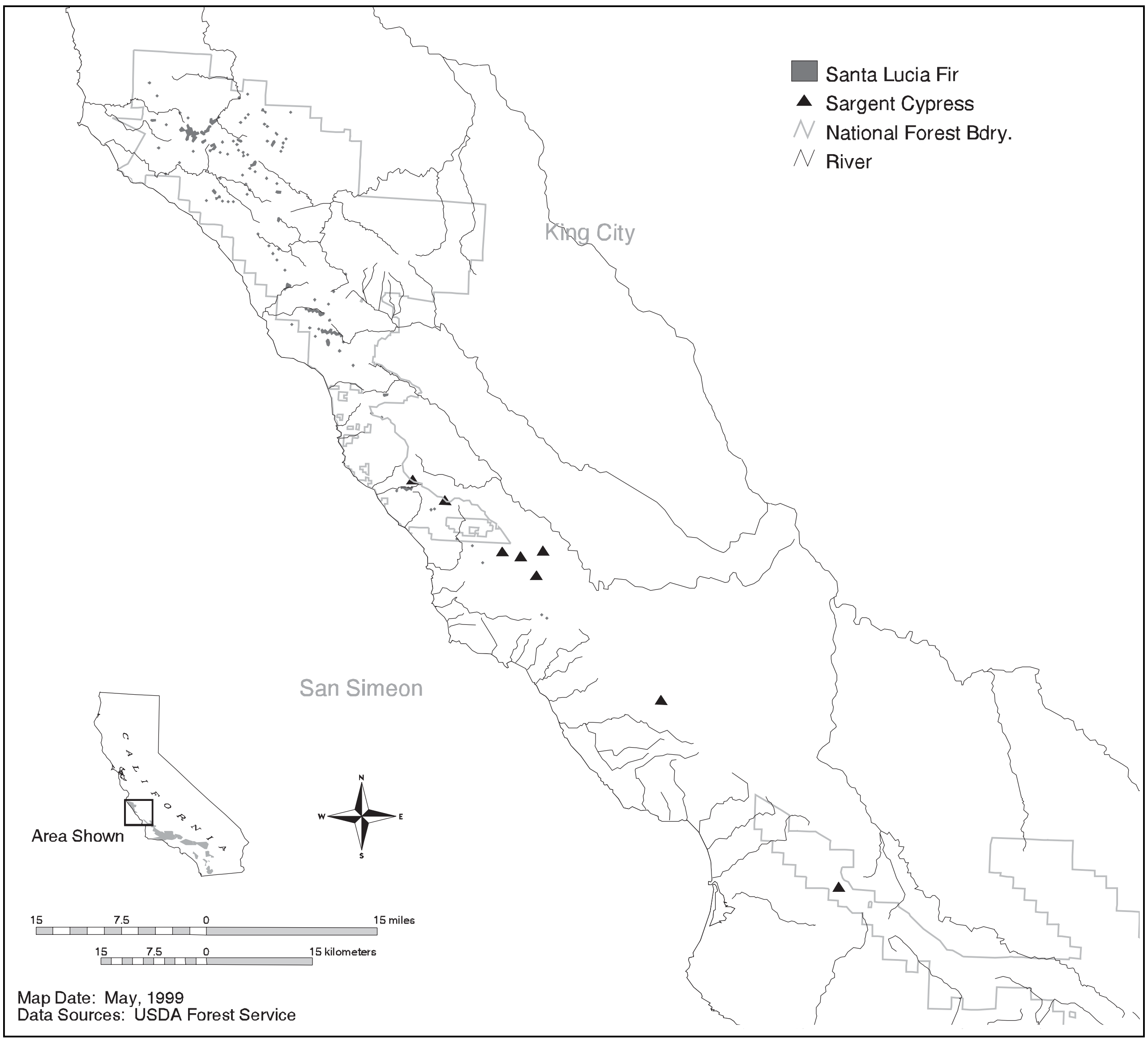


Figure 2.38. Sargent cypress and chaparral growing on serpentine soil at Cuesta Ridge Botanical Area, Los Padres National Forest. MALCOLM MCLEOD

too frequent, however, prevent adequate seed production and can extirpate entire groves (Esser 1994b). South of an existing Waterdog Creek grove, a cypress "swamp" is believed to have been extirpated by fires in 1953 and 1960 (Hardham 1962). The tree has a low-branching habit that makes it susceptible to crown fire and is often killed in wildfires. Required fire-free time intervals are not well defined for the species but might be consistent with other cypress in California (Esser 1994b).

Sargent cypress is generally not considered a rare tree and has no legal status. However, because it is localized on serpentine soil and because some groves, particularly on the Monterey Ranger District, have been reduced in size by short fire-return intervals, Sargent cypress communities are considered rare on forest system lands (M. Borchert, Los Padres NF, pers. comm.).

Santa Lucia Fir Forest

Santa Lucia fir *(Abies bracteata)*, also known as bristlecone fir, is found in the northern Santa Lucia Mountains of Monterey County. The tree is narrowly distributed in an area about thirteen miles wide and fifty-five miles long in the Ventana Wildernes area of the Los Padres National Forest and a portion of U.S. Army Fort Hunter Liggett, bordering the forest on the east (fig. 2.37)(Schoenherr 1992). As part of his master's thesis, Steve Talley produced a coarse-scale map of all known Santa Lucia fir stands (Talley 1974). Based on this map there are an estimated 7,576 acres of Santa Lucia fir forest, with 95 percent located on public lands. The Los Padres Forest Plan however, cites 1,400 acres of Santa Lucia fir within the forest boundary (Los Padres NF 1988).

Stands occur in relatively inaccessible areas: on steep north- or east-facing slopes, along ridges, in canyon bottoms, and on raised stream benches and terraces (fig. 2.39) (Sawyer and Keeler-Wolf 1995). The tree may be dominant in stands or co-dominant with canyon live oak. At lower elevations it occupies the same habitats as coast live oak, Pacific madrone, and coast redwood. At higher elevations it grows with tan oak, interior live oak, and incense-cedar (Johnston 1994).

Occurrences range from a low point at Big Sur Gorge to the top of Cone Peak but greater than half of the fir's distribution is above 3,200 feet (Talley 1974). The southernmost stands occur at lower elevations in San Luis Obispo County. These stands are found along coastal drainages sometimes adjacent to redwood *(Sequoia sempervirens)*. Occupied drainages include Marmolejo Creek, Jackson Creek, the Big Sur River, the west and main forks of Limekiln Creek, Hare Canyon, and Villa Creek. The species is also found along north- and east-flowing drainages including the Carmel River, Miller Fork, Anastasia Canyon, Church Creek, Zig Zag Creek, Higgins Creek, the Arroyo Seco River, the San Antonio River, the Negro Fork of Nacimiento River, and San Miguel Creek.

Based on physical characteristics of the sites it occupies (rocky areas with low fuel loads), Santa Lucia fir is generally regarded as intolerant of fire, yet some mature stands have survived wildland fires (J. Kwasny, Los Padres NF, pers. comm.). Talley looked at the fire history of Santa Lucia fir and determined that there were few differences between past and present fire intensities within stands, despite changing fire regimes in California overall. Fire suppression activities such as fire lines and fuelbreaks are not currently allowed in stands on the Los Padres National Forest. Fire is not prevented from burning through stands nor is it directed toward stands.

Several naturalists, beginning with Sargent in 1898, have recognized Santa Lucia fir as a species at risk due to its narrow endemism and susceptibility to cone parasites (Talley 1974). Occurrences of Santa Lucia fir appear stable at this time; however, a recently recognized threat is the invasion of non-native species into the understory. The rhizomatous shrub French broom *(Genista monspessulana)* is particularly invasive and difficult to eradicate once established. It directly competes with seedlings of Santa Lucia fir and other native understory species (J. Kwasny, Los Padres NF, pers. comm.)

Figure 2.39. A stand of Santa Lucia fir at Cone Peak, Monterey Ranger District, Los Padres National Forest. JEFF KWASNY

Disjunct (Locally Rare) Communities

Two disjunct plant communities were identified in the assessment area. These communities are relatively common in other areas, but are rare or highly localized within the assessment area. They are briefly described below.

Aspen Groves

Quaking aspen *(Populus tremuloides)* is a wide-ranging tree in North America, but its distribution is patchy in the Californias. It is widespread in the Sierra Nevada and there are substantial stands in the White Mountains and in Baja California's Sierra San Pedro Martir. However, aspen is essentially absent in the southern California mountains with the exception of two small groves in the San Bernardino Mountains: one on Fish Creek in the San Gorgonio Wilderness Area and the other on upper Arrastre Creek (Thorne 1977). These two occurrences combined cover less than fifty acres, all of which are located on national forest system land. A third grove, reportedly mapped in 1935 by D. Axelrod, may still exist west of Lake Arrowhead (Jones 1989). The groves are found on decomposed granite at the bottom of canyons and on slopes along creeks.

The Arrastre Creek aspen grove occurs along a seasonal watercourse. It is found mainly with xeric plants (i.e., sagebrush scrub, pinyon, Jeffrey pine forest) and endures a dry summer climate. Aerial photographs from 1972 and 1983 indicate that the grove is decreasing in size (Jones 1989). The Fish Creek aspen grove also occurs along a drainage in what is otherwise a Jeffrey pine and subalpine forest. Beavers were introduced into the habitat and subsequently reduced this grove by an estimated 25 to 50 percent (Jones 1989).

Evidence indicates that the tree was once more common in the mountain ranges of southern California and migrated into northern Baja during prehistoric times (Oberbauer 1986). Aspen is a clonal organism and the San Bernardino Mountain populations were analyzed and found to be almost genetically identical to each other (Zona 1989).

Knobcone Pine Stands

Disjunct stands of knobcone pine *(Pinus attenuata)* occur naturally in the assessment area at just a few locations: in the northern Santa Lucia Range of Monterey County, in San Luis Obispo County at Cuesta Pass, in the western San Bernardino Mountains, and in the Santa Ana Mountains (Vogl et al. 1977). There are approximately 1,233 acres of knobcone pine habitat mapped at these locations, 85 percent of which is located on public lands. The species is more common throughout northern California and also grows near Ensenada, Mexico.

Knobcone pine has been reported from sea level to over 5,500 feet, though stands usually occupy a transitional zone between lower chaparral/woodland and higher elevation conifer forest (Vogl et al. 1977). Talley and Griffin (1980) and Griffin (1982) report on the fire ecology of knobcone pine in the northern Santa Lucia Range. Similar to Coulter pine, knobcone pine has serotinous cones and is dependent on fire for seed dispersal (Vogl 1976).

In the San Bernardino Mountains, stands of knobcone pine cover approximately 990 acres between City Creek and Government Canyon. In the Santa Ana Mountains, small stands of this pine occur in otherwise chaparral-dominated areas on the slopes of Sugarloaf, Pleasants, and Santiago peaks (Thorne 1977; F. Roberts, USFWS, pers. comm.). The stand at Pleasants Peak grows on serpentine soils (EA Engineering, Science, and Technology 1995). Usually restricted to dry, rocky sites with shallow soils, knobcone pine is typically associated with infertile substrates that limit competition from other conifers (Holland 1986) (fig. 2.40).

Figure 2.40. Knobcone pine near Cuyama Grade, Los Padres National Forest. JANET NICKERMAN

Chapter 1 – Introduction and Overview

The sustainability of ecological systems is a necessary prerequisite for strong, productive economies; enduring human communities; and the values people seek from wildlands.
— USDA Committee of Scientists (1999)

The USDA Forest Service and other land management agencies are committed to a stewardship philosophy called ecosystem management. The concept of ecosystem management is to utilize the best available ecological knowledge to produce desired resource values, products, and services in ways that also sustain the diversity and productivity of ecosystems. The desired outcome is sustainable ecological systems that meet the needs of the present without compromising the ability of future generations to meet their own needs.

Ecosystem management is a means the Forest Service and other agencies use to meet objectives specified in agency programs and plans. It is not an end in itself. In application, ecosystem management works only when resulting actions are scientifically credible, legally defensible, and socially acceptable (Manley et al. 1995).

A framework for implementing ecosystem management has been adopted by the Forest Service's Pacific Southwest Region, which encompasses all of the national forests in California. This framework identifies five basic questions which must be addressed in local planning areas (Manley et al. 1995):

1) How did ecosystems evolve?
2) What is sustainable?
3) What do we want?
4) What do we currently have?
5) How do we move from what we have to what we want?

The Southern California Mountains and Foothills Assessment (SCMFA) was initiated by the Cleveland, San Bernardino, Angeles, and Los Padres national forests to help address these questions by compiling, integrating, and interpreting existing information on the status of native ecosystems and species and the processes that influence them. This report summarizes the assessment results and identifies the primary issues resource managers face in trying to conserve native ecosystems and species in this growing region of the state.

Gathering the Best Available Knowledge

Our aim for natural resources management is to utilize the best available knowledge about the land, water, and inhabitants of the region. Applied on public lands, this knowledge can help us sustain native ecosystems and their inherent biological diversity while being responsive to the interests of local economies and the values of all people who use these lands. We believe that effective management can be achieved through collaborative planning, development of a clear strategy, timely implementation, consistent monitoring, thoughtful adaptation, and strong leadership to keep us on course.

This document, together with the SCMFA databases, is the first major step toward fulfillment of that vision. It is not a decision-making document. Rather, it describes existing conditions and compiles the best available knowledge of the ecosystems, habitats, and species in this region. It provides a foundation of information from which policies, strategies, and decisions can be built, evaluated, and modified. In geographic scope it extends beyond state, federal, or private boundaries to assess the "big picture" across

6.1 million acres of coastal mountains (fig. 1.1). In using the assessment data, land managers can now consider the larger, natural boundaries of ecosystems rather than just the artificial boundaries of individual counties, districts, or national forests.

This review of habitat and species conservation issues was accomplished through the cooperation of federal and state natural resource agencies within the southern California region. Cooperating members include U.S. Department of Agriculture, Forest Service; California Department of Fish and Game (CDFG); and U.S. Department of Interior, Fish and Wildlife Service. This cooperation significantly expanded the scope and depth of analysis that might have been accomplished by separate initiatives. The findings in this assessment do not reflect unanimous views of all agencies involved on all points.

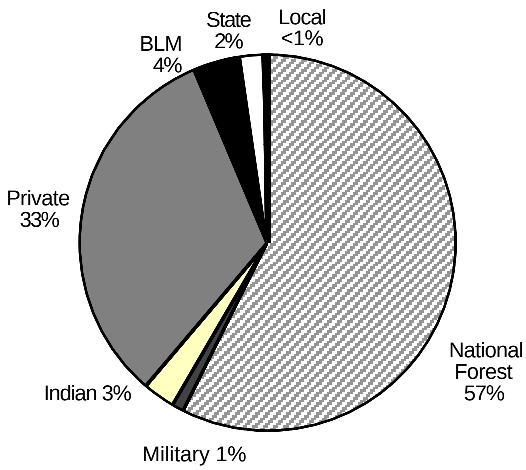
Although the SCMFA is broad and comprehensive in subject matter and geographic scope, there are many opportunities to further expand the analyses based on these data. This type of assessment is an ongoing process. Thus, identifying data gaps and future information needs is as important a task as gathering existing data. This assessment serves as both a useful reference and as a benchmark for future analyses.

There is no specific statutory requirement for this type of regional assessment. However, the value of gathering and analyzing information at a regional scale is now widely recognized and is being done throughout the United States (e.g., southern Appalachian Mountains, Pacific Northwest forests, northern Great Plains, interior Columbia River Basin, and Sierra Nevada). In fact, the four national forests that are the central focus of this report are the last of the national forests in California to be considered in a large-scale regional assessment.

There are a variety of other large-scale habitat conservation planning efforts underway in southern California. The Bureau of Land Management (BLM) is spearheading several planning efforts that focus on public lands in the Mojave and Colorado deserts. In the densely populated coastal region, city and county governments in conjunction with California's Natural Community Conservation Planning (NCCP) program, the U.S. Fish and Wildlife Service (USFWS), and private landowners are engaged in planning efforts to create habitat reserves for maintaining biodiversity in rapidly developing areas where there is little existing public land. Such efforts include the San Diego Multiple-Species Conservation Plan, the Western Riverside County Multiple Species Habitat Conservation Plan, the Coachella Valley Multiple Species Habitat Conservation Plan, and the Santa Clara River Enhancement and Management Plan. Each of these efforts is emphasizing the need for corridor connections from their respective habitat reserves to existing public lands. The SCMFA is an important complement to those ongoing plans because it addresses habitat and species conservation issues in the largest aggregation of public land in the southern California coastal region. As development pressures increase on private lands, the public wildlands are increasingly being looked upon as the core refugia for native habitats and species.

The Land and Resource Management Plans (Forest Plans) for the four southern California national forests date back to the mid-1980s. This assessment provides new and current information for updating and revising those Forest Plans. Given the large role that the national forests play in stewardship of southern California's mountain and foothill ecosystems (fig. 1.2), comprehensive and scientifically credible data are needed to facilitate land management planning. To facilitate easy access to the information gathered in this assessment, many of the databases and maps will be made available over the Internet on the Forest Service, Region 5 Home Page (www.r5.fs.fed.us).

Figure 1.2. Land ownership percentages in the Southern California Mountains and Foothills Assessment area. The entire area covers 6.1 million acres.



Scope of Analysis

This assessment brings together information from published reports, field surveys, "gray" literature (i.e., unpublished technical reports), mapping efforts, satellite imagery, agency files, and expert opinion to provide an in-depth analysis of the following topics:

- Trends in the composition, structure, and extent of ecological communities in the planning area;
- The natural and human processes that are driving landscape change;
- Species and communities at risk and the factors affecting their long-term viability;
- Possible methods and strategies for sustaining species viability and ecological integrity.

Related subjects addressed in this review include broad habitat and land-cover patterns, fire regimes, exotic species, fragmentation, forest health, watershed condition, threatened and endangered (T&E) species, rare communities, and popular game animals (table 1.1). The information databases that were developed for this assessment are extensive but far from complete. We try throughout the document to identify where there are particularly critical information gaps and research needs.

The assessment team set goals to identify and develop information that could be assimilated and analyzed using a Geographic Information System (GIS). A GIS is computer software that allows you to store and display the exact geographic position of different

Table 1.1. Using existing information and referenced material, this assessment attempts to answer key questions in four primary subject areas.

1. **Ecological Communities** — What are the major ecological communities in the coastal mountains of southern California? What is known about their status and distribution? How have they changed in the last one hundred to two hundred years? What rare communities exist and what are their status and trends? (chapter 2)
2. **Ecological and Human Processes** — What are the principal ecological processes and human activities that sustain or drive change in the composition, structure, and extent of southern California mountain and foothill ecosystems? How are those processes and activities affecting the landscape and what can be ascertained regarding the natural range of variability? What current trends are apparent and what threats or opportunities are presented by them? (chapter 3)
3. **Focal Species** — Which species are (1) rare or at risk or (2) of high public interest in the coastal mountains and foothills of southern California? What is known about the status and distribution of each? What factors threaten their abundance or continued persistence? What is the potential for conserving or enhancing populations on public lands? (chapters 4, 5, and 6)
4. **Key Areas** — What specific geographic areas have particularly important ecological significance and what resources are located there? (chapter 7)

elements on the landscape. It is particularly useful for evaluating the distribution and extent of different elements (e.g., vegetation types, species, land uses, fire history) and the degree of overlap between them. GIS products were developed to assess key questions and to compile a unified database. Some resource and land use data were unavailable or available for only a portion of the assessment area. Once again, we have tried to identify where these information gaps exist.

The team consisted of three primary staff members: a wildlife ecologist (project leader), botanist, and GIS analyst. Additional resources included several part-time seasonal technicians and a fifteen-member, multi-disciplinary task group. The task group met ten times to review the assessment data, identify issues, and develop recommendations for new management direction. Members of this committee included a forester, ecologist, fire management specialist, recreation specialist, wildlife biologist, fisheries biologist, land management planner, soil scientist, and district ranger.

Given the infeasibility of separately addressing, let alone individually managing, each and every plant and animal species, our analysis made extensive use of a community-level "coarse-filter" screening approach. The underlying assumption of the coarse-filter approach is that most plant and animal species are predictable occupants of a broad habitat type or structural stage. Thus, the persistence of these species can be assumed in a well-managed, functioning landscape that maintains those native habitats in a condition that is similar to what has historically occurred in the area (Noss 1987; Hunter 1991). This includes the need to maintain or mimic the ecological processes (e.g., fire and floods) that shape and rejuvenate habitats and keep them within the natural range of variability (Smith et. al. 1993; Manley et al. 1995).

There are some species, however, whose rarity or habitat requirements are such that they will not be adequately addressed by the coarse-filter, habitat-based approach. These species need to be considered individually, in a fine-filter, population-based assessment. We developed a process for identifying these fine-filter species and then specifically addressed the conservation status of each.

The Assessment Area

The assessment area covers a 6.1 million acre chain of mountains and foothills that parallel the Pacific coastline from Monterey south to the Mexican border. This long, undulating string of coastal mountain ranges varies considerably in breadth and elevation (fig. 1.3). Collectively, the mountains are a prominent landscape feature that separates coastal basins from the San Joaquin Valley and the Mojave and Colorado deserts. Over 64 percent of the assessment area is public land, the vast majority of which (3.5 million acres) is contained within four national forests (fig. 1.2).

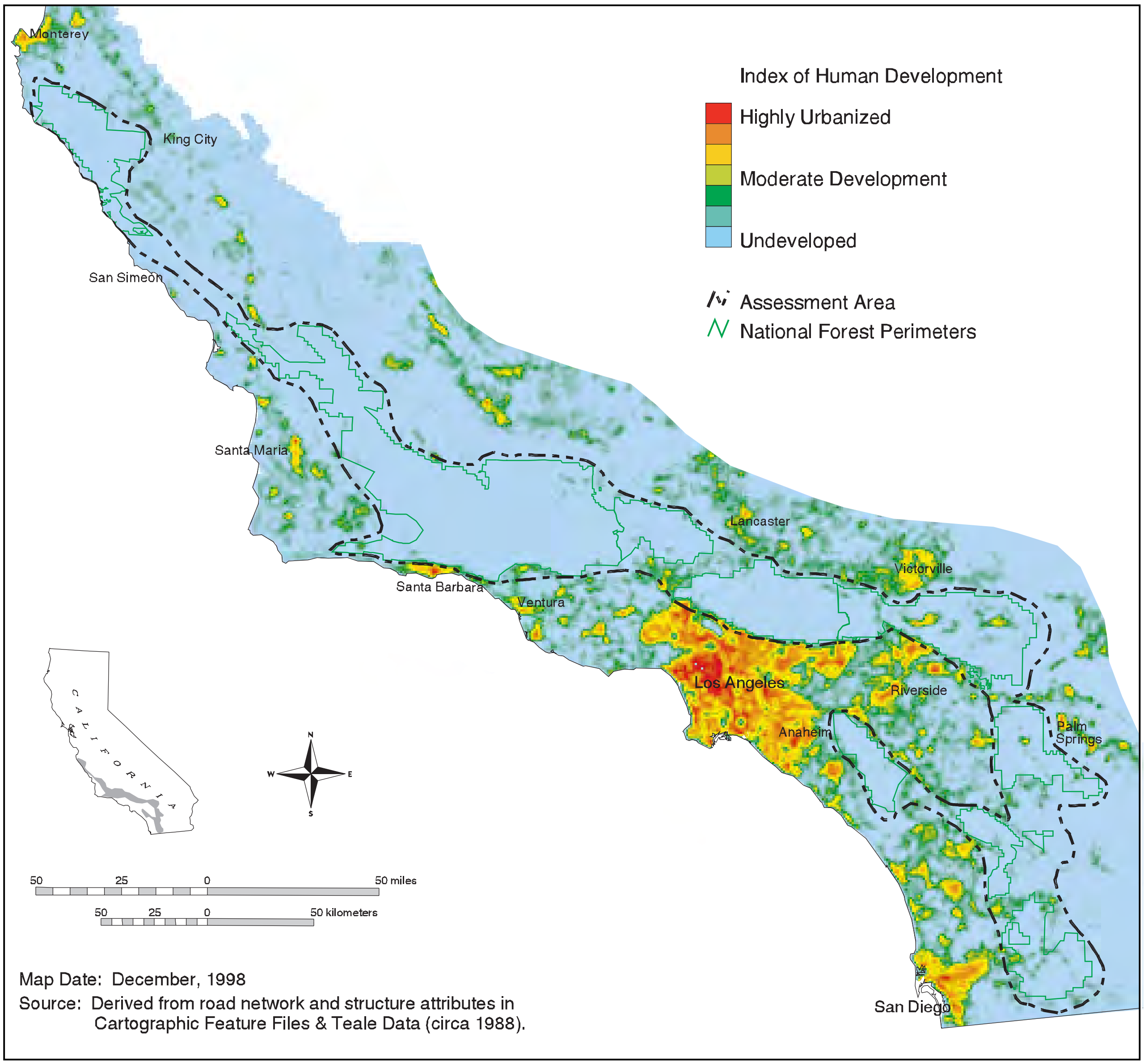
South and west of the mountains, the lower elevations are dominated by small towns and agricultural lands along the narrow central coast, and by extensive urbanization in the broader southern basins that extend from Ventura to San Diego (fig. 1.4). Over fifteen million people live in the greater Los Angeles-San Diego metropolitan area (U.S. Census Bureau). To the north and east, the mountains drop quickly into arid, desert habitats of the southern San Joaquin Valley and the Mojave and Colorado deserts. Urbanization on the desert side is increasing with the rapid growth of communities around Lancaster, Victorville, and Palm Springs.

Geographically, these coastal mountains are identifiable as distinct ranges or groups of ranges. In recognition of the many differences among these mountain ranges, we divided the assessment area into nine distinct regions (fig. 1.5). The boundaries of these regions correspond closely with one or more of the subsections defined in the Ecological Units of California (Goudey and Smith 1994; Miles and Goudey 1997) that are part of the National Hierarchical Framework of Ecological Units (ECOMAP 1993). Some basic information on each of the nine mountain regions is provided below and in table 1.2. The name and code (e.g., M262Bo) for each ECOMAP subsection in the region is also listed. The regions are addressed in the order they occur from south to north.

San Diego Ranges

Beginning at the Mexican border, the San Diego ranges run from south to north through the center of San Diego County, ending just inside the Riverside County line. Covering 958,000 acres, this region consists of a series of low, coastal mountains with foothills, mesas, and valleys lying in between. Only 3,640 acres rise above 6,000 feet. The major mountains in the San Diego ranges are Laguna, Cuyamaca, Volcan, Hot Springs (the highest at 6,533 feet), and Palomar. Geologically, they are all part of the Peninsular Ranges (Schoenherr 1992). Major streams emanating from these mountains are Cottonwood Creek (a tributary of the Tijuana River), Sweetwater River, San Diego River, San Dieguito River (Santa Ysabel Creek), San Luis Rey River, and Santa Margarita River. For additional information, see descriptions of the

Figure 1.4. Patterns of human development along the southern California coast. The mountains are largely surrounded by major population centers, particularly in the south. The data used to generate this map portray the situation as of the late 1980s.



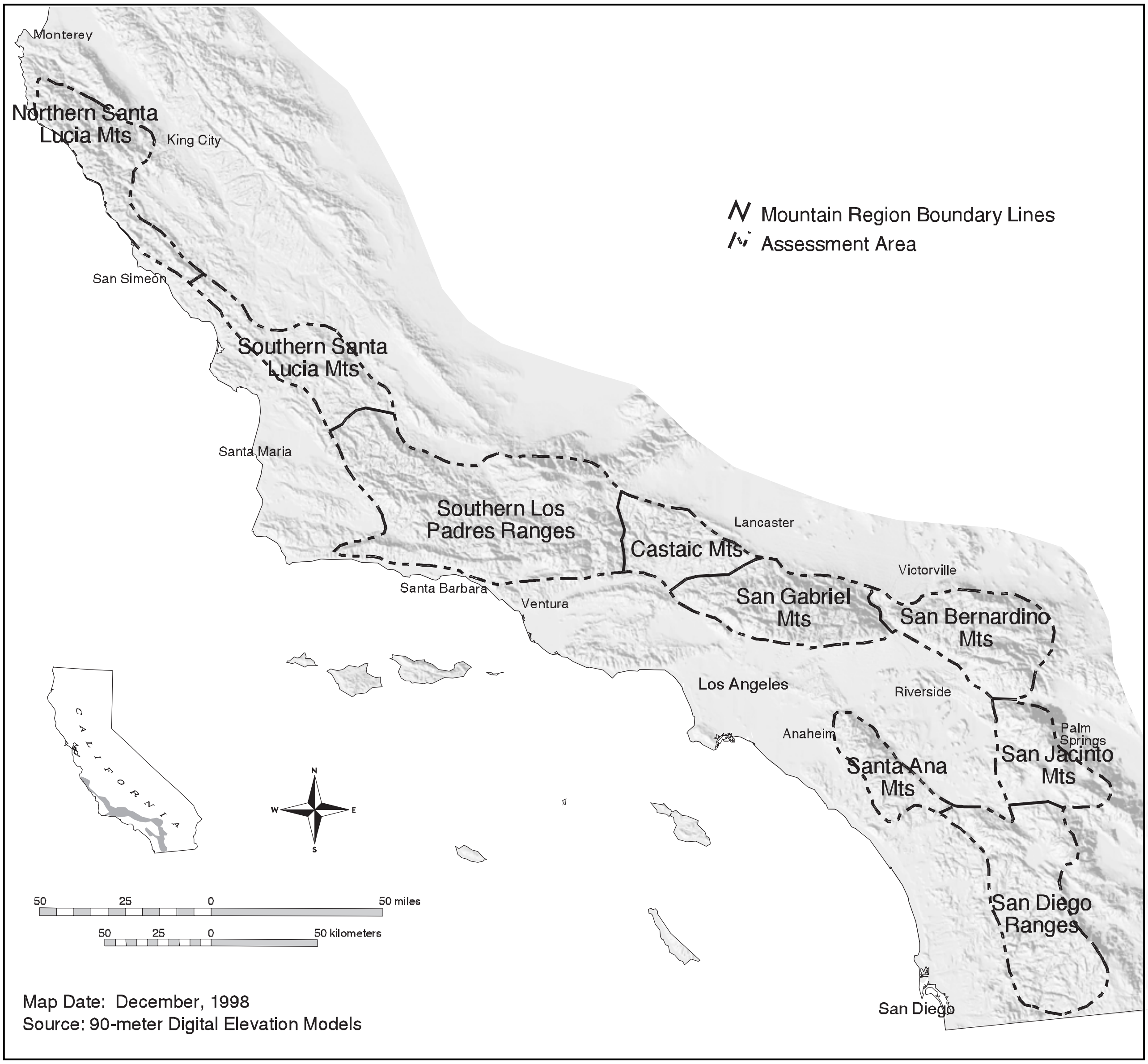


Figure 1.5. The nine mountain regions within the assessment area. See text for a description of each.

Palomar-Cuyamaca Peak (M262Bo) and Western Granitic Foothills (M262Bn) subsections in Miles and Goudey (1997).

The Cleveland National Forest makes up 30 percent of the San Diego ranges region. Three state parks (Cuyamaca Rancho, Palomar Mountain, and Anza-Borrego Desert) cover another 7 percent, BLM lands take in 8 percent, and 11 percent is within Indian reservations.

Santa Ana Mountains

The Santa Ana Mountains region includes the Santa Margarita and Elsinore mountains and the Santa Rosa Plateau. Collectively they cover 275,000 acres that straddle the line between Orange, Riverside, and San Diego counties. These are low, coastal mountains, with the highest point being 5,687-foot Santiago Peak. As the westernmost extension of the Peninsular Ranges, the Santa Ana Mountains jut out into a broad coastal basin and are largely surrounded by urbanization. The primary streams emanating from these mountains are San Mateo Creek, San Juan Creek, Trabuco Creek, and Santiago Creek. For additional information, see the Santa Ana Mountains (M262Bf) subsection description in Miles and Goudey (1997).

The Trabuco District of the Cleveland National Forest makes up 49 percent of this region. Other large areas of natural habitat include the Santa Rosa Plateau Preserve (8,500 acres), Audubon's Starr Ranch, and the Santa Margarita River Reserve. Immediately north of the Santa Ana Mountains is Chino Hills State Park and to the southwest, along the coast, is the Camp Pendleton Marine Corps Base.

San Jacinto Mountains

The San Jacinto Mountains region includes the highest portions of the Santa Rosa Mountains and covers 428,000 acres of Riverside County. Mount San Jacinto, at 10,805 feet, is the second highest peak in southern California. The San Jacinto Mountains are by far the highest of the Peninsular Ranges, with 53,600 acres above 6,000 feet. Most of the precipitation that falls in this range flows into the San Jacinto River. The more arid northern and eastern slopes flow into tributaries of the Whitewater River. For additional information, see the San Jacinto Mountains (M262Bm) subsection description in Miles and Goudey (1997).

The San Jacinto District of the San Bernardino National Forest accounts for 46 percent of the land area in this region. San Jacinto State Park covers an additional 7 percent. BLM lands take in another 7 percent and 9 percent of the area is within Indian reservations.

San Bernardino Mountains

The San Bernardino Mountains cover 652,000 acres in San Bernardino County. Rising between Banning Pass and Cajon Pass, they contain the largest expanse of high elevation country in southern California. Over 248,000 acres of the San Bernardino Mountains are above 6,000 feet, including the highest peak in southern California, 11,502-foot Mount San Gorgonio. Geologically San Bernardino Mountains are part of the east-west trending Transverse Ranges (Schoenherr 1992). These mountains are the primary headwaters of the largest stream in southern California, the Santa Ana River. On the desert side, they also are the headwaters of the Mojave River. For additional information, see descriptions of the San Gorgonio Mountains (M262Bg) and Upper San Gorgonio Mountains (M262Bh) subsections in Miles and Goudey (1997).

Table 1.2. Characteristics of the nine mountain regions within the assessment area.

Southern California's Mountainous Regions	Total Acres	% Public Lands	% National Forest	% below 3000 ft	% above 6000 ft	Highest Point (ft)
San Diego Ranges	958,046	45%	30%	39%	<1%	6,533
Santa Ana Mountains	275,609	51%	49%	89%	0%	5,687
San Jacinto Mountains	428,288	60%	46%	12%	13%	10,805
San Bernardino Mountains	651,970	71%	61%	9%	38%	11,502
San Gabriel Mountains	658,414	81%	80%	28%	14%	10,064
Castaic Ranges	404,583	54%	52%	54%	0%	5,788
So. Los Padres Ranges	1,724,744	75%	74%	40%	5%	8,831
So. Santa Lucia Mountains	502,086	42%	37%	97%	0%	4,063
No. Santa Lucia Mountains	533,624	62%	59%	79%	0%	5,155
Entire Assessment Area:	6,137,363	63%	57%	44%	8%	11,502

The San Bernardino National Forest encompasses this range and accounts for 61 percent of the land area. BLM lands take in an additional 10 percent and state lands, including Silverwood Lake State Park, make up 1 percent of the area. Indian reservations make up 4 percent of the land in this region.

San Gabriel Mountains

West of Cajon Pass is another large transverse range, the San Gabriel Mountains. This range covers 658,000 acres, mostly in Los Angeles County with the eastern edge crossing into San Bernardino County. The highest peak is 10,064-foot Mount San Antonio (Mount Baldy). The San Gabriel Mountains are rugged and steep but with considerably less high country than the San Bernardinos: 91,700 acres rise above 6,000 feet. These mountains are the headwaters of the Los Angeles River and the San Gabriel River. They also contribute significant runoff to the Santa Ana River (via Lytle, Cucamonga, and San Antonio creeks) and the Santa Clara River (via Soledad Canyon). The major desert-flowing drainage is Little Rock Creek. For additional information, see descriptions of the San Gabriel Mountains (M262Bd) and Upper San Gabriel Mountains (M262Be) subsections in Miles and Goudey (1997).

The Angeles National Forest and a small portion of the San Bernardino National Forest account for 80 percent of the land area in the San Gabriel Mountains.

Castaic Ranges

The Castaic Ranges cover 404,000 acres and include Liebre Mountain, Sawmill Mountain, and the Sierra Pelona. They lie northwest of the San Gabriel Mountains, between Soledad Canyon and Piru Creek in Los Angeles County. Geologically, they are considered part of the Transverse Ranges. The area has rugged topography but is relatively low in elevation, climbing above 5,000 feet only on Liebre and Sawmill mountains. The highest point is 5,788-foot Burnt Peak on the south side of Sawmill Mountain. Major drainages in this region are San Francisquito Creek, Elizabeth Lake Creek, and Castaic Creek, all tributaries of the Santa Clara River. Miles and Goudey (1997) split this region somewhat differently. The southeastern half is identified as the Sierra Pelona-Mint Canyon (M262Bc) subsection, and the northwestern half (which includes Liebre and Sawmill mountains) is part of a larger Northern Transverse Ranges (M262Bb) subsection that extends west over to the Mount Pinos area.

The Angeles National Forest makes up 52 percent of this region. Castaic Lake State Recreation Area and Vasquez Rocks County Park are also located here.

Southern Los Padres Ranges

The southern Los Padres ranges region covers 1.7 million acres of mostly mountainous terrain that extends from north of the Santa Clara River and west of Piru Creek to where the Cuyama River cuts through the Coast Ranges. The region encompasses large portions of Ventura and Santa Barbara counties and extends into the southwest corner of Kern County. Major mountains in this region include Pinos, Abel, Frazier, Cobblestone, Sierra Madre, San Rafael, Figueroa, Pine, Alamo, Santa Ynez, and Topatopa. Although large in area and rich in topography, the region does not encompass much high elevation land: Only 5 percent (82,000 acres) rises above 6,000 feet. Mount Pinos is the highest point at 8,831 feet. These mountains are the headwaters for Piru and Sespe creeks (both tributaries of the Santa Clara River) and for the Ventura, Santa Ynez, Sisquoc, and Cuyama rivers. The ecological units described in Miles and Goudey (1997) divide this region into the following subsections: San Rafael-Topatopa Mountains (M262Ba), Northern Transverse Ranges (M262Bb), and Santa Ynez-Sulphur Mountains (261Bb).

The Los Padres National Forest makes up 74 percent of this region. The Hungry Valley State Vehicular Recreation Area and the Hopper Mountain National Wildlife Refuge are also located here.

Southern Santa Lucia Range

The southern Santa Lucia Range region covers 502,000 acres north of the Cuyama River in San Luis Obispo County. Geologically part of the southern Coast Ranges (Schoenherr 1992), the most prominent mountains in this area are the La Panza Range, Pine Mountain, and Garcia Mountain. These are low-elevation peaks, with 4,063-foot Machesna Mountain (in the La Panza Range) being the highest point. The southern Santa Lucia Range is the headwaters of the Salinas River. Other streams emanating from these mountains include the Huasna River, Alamo Creek, and Arroyo Grande Creek. For additional information, see descriptions of the South Coastal Santa Lucia Range (261Ak) and Interior Santa Lucia Range (M262Ae) subsections in Miles and Goudey (1997).

The Los Padres National Forest takes in 37 percent of this region. Most of the remaining area is private ranchland.

Northern Santa Lucia Range

The northern Santa Lucia Range region covers 533,000 acres north of San Simeon in Monterey County. The mountains rise abruptly from the Pacific coastline, reaching 5,155 feet at Cone Peak. The combination of their proximity to the coast, steep topography, and northern latitude results in precipitation amounts that are substantially higher than the rest of the assessment area receives (fig. 1.6). Geologically, the northern Santa Lucia Range is part of the southern Coast Ranges. Major streams emanating from these mountains include the Nacimiento River, San Antonio River, and Arroyo Seco (all tributaries of the Salinas River) and the Big Sur and Carmel rivers. For additional information, see the North Coastal Santa Lucia Range (261Aj) subsection description in Miles and Goudey (1997).

The Monterey District of the Los Padres National Forest makes up 59 percent of this region. A number of state parks are also located along the Big Sur coastline, including Andrew Molera, Pfeiffer Big Sur, Julia Pfeiffer Burns, and Big Creek Reserve. Fort Hunter Liggett Military Reserve encompasses the southeastern flank of these mountains.

Information Sources

The information utilized in this assessment came from a wide variety of sources. Standard methods of literature citation are used in this report to acknowledge material that came from scientific journals and other published material. However, a considerable amount of our information came from unpublished sources. This is particularly true of spatial data on landscape patterns, land uses, and species locations as well as local habitat relationships information for some species. We benefited greatly from the availability of existing data sets and the generous contributions of information from many different individuals. We want to specifically acknowledge those contributions here and describe some of the strengths and limitations of the data that were utilized.

Vegetation Maps

Vegetation information came from a variety of sources. To assemble a complete vegetation layer for the entire assessment area we integrated digital data from five independent mapping efforts. Data sources were the Forest Service Region 5 Remote Sensing Laboratory, San Diego County, Riverside County, the California Gap Analysis Project, and specific information on Engelmann oak distribution provided by Tom Scott of University of California (UC) Riverside, Cooperative Extension. These mapping efforts used different data-capture methods, classification systems, and decision rules.

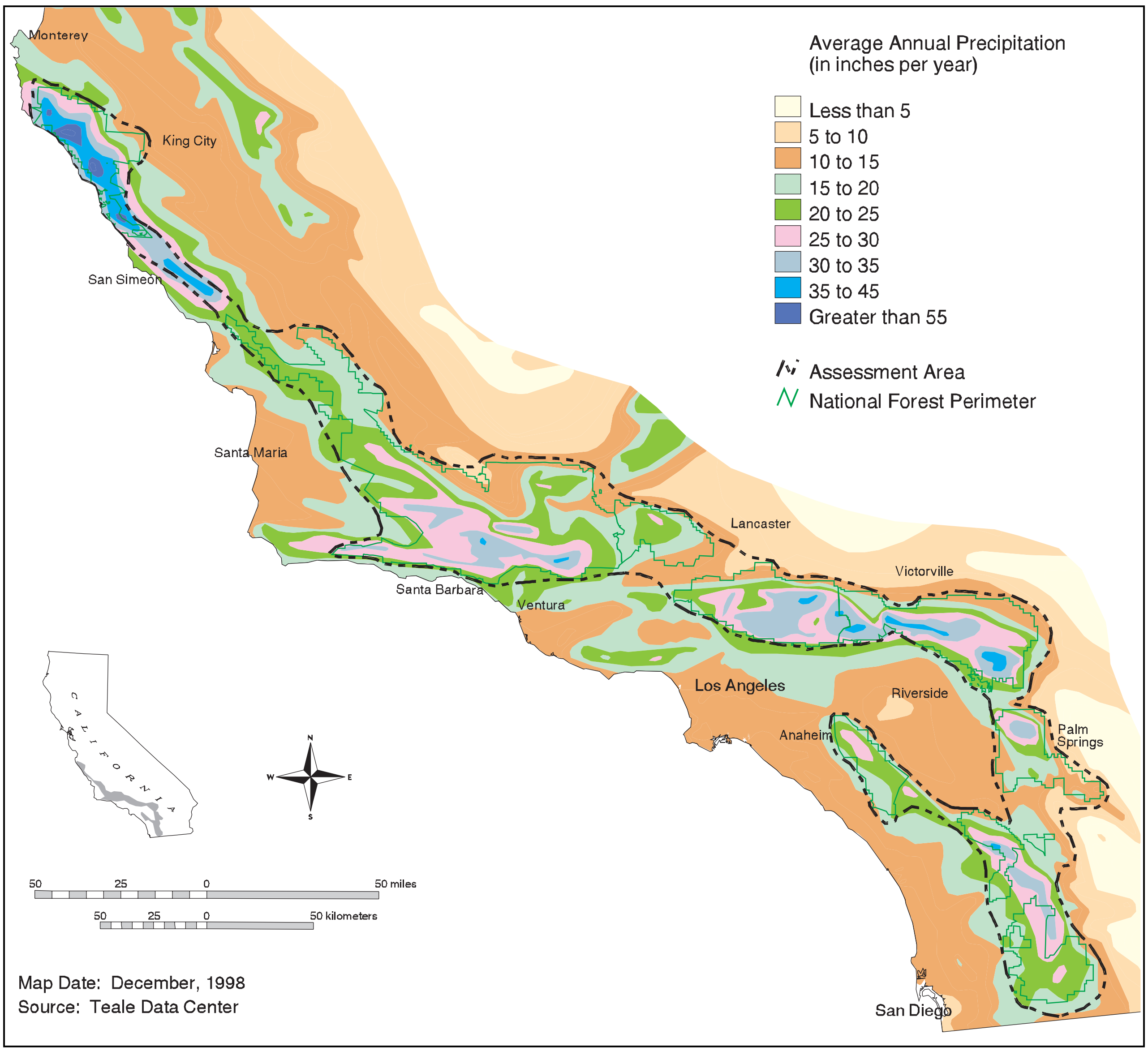
Vegetation maps for the four southern California national forests were developed by Janet Franklin and associates at San Diego State University. These maps use the CALVEG series-level classification system (USDA Forest Service 1981). In forest types, the maps also include labels for percent canopy cover, average tree size, and secondary vegetation.

The minimum mapping unit (MMU) is approximately 5 acres. These maps were developed using advanced image-processing algorithms (segmentation, canopy modeling, mixture modeling) applied to Landsat Thematic Mapper (TM) imagery (Franklin 1996). A detailed description of the methods used can be found in Franklin and Woodcock (1997).

Vegetation maps for San Diego and Riverside counties use a modified Holland (1986) classification system (for a review of classification systems see Sawyer and Keeler-Wolf 1995) and have an MMU of about 5 acres. They were derived primarily from air photo interpretation and do not contain information on canopy cover or tree size.

The Gap Analysis maps, developed by Frank Davis and associates at UC Santa Barbara, also use the Holland classification system. They have primary and secondary vegetation labels but do not contain information on canopy cover or tree size. The Gap Analysis maps provide coverage of the entire state but, with an MMU of around 240 acres (100 hectares), they capture patterns at a significantly coarser resolution. Thus, vegetation patterns appear more generalized in these maps.

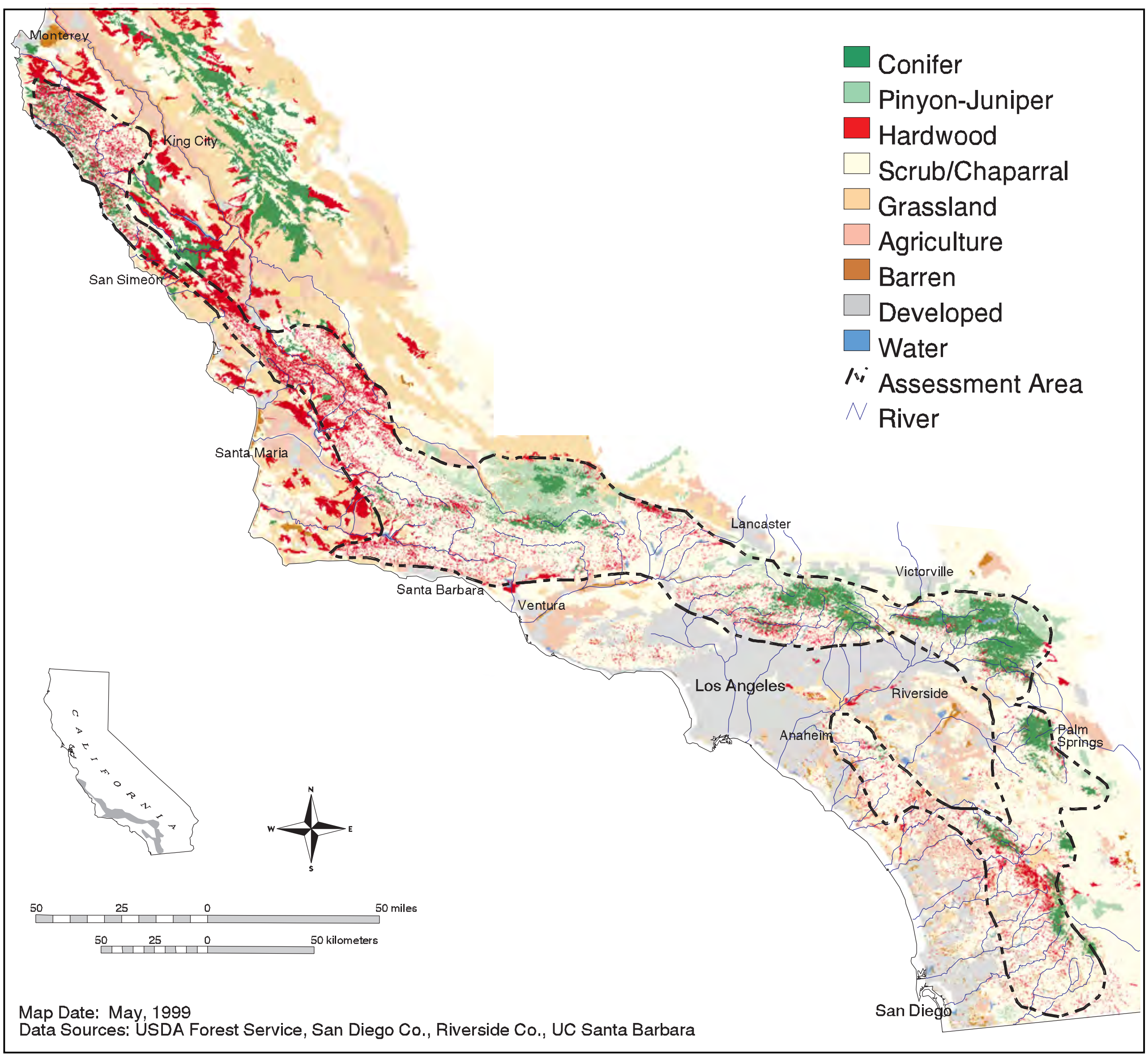
Figure 1.6. Average annual precipitation in southern California for the period from 1961 to 1990. Notice the strong influence that elevation (see fig. 1.3) has on precipitation. Latitude, steepness of terrain, and proximity to the ocean are also important factors.



Our aggregated vegetation layer utilizes the entire Forest Service data set (with Tom Scott's Engelmann oak map used to update oak woodland labels), then fills in gaps with the San Diego and Riverside county maps, and finally fills the remaining holes with the Gap Analysis data (fig. 1.7). The coarser Gap Analysis data are used most extensively to capture private lands in the central Coast Ranges (southern and northern Santa Lucia Ranges). Thus, the vegetation acreages presented in later chapters tend to be skewed towards more dominant vegetation types in those subareas.

Although formal accuracy assessments of these maps have not been completed, it is important to recognize that there are errors associated with them. Each map has its strengths and weaknesses, corresponding with the resolution of the source data and the methods used to assign vegetation labels. Some vegetation types are inherently difficult to capture using remote sensing methods (e.g., narrow riparian communities) and others are difficult to reliably distinguish from similar types regardless of the method used (e.g., separating live oak chaparral from live oak woodland). Map error rates are generally higher for such types.

Figure 1.7. The distribution of major land-cover classes across the assessment area and surrounding lands.



The derivation of structural attributes (i.e., canopy cover and tree size) from satellite imagery is challenging and the confidence in these mapped attributes is lower than the labels for vegetation type. There appear to be particular problems with the modeling methods used to estimate tree size (Franklin 1996), and consequently we seldom used this attribute in our analyses.

Other Mapped Landscape Features

Spatial data on many other landscape features were compiled for the assessment area from a variety of sources. Cartographic Feature Files (CFFs)(1:24,000 scale) from the Forest Service Geometronics Service Center and coarser-scale data (1:100,000) from the state's Teale Data Center were used to assemble coverages of streams, lakes, roads, and structures. Soil coverages for portions of the study area were obtained from the Los Padres National Forest, the National Resource Conservation Service, and San Diego State University.

To derive slope, aspect, and elevation we compiled 30-meter digital elevation models (DEMs) for all the 7.5 minute quads in our study area. These came from the Forest Service Geometronics Service Center and the U.S. Geological Survey (USGS). Ecological subsection maps and 10-meter SPOT satellite imagery were obtained from the Region 5 Remote Sensing Laboratory.

Land Use Information

Julie Difani of the San Bernardino National Forest was particularly instrumental in gathering information on the spatial extent and intensity of different land uses. Shawna Bautista on the Angeles National Forest also provided this type of information.

Fire History Information

Digital data on historic fires (including mapped perimeters) were received from the California Department of Forestry and Fire Protection (CDF), San Diego and Los Angeles counties, and the four southern California national forests. Hard copy maps of recent fires were also digitized to update the existing digital data. To develop an integrated GIS coverage from these various sources, considerable time was spent looking at areas of overlap, eliminating duplicate fires, and determining which source had the most carefully mapped perimeter (there often was considerable variation). In the combined coverage, we used the best perimeter data from the available sources to obtain as complete a fire history as possible for the entire assessment area.

Several aspects of the historic fire perimeter data need to be understood in order to aviod misinterpreting what they represent. First, each data source extended back to a different point in time; thus, the coverage does not uniformly cover all areas back through time. This is most significant for areas where the sole source was CDF data, which only extend back to 1950 (the other sources went back more or less to around 1910). The primary area where CDF data are the sole source is the large expanse of private land between the Monterey and Santa Lucia districts of the Los Padres National Forest.

Second, even within the time period covered by each source, not every fire was mapped and the record appears to become less accurate the further back in time you go (particularly prior to the 1930s)(Minnich 1988). Third, where the data are incomplete, large fires are more likely to be represented than small fires because of the increased visibility and attention given to them. Finally, the fire perimeters were not always mapped accurately, or at least not drawn on fine-scale maps that could be transferred accurately. Thus, while we believe the fire history data are effective at capturing key temporal and spatial patterns at the landscape scale, they are far less reliable for fine-scale assessments of burn histories at specific points on the ground.

Species Locations and Status Information

We obtained information on species locations and status from a number of unpublished sources and are extremely grateful for the many contributions. The California Natural Diversity Data Base (CNDDB) was an excellent source of information on many rare species as were historic survey records and atlases in the offices of the four southern California national forests.

Specific locational information on birds was provided by Robert McKernan (San Bernardino Natural History Museum) and Dan Cooper (UC, Riverside). Distribution information on amphibians and reptiles was received from Joe Copp (California Academy of Sciences), Dan Holland (independent researcher), Sam Sweet (UC, Santa Barbara), Robert Fisher and Ed Ervin (San Diego State University), and Robert Goodman (California Polytechnic, Pomona). For fish, we received information from Cam Swift (Occidental College), Alex Vejar (California Department of Fish and Game), and Ben Matibag (San Bernardino National Forest).

For plants, distributional information was obtained from Tom Scott (UC Cooperative Extension, Riverside), Steve Boyd (Rancho Santa Ana Botanic Garden), Dieter Wilken (Santa Barbara Botanic Garden), Fred Roberts (U.S. Fish and Wildlife Service), Eric Wittner (University of Redlands), and Mark Borchert (Los Padres National Forest).

Additional information on plants came from Region 5 “Sensitive Plant Species Evaluation and Documentation” forms completed by resource personnel from the four southern California national forests (on file at the Cleveland National Forest Supervisor’s Office). Those evaluations were completed by Bill Brown (Angeles National Forest), Mike Foster (Los Padres National Forest), Melody Lardner (San Bernardino National Forest), and Kirsten Winter (Cleveland National Forest). Information was also provided by Karen Danielsen (formerly Los Padres National Forest), Dirk Rodriguez (Eldorado National Forest), Jeff Kwasny (Los Padres National Forest), James O’Hare (Angeles National Forest), Janet Nickerman (Barden Environmental), Patty Krueger (Angeles National Forest), Brad Henderson (formerly San Bernardino National Forest), Scott Eliason (San Bernardino National Forest), Gary Wallace (U.S. Fish and Wildlife Service), Charles E. Blair (northern Santa Barbara County Liaison, California Native Plant Society) and Scott White (Scott White Biological Consulting).

Chapter 7 – Areas of High Ecological Significance

The problem, then, is how to bring about a striving for harmony with land among a people many of whom have forgotten that there is any such thing as land, among whom education and culture have become almost synonymous with landlessness.

— Aldo Leopold, 1949

Key Questions

- **Which areas have particularly high ecological significance and what makes them significant?**
- **What factors threaten the ecological integrity of these areas?**

This final chapter identifies areas of particularly high ecological significance in each of the assessment area's nine mountain regions. These "key places" include critical habitats for rare and vulnerable species, areas of high ecological integrity, and locations with unique ecological associations. Primarily they are places where a number of ecologically significant features overlap. Thus, the need for effective stewardship of these areas is particularly important.

The areas identified in this chapter clearly do not represent all areas of ecological importance and should not be interpreted as such. The purpose of highlighting these places is to increase public and agency awareness of their regional significance. They are key parts of the ecological heritage of southern California and should be recognized as such.

San Diego Ranges

The mountains and foothills of San Diego County contain a large number of rare species and habitats. The list of key ecological areas for this region is dominated by some of the best remaining occurrences of low-elevation ecosystems (e.g., riparian woodland, coastal sage scrub, grassland, and Engelmann oak woodland) that are poorly represented on public lands and declining in the southern part of the assessment area (fig. 7.1).

Public lands and habitat reserves are patchily distributed in the San Diego ranges. As development intensifies in the foothills, far-sighted planning is needed to ensure that habitat connectivity is maintained between the mountains and the remaining natural areas in the coastal and inland valleys.

Upper San Luis Rey River and the Warner Basin

An approximately 4-mile stretch of riparian habitat along the San Luis Rey River below Lake Henshaw supports the largest southwestern willow flycatcher population in southern California. Above the lake, there are significant populations of arroyo toad and arroyo chub in the West Fork, North Fork, and Agua Caliente Creek. Extensive grasslands in the Warner Basin are occupied by Stephens kangaroo rat. The basin is also one of the few areas in southern California where the red-sided garter snake has recently been observed. Lake Henshaw supports a wintering population of approximately four to ten bald eagles. Gray vireos occur in redshank chaparral habitats on the north end of the basin.

Factors affecting the ecological integrity of this area include surface and groundwater extraction on private lands above Lake Henshaw. The San Luis Rey River below the lake is regulated by water releases from the dam. Much of the Warner Basin is intensively grazed by cattle. Brown-headed cowbirds are common in the area. Several roads and developed

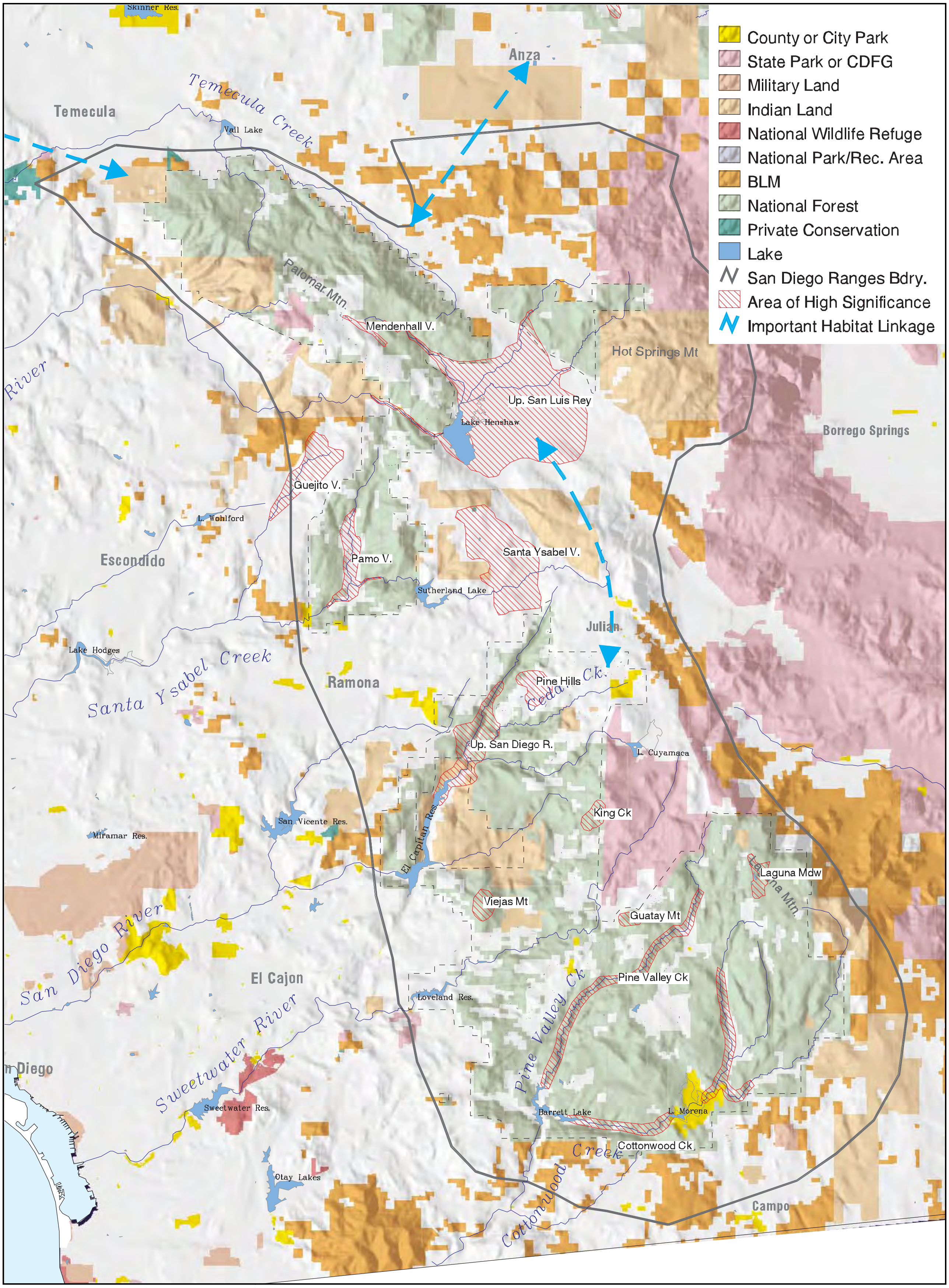


Figure 7.1. Areas of high ecological significance in the San Diego ranges.

recreation sites are located in riparian habitats occupied by willow flycatchers and arroyo toads.

Pine Valley and Cottonwood Creeks

Pine Valley and Cottonwood creeks are adjacent drainages that come together at Barrett Lake. Both have high-quality riparian habitat and significant populations of arroyo toads, least Bell's vireos, and pond turtles. The pond turtle population on Pine Valley Creek is one of the largest remaining in southern California (D. Holland, pers. comm.). The arroyo toad population on upper Pine Valley Creek is probably the largest aggregation of this species on the Cleveland National Forest. The population of least Bell's vireos on Cottonwood Creek is the largest on the Cleveland National Forest. Pine Valley Creek is undammed and one of the longest free-flowing, low-elevation streams in the assessment area. The lower portion of the creek is in a designated wilderness area.

Factors affecting ecological integrity include high recreation use, livestock grazing, and non-native species. The upper portions of Pine Valley and Cottonwood creeks are popular recreation areas. A recreation residence tract occurs along Pine Valley Creek as do several popular trails and trailhead facilities. These are popular areas for mountain bike and horseback riding. Several cattle grazing allotments exist in the area. Stream flows on Cottonwood Creek are regulated by dams at Morena and Barrett lakes. Invasive non-native species such as tamarisk, bullfrogs, sunfish, and cowbirds are a problem in some areas.

Upper San Diego River

The San Diego River canyon above El Capitan Lake contains extensive stands of coastal sage scrub vegetation that support a population (twenty to thirty pairs) of California gnatcatchers. Along the river are several stretches of high-quality riparian woodland and populations of arroyo toad and southwestern pond turtle. Coastal rosy boas, horned lizards, orange-throated whiptails, and two-striped garter snakes also occur in this area.

Factors affecting ecological integrity in the upper San Diego River include housing developments along the canyon's rim, increased fire starts, and non-native species. The area has burned several times in the last eight years, resulting in degradation of coastal sage scrub habitat.

Pamo Valley

Pamo Valley is a broad foothill valley that surrounds the confluence of Temescal and Santa Ysabel creeks. The area supports a large arroyo toad population and also contains high-quality riparian woodland, Engelmann oak woodland, and some coastal sage scrub. Least Bell's vireos, California gnatcatchers, and golden eagles occur in this valley. Red-legged frogs historically occurred in this area.

Most of Pamo Valley is owned by the City of San Diego, although the surrounding hills are part of the Cleveland National Forest. Factors affecting the ecological integrity of this area include year-round cattle grazing, unauthorized and unmanaged recreation use, illegal dumping of trash, and high numbers of invasive, non-native species. Aquatic habitats along Santa Ysabel Creek are highly impacted by bullfrogs, sunfish, bass, and crayfish.

Guejito Valley

Guejito Valley lies just to the west of Pamo Valley and is another broad foothill valley that contains extensive Engelmann oak savanna, grassland, and low-elevation riparian habitat. Arroyo toads, Stephen's kangaroo rats, and golden eagles occur here. The valley is privately owned and is heavily grazed by cattle.

Mesa Grande-Santa Ysabel Valley-Pine Hills Oak Woodlands

This area supports the largest remaining expanse of Engelmann oak woodland habitat in southern California. Most of this area is private or Indian land and the primary factor affecting its ecological integrity is the likelihood of increased subdivision and development of those lands. Cattle ranching is a common use of land in this area. Non-native annuals are the dominant grasses in the oak savannas and grasslands.

Mendenhall Valley

In this valley near the top of Palomar Mountain there is a large montane meadow that supports the largest known population of the Laguna Mountain skipper butterfly. Populations of Parish's meadowfoam and San Bernardino bluegrass also occur here. This valley is the headwaters for the West Fork of the San Luis Rey River. Downstream resources include arroyo toads, arroyo chub, and a self-sustaining wild trout fishery.

The primary land uses in Mendenhall Valley are cattle grazing and several private residences (over half of the valley is in private ownership). Altered fire regimes and non-native grasses and forbs may be affecting plant species composition in the meadow. Bullfrogs occur in several ponds within the valley and undoubtedly affect native amphibian populations.

Laguna Meadow

On top of Laguna Mountain is an extensive montane meadow that supports a number of rare plant species and the Laguna Mountain skipper butterfly. It is one of the few large montane meadows in the mountains of San Diego County that is predominately on public lands. Pine-oak forests surrounding the meadow contain spotted owls. Ecological integrity on Laguna Mountain is affected primarily by high levels of recreation use and cattle grazing.

Viejas, Poser, and Guatay Mountains and King Creek

These areas have gabbro soils that support several unique, endemic plants. The largest population of San Diego thorn-mint *(Acanthomintha ilicifolia)* occurs on Viejas Mountain. *Monardella hypoleuca lanata* and *Nolina cismontana* occur on Viejas and Poser mountains. Tecate cypress is found on Guatay Mountain and Cuyamaca cypress occurs along upper King Creek on the southwest flank of Cuyamaca Peak. Overly frequent fire is a threat to some of these plants, particularly cypress forests.

Santa Ana Mountains

The Santa Ana Mountains region is an island of wildland habitat that is nearly surrounded by urban development. It contains a number of important ecological areas. From an ecosystem conservation standpoint, the most significant areas are probably along the base of the mountains where imperiled low-elevation habitats extend up into the foothills. These habitats include Engelmann oak-grassland savanna, low-elevation riparian, and coastal sage scrub (fig. 7.2).

San Mateo Creek and Surrounding Uplands

San Mateo Creek is probably the most pristine coastal stream south of the Santa Monica Mountains. It flows unimpeded into the ocean. The upper watershed is mostly unroaded and primarily within the San Mateo Canyon Wilderness Area. Its lower reaches run through Camp Pendleton Marine Corps Base and San Onofre State Beach. The creek and its principal tributaries contain significant populations of arroyo toads, pond turtles, and California newts. In 1999, juvenile southern steelhead were documented in San Mateo Creek (A. Vejar, CDFG, pers. comm.).

Factors affecting ecological integrity include recreation use, military activities, and exotic species. However, this may be one of the few streams where conditions are conducive for extirpating aquatic exotic species.

Santa Rosa Plateau

The Santa Rosa Plateau contains a large expanse of undeveloped, Engelmann oak savanna that is well managed and in good condition. In this area is the only remaining red-legged frog population south of Los Angeles County. Several large vernal pools support fairy shrimp and a number of rare plant species.

The primary factor affecting ecological integrity in this area is the subdivision and development of private land on and around the Santa Rosa Plateau. Exotic species such as European grasses and bullfrogs are also a threat.

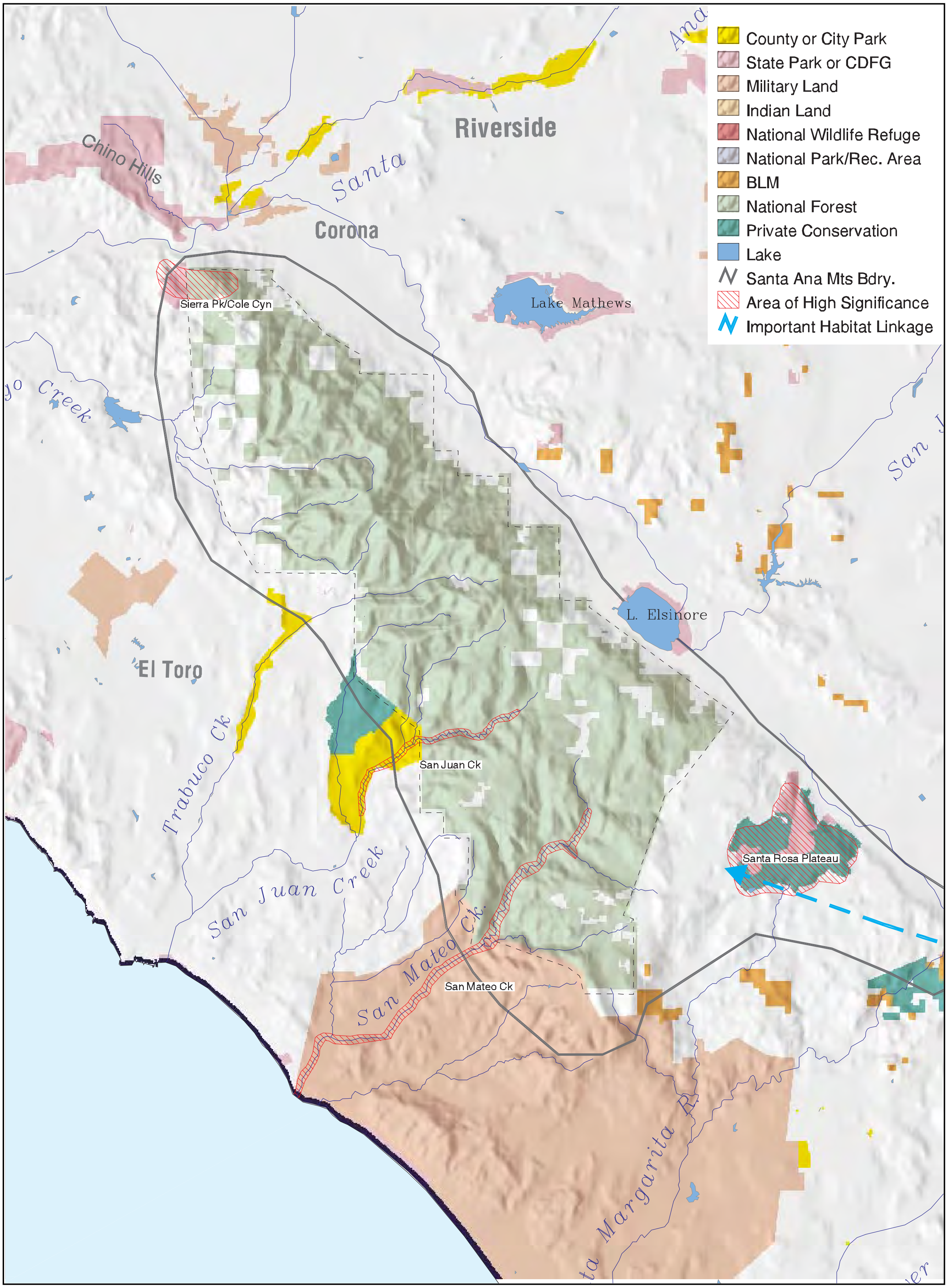


Figure 7.2. Areas of high ecological significance in the Santa Ana Mountains.

Sierra Peak/Cole Canyon Area

Unique soils in this area support a number of rare plants, including several large Tecate cypress groves. This area is also a key part of an important habitat corridor between the Santa Ana Mountains and the Chino Hills. Development on private lands in Cole Canyon threatens this unique habitat area. Overly frequent fire is also a threat.

San Juan Creek

This area contains significant populations of arroyo toad, *Dudleya viscida,* and *Tetracoccus dioicus.* At low elevations, coastal sage scrub is common along the slopes of San Juan Canyon. California gnatcatchers, cactus wrens, and orange-throated whiptails occur in the lower canyon. Recreation use, a major state highway, and non-native species are the primary factors affecting ecological integrity.

San Jacinto Mountains

This range contains a large expanse of montane wildland habitat that is becoming increasingly surrounded by urban development. The San Jacinto Mountains (and the adjoining higher peaks of the Santa Rosa Mountains) lie between the San Bernardino Mountains to the north and Palomar and Hot Springs mountains to the south. There are sizeable gaps in the distribution of public lands between these ranges, and coordinated land use planning will be needed to ensure that habitat connectivity between them is maintained. Another key issue is the establishment of wildland linkages that "connect" the San Jacinto Mountains to the habitat reserves being created in western Riverside County and Coachella Valley. Within the mountains themselves, areas of high ecological significance include montane meadows and habitats utilized by the mountain yellow-legged frog and the Peninsular Ranges' bighorn sheep (fig. 7.3).

North Fork, San Jacinto River

The North Fork of the San Jacinto River and its upper tributaries contain high-quality mixed conifer and bigcone Douglas-fir forest and hold some of the last remaining mountain yellow-legged frog populations in southern California. The watershed also contains four to five pairs of spotted owls, and the southernmost population of southern rubber boas.

Factors affecting ecological integrity in this area include concentrated recreation use, expanding development on private lands in the Pine Cove and Idyllwild areas, and altered fire regimes. Mixed conifer forests in this area have become increasingly dense over the last eighty years, prompting fears that the area is now more susceptible to a large stand-replacing fire.

Palm Canyon

Palm Canyon, on the desert side of the mountains, provides important habitat for the Peninsular Ranges' bighorn sheep. Several factors threaten the survival of this sheep population, including disease and excessive predation by mountain lions, but development on private lands in and around the community of Palm Desert is of particular concern. As its name implies, Palm Canyon also contains several highly localized and rare palm oases.

Garner Valley

This large montane meadow contains several sensitive plant populations. It is also an important deer fawning area and productive habitat for many species. Housing developments on private land in the valley, water extraction and diversion, and non-native species are the primary factors affecting ecological integrity in this area.

Bautista Creek

This low-elevation stream contains some high-quality riparian habitat. Arroyo toads historically occurred in this drainage and may still be there. Swainson thrush and yellow-breasted chat are riparian-dependent birds that occur in this drainage. The greenest tiger beetle is a rare invertebrate that was collected along Bautista Creek in the 1970s and may still occur in the area.

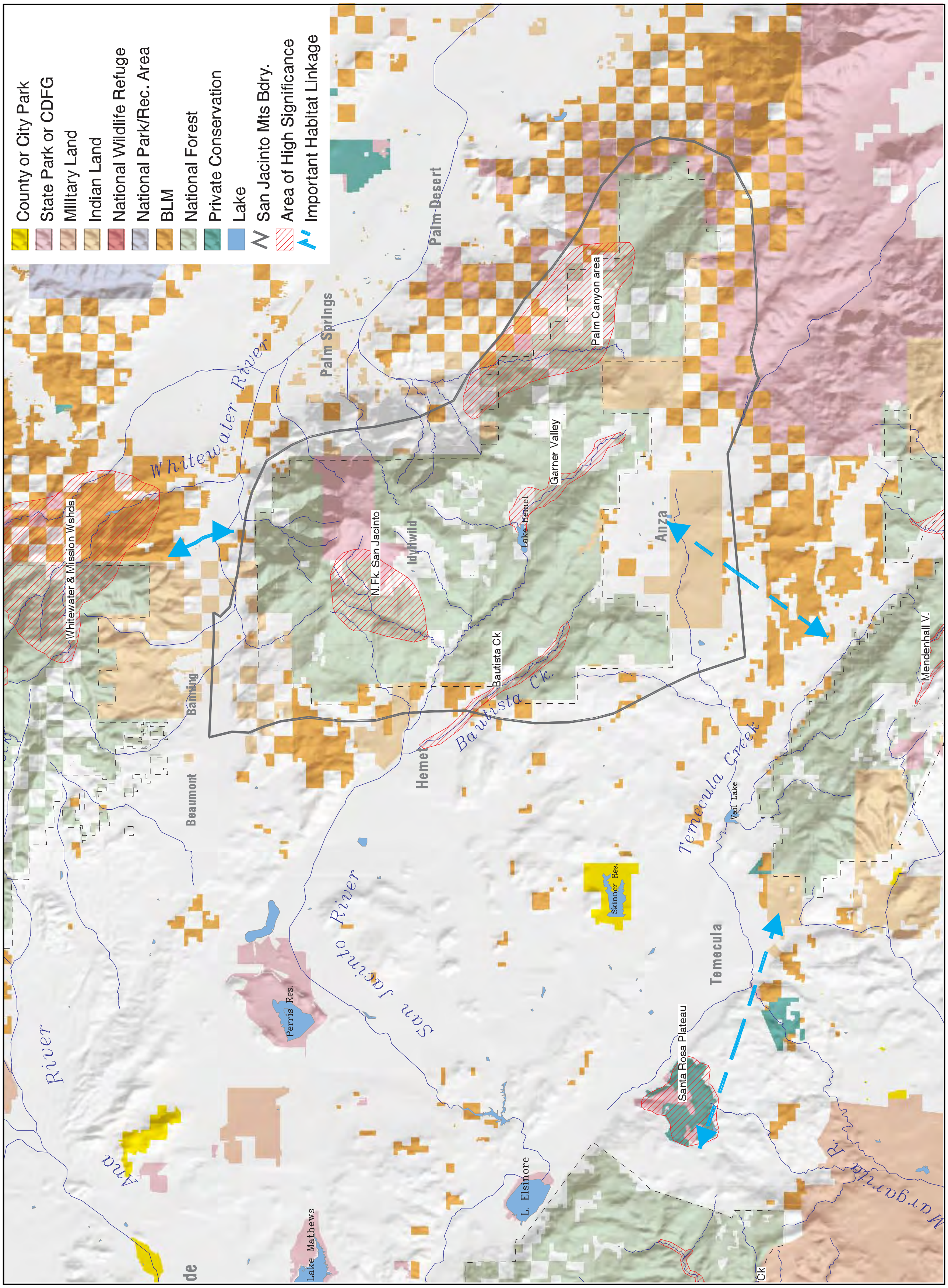


Figure 7.3. Areas of high ecological significance in the San Jacinto Mountains.

San Bernardino Mountains

The San Bernardino Mountains are the highest and most extensively forested range in the assessment area. This range contains an unusually large number of endemic plants as well as many rare animals. There are many areas of high ecological significance in this range (fig. 7.4), reflecting many unique vegetation associations and rare species occurrences.

Unique Habitats in the Big Bear-Baldwin Lake-Holcomb Valley Area

Pebble plains, carbonate outcrops, montane meadows, pinyon and Joshua tree woodlands, and a large ephemeral lake, all in close proximity to one another, combine to make this a unique and highly significant area. This area contains the largest concentration of endemic plants in California, eleven of which are now federally listed as threatened or endangered. Big Bear Lake supports the largest wintering population of bald eagles in southern California. Baldwin Lake and its primary tributary, Shay Creek, are home to a isolated and highly imperiled population of unarmored threespine stickleback fish. The Dammer's blue butterfly is endemic to the Baldwin Lake area and nearby Coxey Meadow supports one of the few known populations of the vernal blue butterfly. This area is also one of the few places in the assessment area where common nighthawks, gray vireos, and gray flycatchers breed. Nelson's bighorn sheep also occur on the northern edge of this area.

Big Bear and Holcomb valleys are popular recreation areas. There are many developed facilities and maintained roads that attract large numbers of recreationists. Mining is a major land use activity in high-grade carbonate deposits that extend from the north side of Holcomb Valley to the desert's edge.

Mid-Elevation Conifer Forests from Cedarpines Park to Barton Flats

The San Bernardino Mountains contain by far the largest expanse of coniferous forest in southern California. Of particular significance are the mesic mid-elevation (4,500 to 7,000 feet) forests on the coastal side of the mountains. These productive pine- and fir-dominated forests are key habitats for the California spotted owl, San Bernardino flying squirrel, southern rubber boa, flammulated owl, and many other forest-dependent species. The large spotted owl population in the San Bernardino Mountains is reported to be critical to the continued viability of this species in southern California (Noon and McKelvey 1992).

The primary factor affecting the ecological integrity of these forests is an altered fire regime. The almost complete exclusion of fires in these forests for over eighty years has led to changes in stand structure, shifts in species composition, and an increased vulnerability to large stand-replacing fires. The area also receives a high level of recreation use and is interspersed with private lands that are becoming increasingly developed.

Deep Creek

This desert-flowing stream contains high-quality aquatic and riparian habitat. A population of arroyo toads and a hybridized population of Mojave chub occur in the lower portions of this drainage. Deep Creek is also a popular trout fishery and has been designated by CDFG as a wild trout stream.

Concentrated recreation use in portions of this drainage affects the ecological integrity of Deep Creek. Impoundments and water diversions in the upper watershed affect stream flow volume and seasonality. The Willows Fire in the summer of 1999 burned over 60 percent of this watershed and will trigger high rates of soil erosion and stream sedimentation in the next few years.

Onyx Summit

A high-elevation ecotonal area where desert and coastal influences meet, the Onyx Summit area contains a unique assemblage of vegetation types including old-growth western juniper and mountain mahogany mixed with pinyon and limber pine. There are many inholdings of private land in this area and houses are being constructed on some of these.

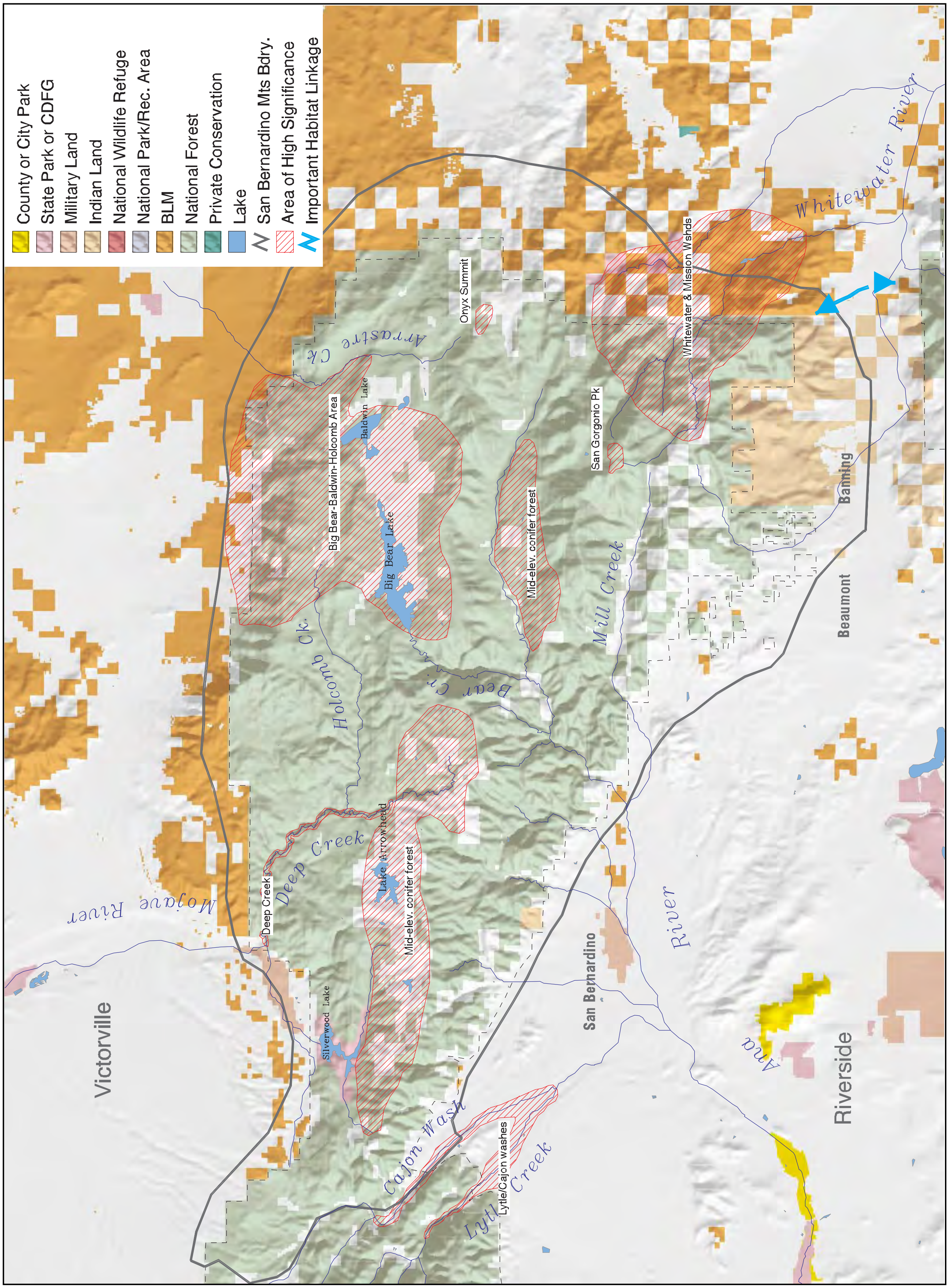


Figure 7.4. Areas of high ecological significance in the San Bernardino Mountains.

Increased development could degrade the unique habitats in this area and will reduce fire management options.

Whitewater River

The upper watershed of the Whitewater River is one of the most remote, unroaded places in the assessment area. As such, it is relatively pristine and is an important area for bighorn sheep and mule deer. Arroyo toads occur on this drainage at low elevations near the base of the mountains.

San Gorgonio Peak

The tallest peak in southern California, it is the only place in the region that contains significant amounts of alpine habitat. The water pipit potentially breeds here and a variety of sensitive alpine plants occur in this area. Completely within a designated wilderness area, the primary threat to this peak is degradation of fragile habitats from overuse of areas by backcountry hikers.

San Gabriel Mountains

The San Gabriel Mountains are steep and rugged, with many areas not easily accessible by road. This has helped maintain a high level of ecological integrity in some of the upper canyons. This remote character is probably why mountain yellow-legged frogs and Nelson's bighorn sheep still occur in these mountains. The range also contains some important aquatic and forest habitats (fig. 7.5).

Upper San Gabriel River

The three primary forks of the San Gabriel River (West, North, and East forks) and their tributaries contain highly significant aquatic habitats. Low-elevation portions of these streams are key refugia for imperiled native fish, including the Santa Ana sucker, Santa Ana speckled dace, and arroyo chub. The West Fork is a high-quality rainbow trout stream and supports a large pond turtle population. High-elevation tributaries in the Sheep Mountain Wilderness Area support several mountain yellow-legged frog populations. Moyle et al. (1995) suggested that the upper San Gabriel River by designated as an "Aquatic Diversity Management Area" similar to ones being proposed in the Sierra Nevada.

The primary factors affecting the ecological integrity of these aquatic habitats are (1) irregular releases of water and sediment from Cogswell Dam on the West Fork, (2) suction dredging on the East Fork, and (3) concentrated recreation use on the East and North forks.

Little Rock Creek

This long, desert-flowing drainage contains a substantial arroyo toad population along its lower reaches and a mountain yellow-legged frog population near its headwaters. Little Rock Creek also contains high-quality riparian habitat. Upper parts of the drainage are remote and unroaded, which has helped maintain a high level of ecological integrity.

Recreation activities are the primary land uses in this drainage. Camping and OHV use are popular activities in the lower drainage near Little Rock Reservoir. Rock climbing and hiking are common activities in the upper headwaters near the Angeles Crest Highway.

Mount Wilson/Monrovia Peak Area

The steep canyons and north-facing slopes that extend from west of Mount Wilson to just east of Monrovia Peak contain the region's largest and most continuous stands of bigcone Douglas-fir, a tree that is endemic to southern California. These forests are highly productive for spotted owls. The recently discovered San Gabriel Mountain slender salamander also occupies these forests. Bigcone Douglas-fir forests are at risk to stand-replacing fire and have been declining in extent over the last century.

Lytle and Cajon Washes

Low-elevation, alluvial areas along Lytle and Cajon creeks and their adjacent floodplain terraces contain several imperiled species and vegetation types. The San Bernardino kangaroo rat, California gnatcatcher, slender-horned spineflower, and Santa Ana woollystar are

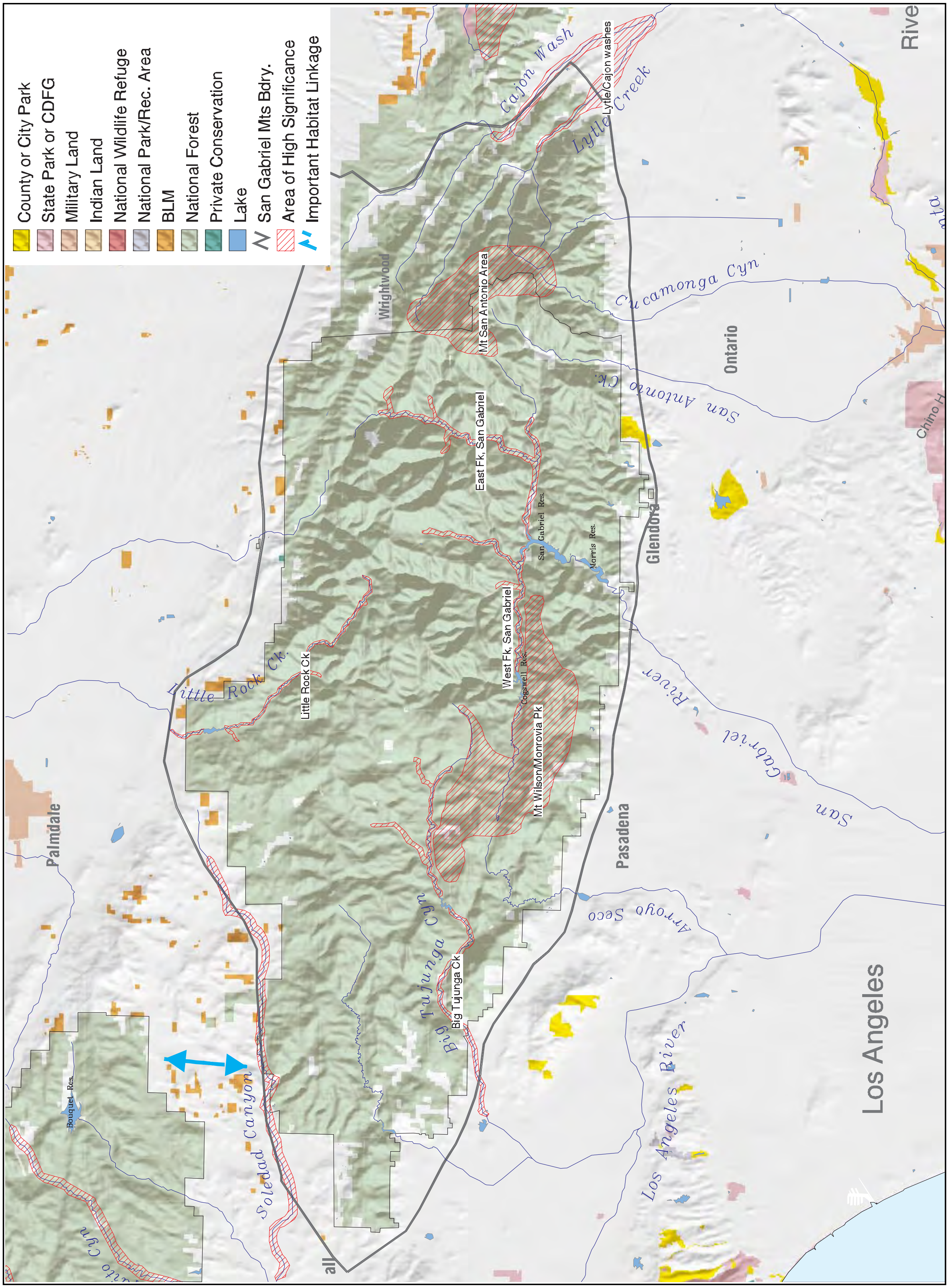


Figure 7.5. Areas of high ecological significance in the San Gabriel Mountains.

known to occur in this area. It is a historic locality for the Los Angeles pocket mouse, coastal black-tailed jackrabbit, and badger, and these species may still occur here.

Urban development is occurring at a rapid rate along the border of the national forest in the uplands surrounding Lytle and Cajon washes. Sand and gravel mining is also a major activity in portions of these washes.

Big Tujunga Creek

Although this stream is dammed at an elevation of approximately 2,400 feet, there is still important riparian and aquatic habitat both upstream and downstream of the reservoir. Big Tujunga Creek continues to support populations of the Santa Ana sucker and arroyo chub. Santa Ana speckled dace historically occurred in the drainage but may have been extirpated. Arroyo toads, pond turtles, and Swainson's thrush also occur here.

Introduced red shiners occur below the reservoir and have been blamed for the decline of native fish in this drainage and the possible extirpation of speckled dace. Non-native aquatic species are a large problem in this drainage due to the mid-elevation reservoir. Variable and sometimes extreme releases of water from the dam are a threat to downstream fish and aquatic amphibian populations. Recreation use is high along this stream, particularly in the lower canyon, and has resulted in habitat degradation in some areas.

Upper San Antonio and Lytle Creek Watershed

The steep slopes around Mount San Antonio (also known as Mount Baldy) and in the upper forks of Lytle Creek are important habitat for Nelson's bighorn sheep. The recently discovered San Gabriel Mountain slender salmander also occurs in this area.

The remoteness of these upper watershed areas is critical to the continued existence of bighorn sheep in the San Gabriel Mountains. Increased demand for recreation developments in this area threatens the remote character. Altered fire regimes also may be changing the distribution and availability of some habitat types that are important to bighorn sheep.

Castaic Ranges

The mountains and foothills north of Castaic are dominated by chaparral-covered hills, but they also contain several low-elevation streams that have high-quality riparian and aquatic habitats (fig 7.6). In addition, the upper elevations of Liebre and Sawmill mountains contain unique and important montane habitats. The geographic position of this region—between the San Gabriel Mountains to the east, the Tehachapi Mountains to the north, and the Los Padres ranges to the west —makes it a key wildland linkage. A 4- to 6-mile break in the connectivity of public lands exists between the San Gabriel Mountains and the westernmost part of this region, the Sierra Pelona Mountains. Protected habitat corridors will be needed between these ranges as development intensifies along Interstate 14.

Soledad Canyon

Soledad Canyon contains high-quality riparian and aquatic habitat. Portions of the upper Santa Clara River in this canyon are designated as critical habitat for the unarmored threespine stickleback fish. Santa Ana suckers, southwestern willow flycatchers, and summer tanagers also occur in this area.

A principal factor affecting the ecological integrity of Soledad Canyon is that most of the area is on private land and subject to increasing development. Invasive, non-native species are also a problem, particularly arundo and warm-water fish.

San Francisquito Creek

San Francisquito Creek contains high-quality, low-elevation riparian and aquatic habitat. The unarmored threespine stickleback, California red-legged frog, southwestern willow flycatcher, Swainson's thrush, yellow-breasted chat, and Nevin's barberry all occur along this drainage.

The primary factors affecting ecological integrity in the area are water diversions,

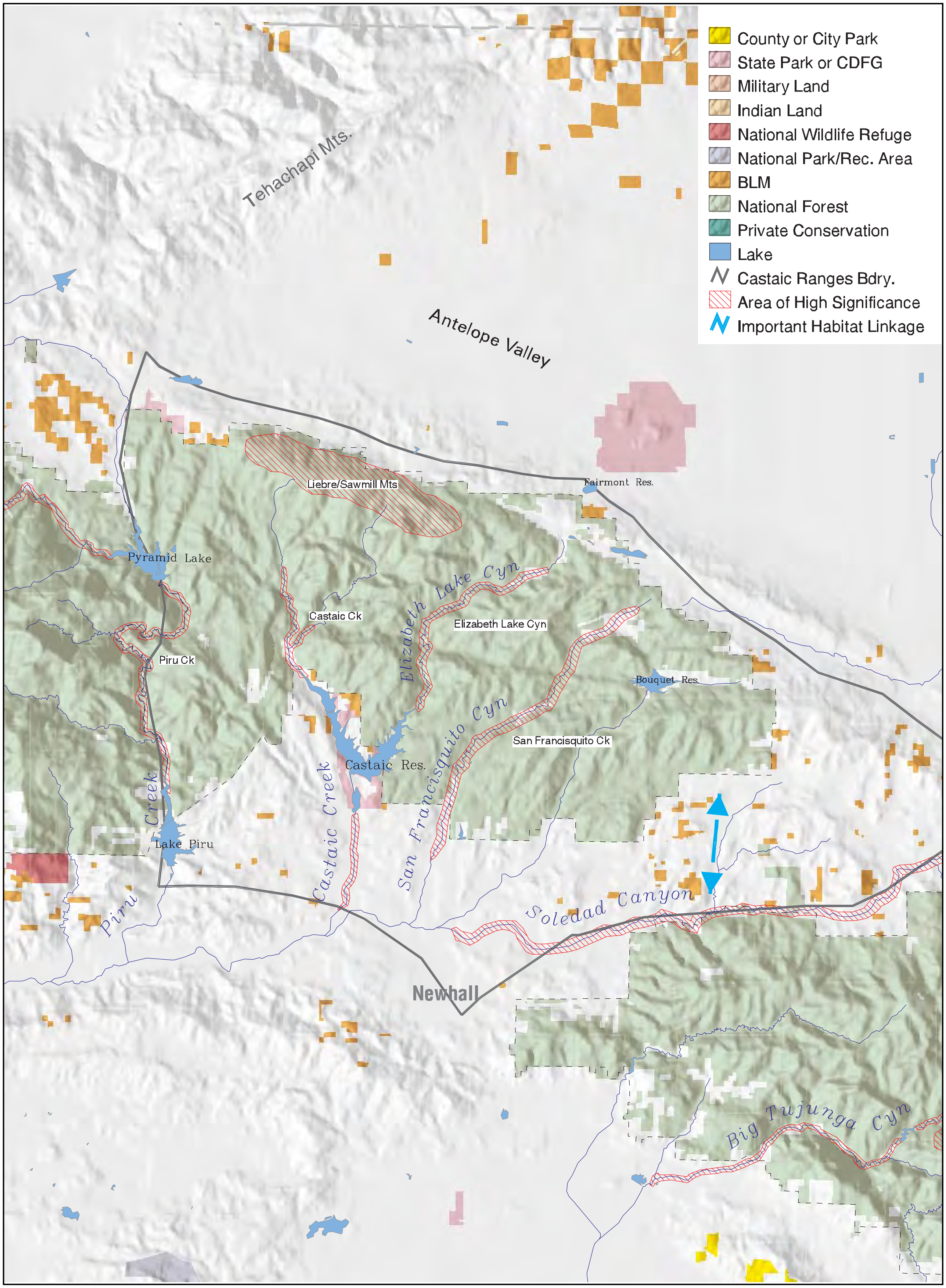


Figure 7.6. Areas of high ecological significance in the Castaic Ranges.

encroachment of non-native species, and land uses associated with a major paved road that runs the length of this canyon.

Castaic Creek

Although much of this creek is now covered by Castaic Lake, there are still areas of important riparian habitat. Arroyo toads occur upstream and downstream of the lake. A pond turtle population also exists in the upper reaches of Castaic Creek.

Streamflows below Castaic Lake are controlled by releases from the dam. The lake contains a wide variety of non-native species that can disperse both up and down stream. Bullfrogs and warm-water fish in particular are a threat to arroyo toads and pond turtles.

Elizabeth Lake Canyon

Elizabeth Lake Canyon contains some high-quality riparian and aquatic habitat. Swainson's thrush and yellow-breasted chat are known to occur along this drainage. It is also a historic locality for the Tehachapi white-eared pocket mouse and the foothill yellow-legged frog.

A paved road runs the length of this canyon and several campgrounds are located along it. The stream flows into Castaic Lake, which makes it more susceptible to infestations of bullfrogs and warm-water fish.

Liebre and Sawmill Mountains

Liebre and Sawmill mountains support several forest types and some unique dry meadow-grassland habitats. A series of north-facing canyons contain bigcone Douglas-fir/canyon live oak forests, with a pair of spotted owls in almost every canyon. Ponderosa pine and black oak blanket the mountain crest but are interspersed with large grass-dominated openings. The only known occurrences of Forest Camp sandwort *(Arenaria macradenia* var. *kuschei)* are on Liebre Mountain. Bigcone Douglas-fir stands in this area are at risk to stand-replacing fires.

Southern Los Padres Ranges

The southern Los Padres region is a large, highly intact block of natural habitat, with relatively few areas of human development within it (see figure 1.4 in chapter 1). This characteristic, in and of itself, makes the area unique in coastal southern California and highly significant from an ecological perspective. In general, the mountains and streams in this region are less heavily utilized by people than are the mountain ranges to the south.

Sisquoc River

A relatively large, remote, free-flowing stream, the Sisquoc River is arguably the most pristine stream in the assessment area. It has few exotic species and contains populations of southern steelhead, California red-legged frogs, arroyo toads, and pond turtles. A least Bell's vireo was also observed along this river in 1999 (K. Cooper, Los Padres NF, pers. comm.).

The Sisquoc River has high ecological integrity because it is unregulated, there is no road access to most of the drainage, and the watershed is almost entirely undeveloped and lightly used public land.

Sespe Creek

Sespe Creek is a major undammed stream that contains high-quality riparian habitat and important populations of southern steelhead, red-legged frogs, pond turtles, and arroyo toads. It is a tributary of the Santa Clara River, and its connection to the ocean is affected by intensive land use along that river. Portions of Sespe Creek are extremely remote, while others can be easily accessed by roads and contain several popular developed recreation sites.

Mono Creek, Indian Creek, and the Upper Santa Ynez River

Mono and Indian creeks are undammed tributaries of the Santa Ynez River. They support high-quality riparian habitat and contain important populations of arroyo toads, red-legged frogs, and pond turtles. Mono Creek is essentially free of bullfrogs and predatory fish. A substantial least Bell's vireo population is concentrated around the confluence of these

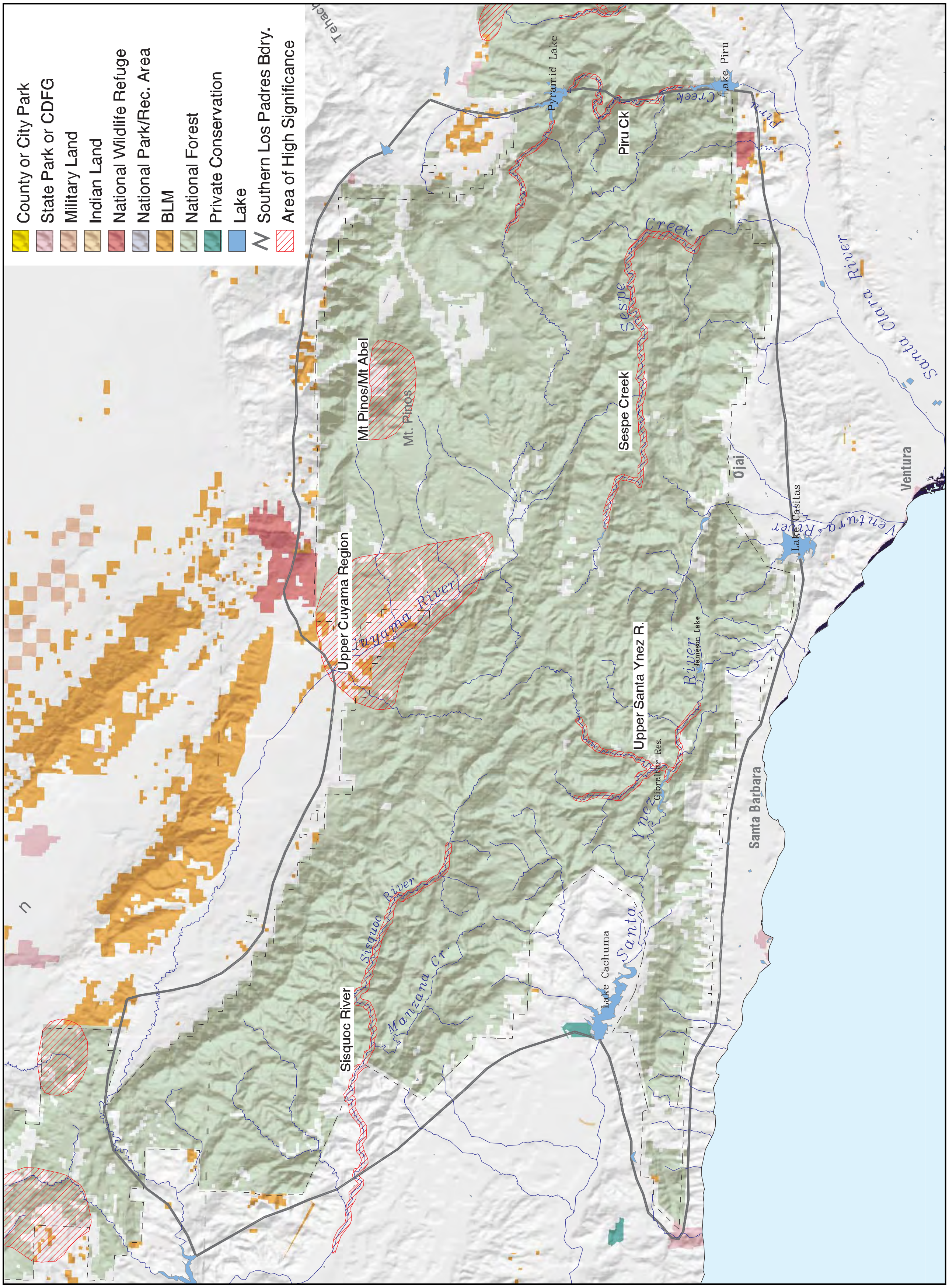


Figure 7.7. Areas of high ecological significance in the southern Los Padres ranges.

three drainages. This area receives a lot of recreation use, which affects habitat conditions.

Mount Pinos-Mount Abel Area

The high country around Mount Pinos and Mount Abel is a unique montane island that supports several endemic taxa and provides an important refugia for other species associated with montane habitats. The area supports endemic subspecies of blue grouse, lodgepole chipmunk, and white-eared pocket mouse. It also contains a unique population of rubber boa snakes that are intermediate in morphology and genetic make-up between the southern and northern subspecies. Montane meadows in this area support a number of sensitive bird and plant species, and a small northern goshawk population persists in these mountains.

Recreation activity and altered fire regimes are the primary factors affecting ecological integrity in the Mount Pinos/Mount Abel area. Several developed campgrounds are located on Mount Pinos and also on Mount Abel, but the high country in between is now within the Chumash Wilderness Area. Fires have been effectively suppressed for many years in this area, spawning concerns about fuel buildups, shifts in forest species composition, and increased risk of future stand-replacing fires.

Piru Creek

Although a highly regulated stream that is dammed in two places, Piru Creek still contains important riparian and aquatic habitat and supports a number of rare or at-risk species. Large arroyo toad and pond turtle populations occur along the creek between Pyramid and Piru reservoirs. The creek also contains Santa Ana suckers and red-legged frogs.

The reservoirs are a constant source of invasive, non-native aquatic species, and the stream contains large numbers of them. Water releases from the dams also control much of the creek's flow regime.

Upper Cuyama River Region

The arid, rugged region along the upper Cuyama River is often described as a "badlands." It has unique topography and habitats and contains relictual populations of several plant species and pina plains. A hybridized population of blunt-nosed leopard lizards occurred historically in this area and may still be present in Ballinger Canyon. Recreation, particularly off-road vehicle activity, is the primary land use in this area.

Southern Santa Lucia Range

The southern Santa Lucia Range, Garcia Mountain, and the La Panza Range contain a number of unique habitats and ecologically significant areas. Coastal slopes contain some high-quality riparian habitats, many of which support red-legged frogs. The arid east side comes into contact with unique and highly imperiled habitats of the San Joaquin Valley and its western foothills. Several areas of particularly high ecological significance are described below and shown in figure 7.8.

Cuesta Ridge

Serpentine outcrops on Cuesta Ridge support groves of Sargent cypress and a number of sensitive plant species, including San Luis mariposa lily, San Luis Obispo sedge, Brewer's spineflower, San Benito fritillary, and hooked popcorn-flower. The Cuesta Pass checkerbloom is endemic to Cuesta Ridge. The Los Padres National Forest has established a botanical area on west Cuesta Ridge to protect populations of these sensitive species. Factors affecting the ecological integrity of this area include non-native species, mining, and changes to the historic fire regime.

Lopez Canyon

Lopez Canyon contains high-quality riparian and aquatic habitats. California red-legged frogs, Coast Range newts, and several sensitive riparian birds occur in this area. At least three pairs of spotted owls also occur in the canyon. Only the upper part of the canyon is national forest system land; the rest is privately owned. The stream is dammed at its lower end where it meets Arroyo Grande Creek.

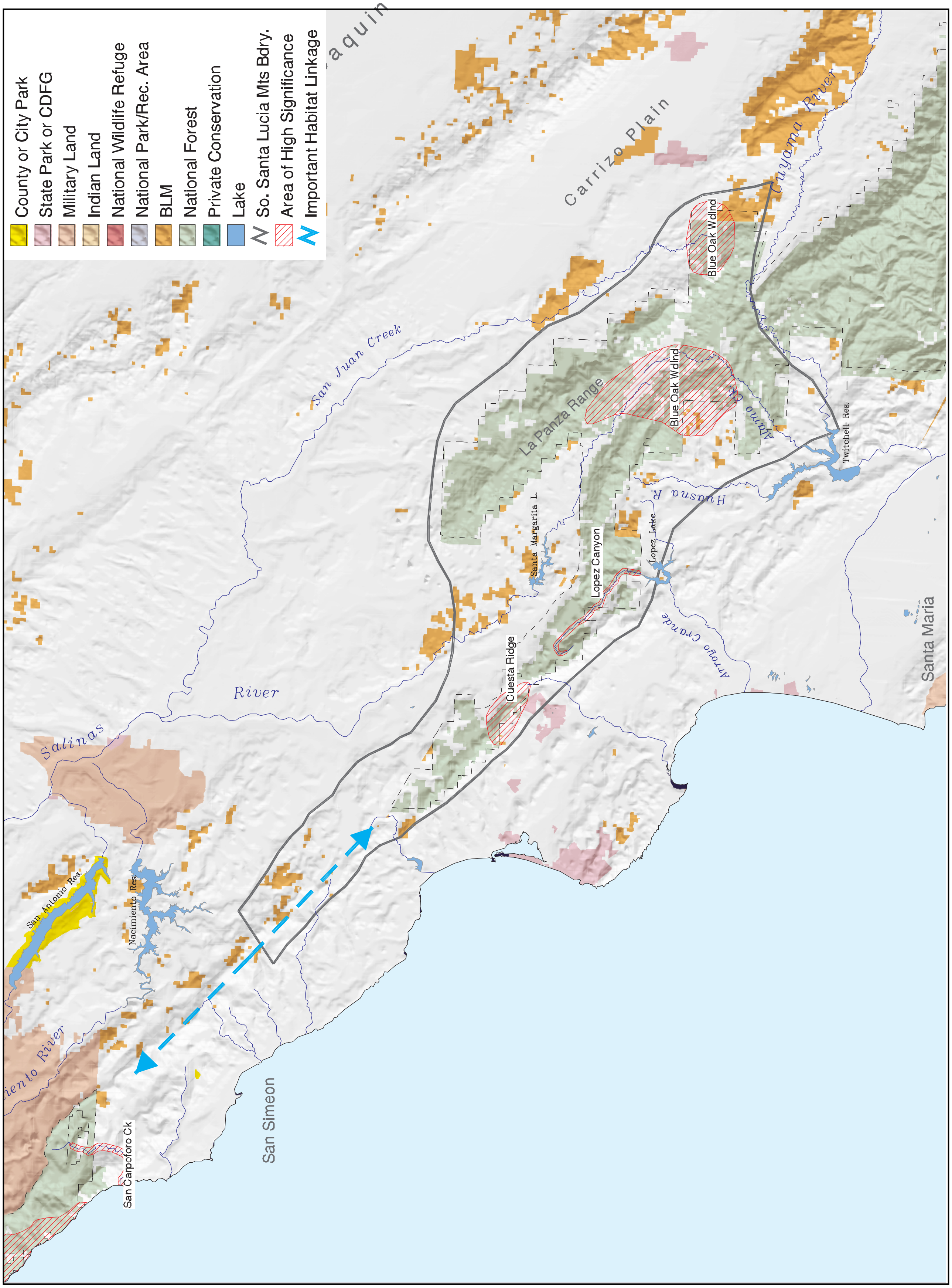


Figure 7.8. Areas of high ecological significance in the southern Santa Lucia Range region.

Blue Oak Woodlands West of Garcia Mountain

Extensive patches of high-quality blue oak woodland can be found west of Garcia Mountain, particularly in the upper Avenales Valley, the Joughlin Ranch area, and in the vicinity of Branch Mountain. Blue oak woodlands are productive habitats for many wildlife species and they are relatively poorly represented on public lands. Primary factors affecting the ecological integrity of these woodlands are non-native grasses, increasing subdivision and development of private lands in the area, and livestock grazing.

Northern Santa Lucia Range

The remoteness and rugged topography of the northern Santa Lucia Range are reflected in a relatively low level of human intrusion. Much of the region is unroaded and a substantial portion is formally designated as wilderness. Most of the streams on the coastal side of the mountains are undammed and flow freely to the ocean.

These factors combine to foster high ecological integrity, characterized by natural hydrologic regimes, relatively few exotic species, low levels of human impact, and extant populations of native species which have disappeared from many areas. Areas of particularly high ecological significance are described below and shown in figure 7.9.

Big Sur River

The Big Sur River is a major stream that flows unimpeded to the ocean. Its natural hydrologic regime and largely undeveloped upper watershed have helped maintain a high level of ecological integrity. The aquatic habitat has few invasive, non-native species. Southern steelhead spawn in this river and there are populations of red-legged frog, foothill yellow-legged frog, and Pacific giant salamanders.

The primary factor affecting ecological integrity is recreation activity, which is high along the lower reaches of this stream near Highway 1. There are several developed campgrounds and a trail system extends into upper portions of the drainage.

Little Sur River

The Little Sur is a free-flowing stream that contains southern steelhead, Pacific giant salamanders, and California red-legged frogs. Tiger salamanders occur in upper portions of the Little Sur watershed. This is a relatively pristine drainage with few non-native species, especially in the upper part of the drainage which is within the Ventana Wilderness Area. Lower stretches of the Little Sur are on private land.

San Carpoforo Creek

San Carpoforo Creek is a free-flowing stream that contains one of the few remaining populations of foothill yellow-legged frogs along the central coast. California red-legged frogs and southern steelhead also occur in this drainage. Most of San Carpoforo Creek is on private land. A primitive road also runs along the length of it.

Coastal Redwood and Santa Lucia Fir Forests

The narrowly endemic Santa Lucia fir and the southernmost stands of coastal redwood occur in this area. These forests provide the southernmost breeding habitat for the marbled murrelet. Spotted owls and Pacific giant salamanders also occur in these mesic forests. Almost all of these forests are protected from harvesting, but they are at risk to stand-replacing fires.

Coastal Prairie and Coastal Scrub

Along the immediate coast are grass-dominated prairies and sagebrush/buckwheat-dominated shrublands that support several sensitive plants (e.g., Hutchinson's larkspur and adobe sanicle) and butterflies (e.g., Smith's blue butterfly and Doudoroff's elfin butterfly). Factors affecting these habitats include non-native species (e.g., European grasses, kikuyu grass, pampas grass, and French broom), recreation use, and livestock grazing.

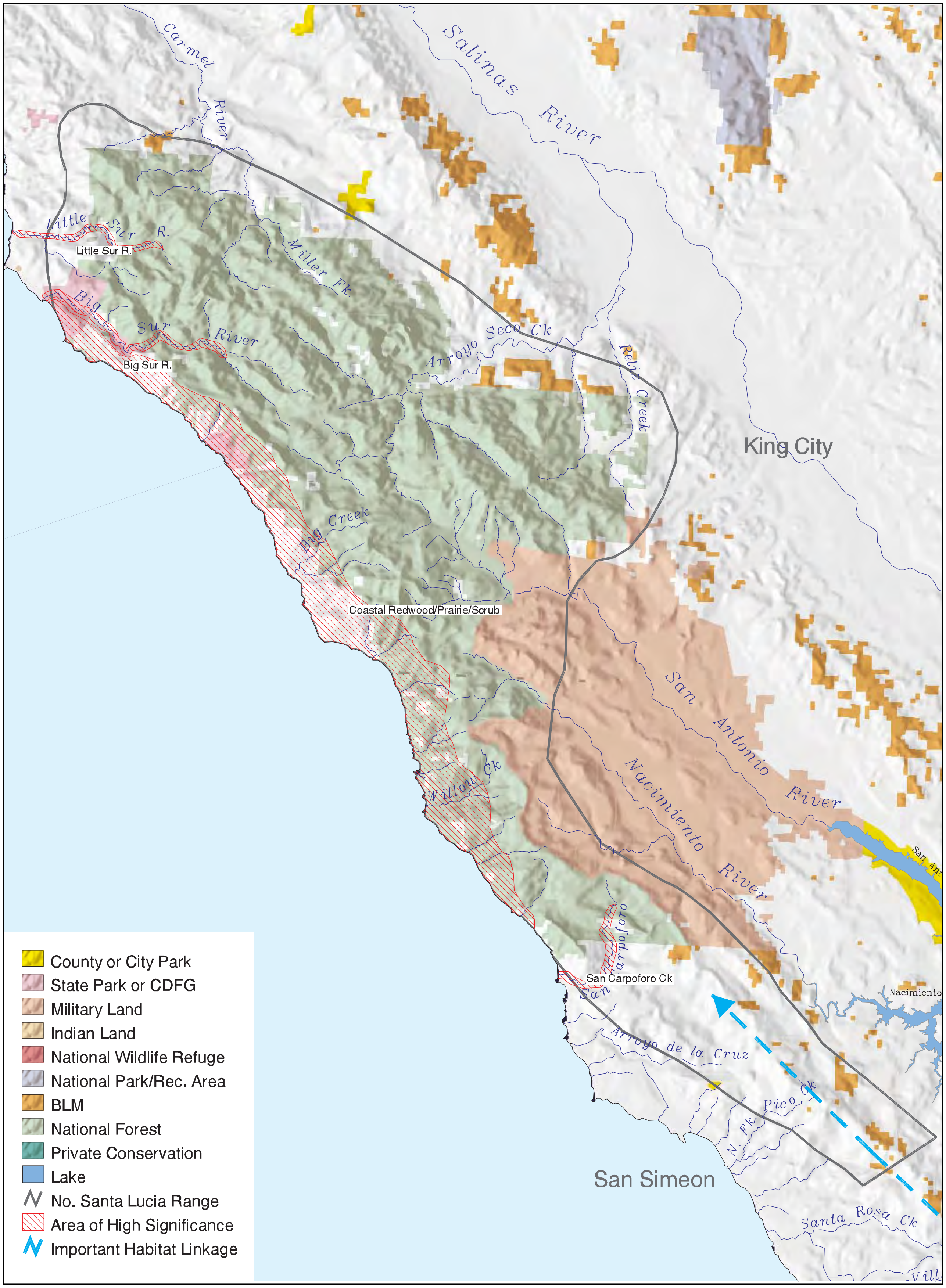


Figure 7.9. Areas of high ecological significance in the northern Santa Lucia Range.

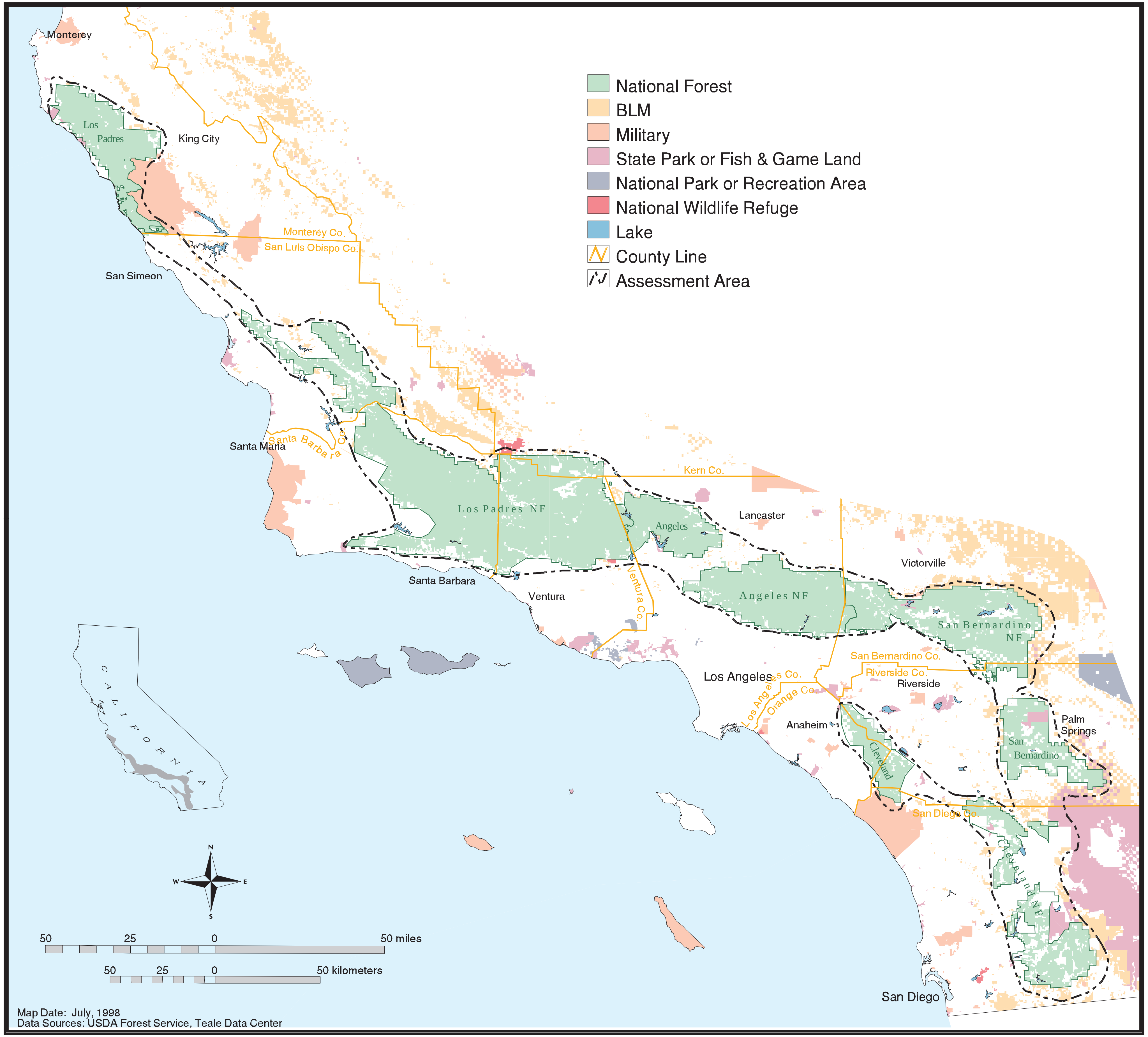


Figure 1.1. The Southern California Mountains and Foothills Assessment area boundary (dashed black line) and the distribution of public lands in and around it.

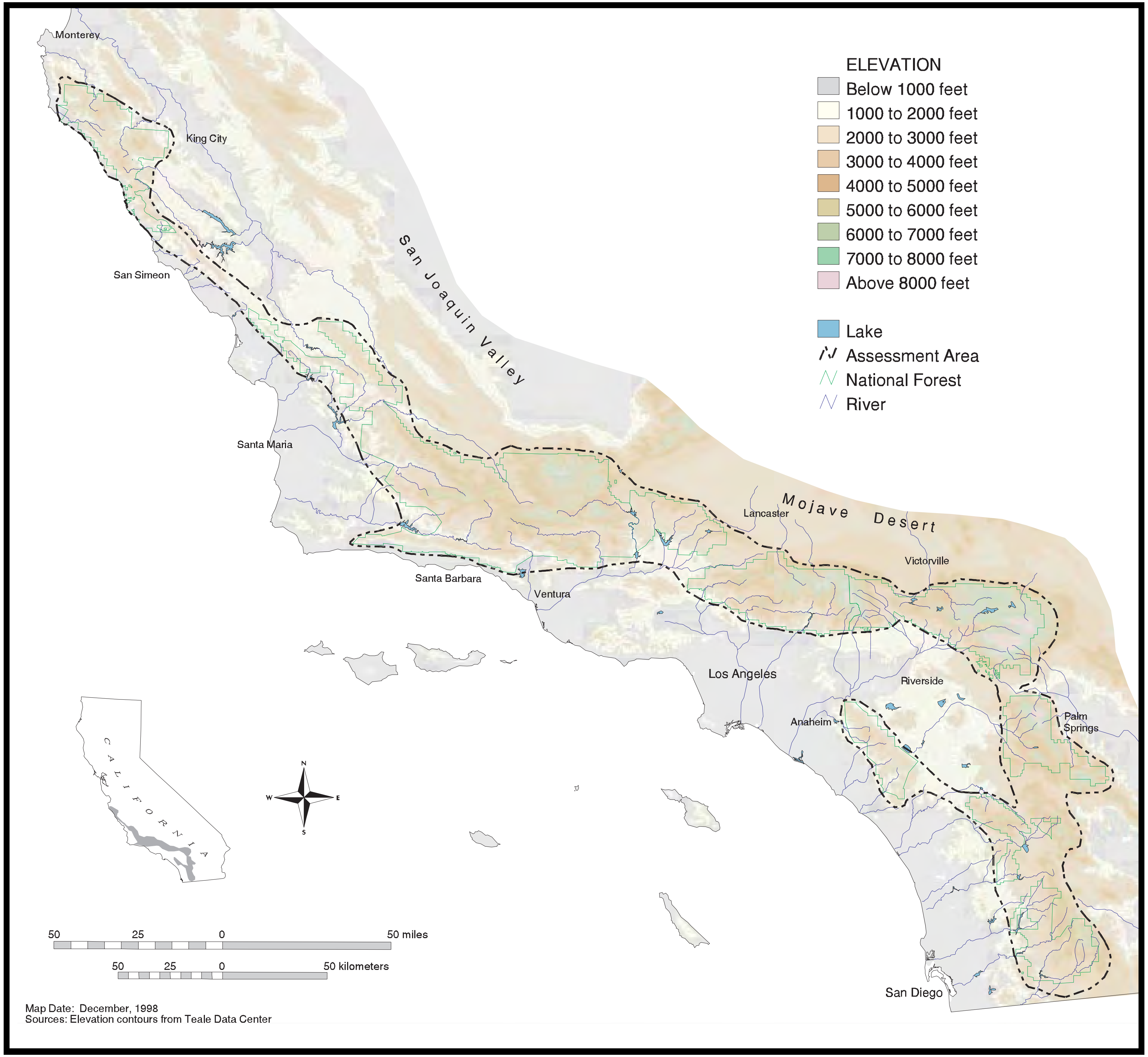


Figure 1.3. Elevation patterns across the assessment area and surrounding lands. Note how widely elevations vary across the region, resulting in a tremendous amount of habitat diversity.

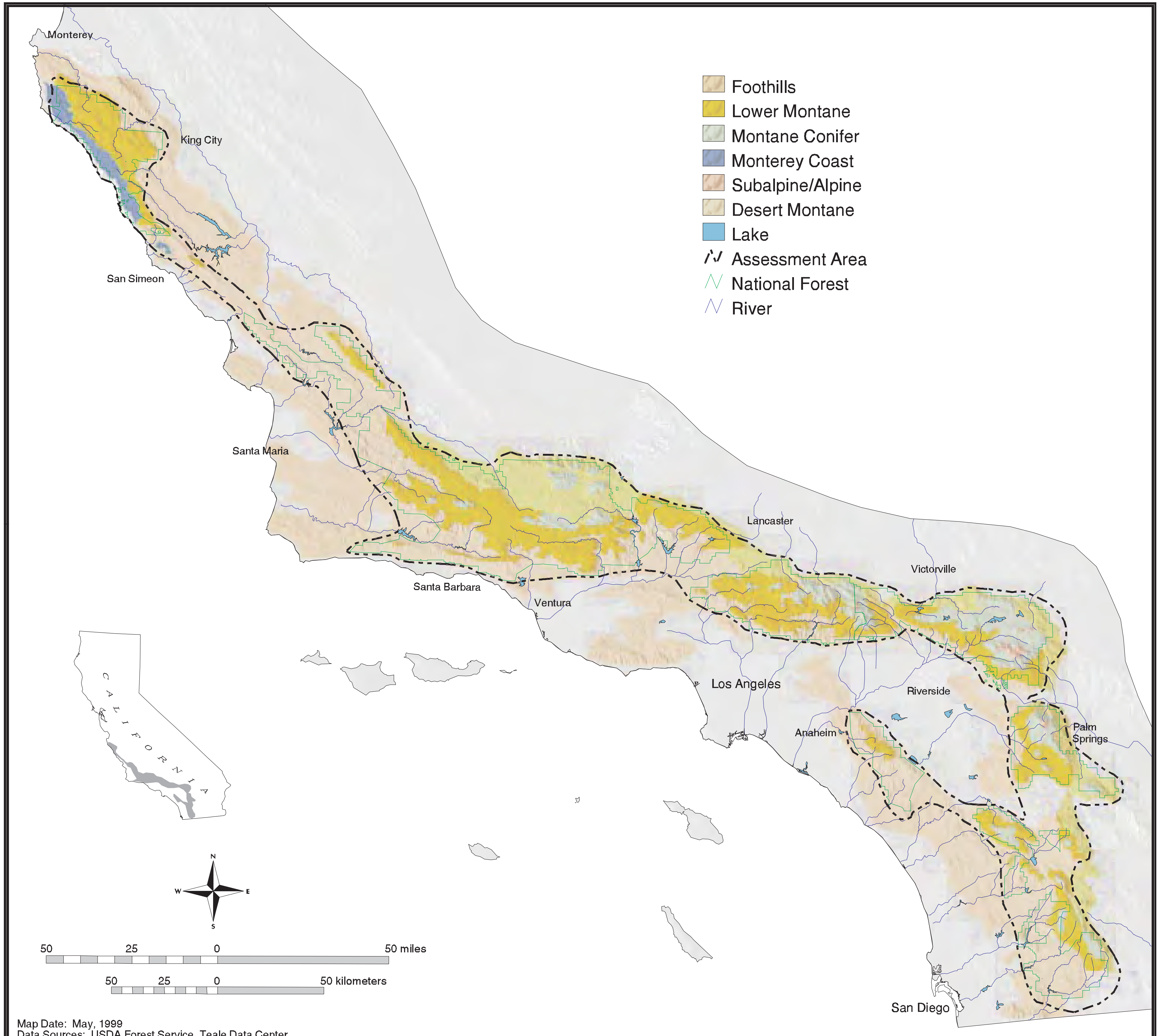


Figure 2.3. Large-scale vegetation patterns in the southern California mountains.

The coastal foothills (approximately 800 to 3,000 feet) are dominated by chaparral and coastal scrub, but also contain oak woodlands and riparian hardwood forests.

The lower montane landscape (approximately 3,000 to 5,000 feet) contains patches of conifer/live oak forest in an otherwise chaparral-dominated landscape. In the lower montane are two forest types endemic to southern California: bigcone Douglas-fir forest and Coulter pine forest.

The montane conifer landscape (approximately 5,000 to 8,500 feet) is dominated by pine and fir forests.

Subalpine/alpine plant communities of lodgepole and limber pine and above-treeline cushion plants occur at the very top of the highest mountains (above 8,500 feet).

The desert montane region (approximately 3,000 to 7,000 feet) is dominated by open pinyon pine woodlands, desert scrub, and sagebrush flats.

The Monterey coast landscape encompasses the southernmost extension of coastal redwood forest.

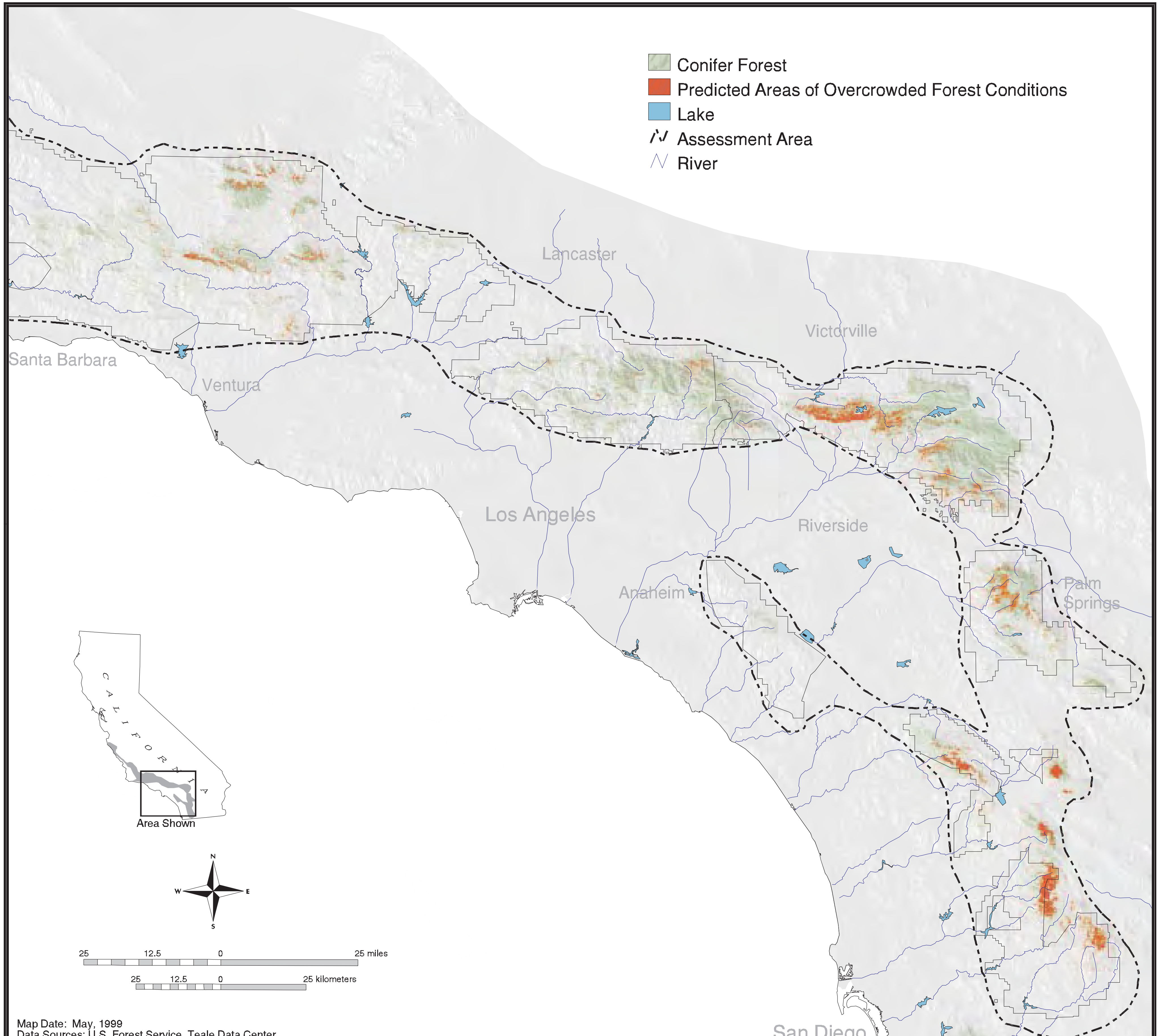


Figure 2.17. Areas shown in red are montane conifer forests predicted to be experiencing high understory densification due to the long-term absence of low- to moderate-intensity fires. Conifer forests not likely to be experiencing this problem are shown in green. The densified stands are at increased risk to loss from stand-replacing crown fire or insect and disease outbreaks.

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Plant and Animal Species of the Southern California Mountains and Foothills Assessment

The following table contains the complete list of "emphasis" species addressed in the Southern California Mountains and Foothills Assessment. Information provided for each species includes: scientific name, common name, taxa, distribution by national forest, federal status, state status, criteria used to identify species as "emphasis," assigned grouping based on habitat association and conservation category.

Conservation Category Definitions:

"Minimal Influence" — Minimal ability to conserve within the study area

Species whose conservation is affected minimally by public land management actions in the mountains and foothills. These are species whose primary habitat is outside the assessment area (or at least outside public lands within the assessment area) and they occur within the area only incidentally or in insignificant numbers.

"Landscape-level" — Species best conserved through habitat or landscape level management

Species that can be conserved through management activities at the habitat or landscape scale. These species have relatively robust populations and/or have life history characteristics that respond to habitat scale conservation. They are predictable occupants of a broad habitat type or structural stage; thus, species-specific surveys are not crucial in order to conserve. Their persistence can be relatively accurately inferred in a well-managed, functioning landscape that is within the natural range of variability.

"Site Specific" — Species requiring specific conservation measures

Organisms requiring species-level conservation action (including protection of individual locations) in order to ensure their persistence in the planning area. Species in this category have one or more of the following characteristics: extremely small populations, narrowly endemism within the landscape, highly specialized life history requirements, high sensitivity to small changes in habitat, and dependence on intensive conservation activities (e.g. exotic species control). The species in this category require one or more of the following conservation actions: (1) site-specific protections or habitat enhancements, (2) reintroductions, and (3) additional data collection and research to determine basic needs.

Code Definitions:

[1] Forest Occurrence Codes

y = occurs; breeds or probably breeds
p = potentially occurs and breeds
w = winters on forest
h = historically occurred and bred
t = transient, migrates through forest

[2] Federal Status Codes

FE = Federally Listed Endangered
FT = Federally Listed Threatened
SC = "Species of Concern" List (former C2)
S = Forest Service Sensitive List
PE = Federally Proposed Endangered
PT = Federally Proposed Threatened
C = Candidate species

[3] State of California Status Codes

CE = State Listed Endangered
CT = State Listed Threatened
SSC = Species of Special Concern
CR = State Listed Rare

Species Type (Spp. Type) Codes

1 = Federal/State Endangered, Threatened or Proposed
2 = Forest Service Sensitive
3 = Federal Candidate and "Species of Concern," State Rare and "Species of Special Concern"
4 = Game Species
5 = High Management/Public Interest
6 = Local Viability Concern
7 = Riparian Species of Concern

Habitat Group (Hab. Grp.) Codes

Habitat Group (Hab. Grp.) Codes	Beginning Page Number: Animals	Beginning Page Number: Plants
1 = Riparian, Aquatic and Aquatic/Upland	p. 125	p. 226
1.1 = primarily at low elevations (<4,000 ft.)		
1.2 = primarily at high elevations (>4,000 ft.)		
2 = Foothill Oak Woodland, Savanna, and Grassland	p. 182	p. 234
3 = Scrub and Chaparral	p. 171	p. 239
3.1 = primarily in coastal sage scrub		
3.2 = primarily in chaparral		
4 = Mixed Hardwood and Conifer	p. 185	
5 = Montane Conifer Forest	p. 192	p. 262
5.1 = primarily in lower elevation, pine-dominated forests		
5.2 = primarily in upper elevation, fir-dominated forests		
6 = Monterey Coast	p. 158	p. 307
7 = Subalpine and Alpine	p. 210	p. 287
8 = Desert Montane	p. 211	p. 292
9 = Gabbro	p. 256	
10 = Limestone/Carbonate		p. 300
11 = Pebble Plain		p. 271
12 = Serpentine		p. 308
13 = Montane Meadow	p. 206	p. 274
13.1 = primarily in wet meadows		
13.2 = primarily in dry meadows		
14 = Lake	p. 157	
16 = Habitat Generalist	p. 115	p. 312
16.1 = cliff nesting species		
17 = Low Elevation Valley Floor	p. 163	
17.1 = primarily in cismontane valleys		
17.2 = primarily in the western San Joaquin Valley		
18 = Desert Floor	p. 218	p. 306

Table A. The 184 animal and 255 plant taxa that were evaluated to assess their vulnerability and conservation potential within the Southern California Mountains and Foothills Assessment Area.

Scientific Name	Common Name	C N F[1]	SB N F	A N F	LP N F	Fed.[2]	CA[3]	Spp. Type	Hab. Grp.	Conservation Category	Page Num.
Invertebrates											
Branchinecta longiantenna	longhorn fairy shrimp				p	FE		1	17.2	Min influence	p. 163
Branchinecta lynchi	vernal pool fairy shrimp	p			p	FT		1	17	Landscape	p. 170
Psychomastix pysylla deserticola	desert monkey grasshopper		y			SC		3	8	Landscape	p. 211
Diplectronan californica	CA diplectronan caddisfly		y	y		SC		3	1	Landscape	p. 155
Cicindela tranquebarica virudissima	greenest tiger beetle		p			SC		3	1.1	Min influence	p. 155
Paleoxenus dorhni	Dorhns elegant eucnemid beetle		p	p		SC		3		Landscape	
Pleocoma bicolor	Bicolored rainbeetle		y					6	5.1	Landscape	p. 193
Coloradia velda	San Bernardino Mts. silk moth		y					6	8	Landscape	p. 211
Euchloe hyantis andrewsi	Andrew's marble butterfly		y			SC		3	5	Landscape	p. 194
Euphilotes baueri vernalis	vernal blue butterfly		y					6	8	Landscape	p. 213
Euphilotes enoptes cryptorufes	Pratt's blue butterfly		y					6	3	Landscape	p. 179
Euphilotes enoptes smithi	Smith's blue butterfly				y	FE		1	6	Site specific	p. 158
Euphilotes enoptes dammersi	Dammer's blue butterfly		y					6	8	Landscape	p. 213
Euphydryas editha augusta	August checkerspot butterfly		y					6	5	Landscape	p. 195
Euphydryas editha quino	Quino checkerspot butterfly	h/p	p	p		FE		1	3	Site specific	p. 173
Euphyes vestris harbisoni	Harbison's dun skipper butterfly	y				SC		3	1	Landscape	p. 156
Incisalia mossii doudoroffi	Doudoroff's elfin butterfly				y			6	6	Landscape	p. 160
Incisalia mossii hidakupa	San Gabriel Mts. elfin butterfly		y	y		SC		3	4	Site specific	p. 185
Lycaena hermes	Hermes copper butterfly	y				SC		3	3	Landscape	p. 178
Lycaena heteronea clara	bright blue copper butterfly				y			6	8	Site specific	p. 211
Mitoura thornei	Thorn's hairstreak butterfly	p				SC		3	9	Site specific	p. 187
Plebulina emigdionis	San Emigdio blue butterfly			p	y	SC		3	8	Site specific	p. 213
Plejebus saepiolus aureolus	San Gabriel Mts. greenish blue			y		SC		3	13	Site specific	p. 208
Pyrgus ruralis lagunae	Laguna Mts. skipper butterfly	y				FE		1	13	Site specific	p. 206
Speyeria adiaste clemencei	Clemence's silverspot butterfly				y			6	3	Landscape	p. 161
Fish											
Lampetra tridentata	Pacific lamprey	h/p			y			6	1.1	Landscape	p. 125
Oncorhynchus mykiss	rainbow trout	y	y	y	y			4	1	Landscape	p. 317
Oncorhynchus mykiss	southern steelhead	h/p	h	h	y	FE/T	SSC	1	1.1	Site specific	p. 125
Gila bicolor mohavensis	Mohave tui chub		y[h]			FE	CE	1	1.1	Site specific	p. 127
Gila orcutti	arroyo chub	y	y	y	y[i]	S	SSC	2	1.1	Landscape	p. 128
Rhinichthys osculus	Santa Ana speckled dace	y	y	y	y	S	SSC	2	1.1	Landscape	p. 129
Catostomus santaanae	Santa Ana sucker	h	h/p	y	y[i]	S	SSC	2	1.1	Site specific	p. 129
Gasterosteus aculeatus microcephalus	partially armored 3-spinestickleback	y	y	y[i]	y	S		2	1	Landscape	p. 131
Gasterosteus aculeatus williamsoni	unarmored 3-spine stickleback			y		FE	CE	1	1.1	Site specific	p. 131
Gasterosteus aculeatus undescribed	Shay Creek stickleback		y			FE		1	1.2	Site specific	p. 131
Eucyclogobius newberryi	tidewater goby				p	FE	SSC	1	1.1	Min influence	p. 133
Amphibians											
Ambystoma californiense	California tiger salamander				p		SSC	3	17.1	Site specific	p. 167
Dicamptodon ensatus	Pacific giant salamander				y			6	6	Landscape	p. 161
Taricha torosa torosa	Coast Range newt	y	p	y	y		SSC	3	1.1	Site specific	p. 133
Ensatina eschscholtzii croceater	yellow-blotched salamander		y		y	S	SSC	2	4	Landscape	p. 187
Ensatina eschscholtzii eschscholtzii	Monterey salamander	y	y	y	y			6	2	Landscape	p. 182
Ensatina eschscholtzii klauberi	large-blotched salamander	y	y			S	SSC	2	4	Landscape	p. 187
Batrachoseps gabrieli	San Gabriel Mt. slender salamander		y	y		S		2	4	Landscape	p. 188
Batrachoseps stebbinsi	Tehachapi slender salamander			p	p	S	CT	2	4	Min influence	p. 189
Aneides lugubris	arboreal salamander	y	y	y	y			6	2	Landscape	p. 183
Spea hammondii	western spadefoot	y	p	p	y	SC	SSC	3	17	Landscape	p. 135
Bufo californicus	arroyo toad	y	y	y	y	FE	SSC	1	1.1	Site specific	p. 135
Rana aurora draytonii	California red-legged frog	h/p	h/p	y	y	FT	SSC	1	1.1	Site specific	p. 138
Rana boylii	foothill yellow-legged frog			h	y	S	SSC	2	1.1	Site specific	p. 140
Rana muscosa	mountain yellow-legged frog	h	y	y		S	SSC	2	1.2	Site specific	p. 141

Scientific Name	Common Name	CNF[1]	SBNF	ANF	LPNF	Fed.[2]	CA[3]	Spp. Type	Hab. Grp.	Conservation Category	Page Num.
Reptiles											
Clemmys marmorata pallida	southwestern pond turtle	y	y	y	y	S	SSC	2	1.1	Site specific	p. 143
Xerobates (Gopherus) agassizii	desert tortoise		p	p		FT	CT	1	18	Min influence	p. 218
Gambelia silus	blunt-nosed leopard lizard				p	FE	CE	1	17.2	Min influence	p. 163
Sceloporus graciosus vandenburgianus	southern sagebrush lizard	y	y	y		SC		3	5	Landscape	p. 195
Sceloporus graciosus gracilis	northern sagebrush lizard				y			6	4	Landscape	p. 195
Urosaurus microscutatus	small-scaled lizard	y						6	8	Landscape	p. 214
Phrynosoma coronatum	coast horned lizard	y	y	y	y	S	SSC	2	3	Landscape	p. 179
Eumeces skiltonianus interparietalis	Coronado skink	y	y			SC	SSC	3	16	Landscape	p. 117
Cnemidophorus hyperythrus	orange-throated whiptail	y	y			SC	SSC	3	3.1	Landscape	p. 175
Anniella pulchra	California legless lizard	y	y	y	y	S	SSC	2	16	Landscape	p. 115
Charina bottae umbratica	southern rubber boa		y			S	CT	1	5.1	Landscape	p. 195
Lichanura trivirgata roseofusca	coastal rosy boa	y	y	y		S		2	3	Landscape	p. 180
Diadophis punctatus modestus	San Bernardino ringneck snake	p	y	y		S		2	16	Landscape	p. 118
Diadophis punctatus similis	San Diego ringneck snake	y	y			S		2	16	Landscape	p. 118
Salvadora hexalepis virgultea	coast patch-nosed snake	y	y	y	y	SC	SSC	3	3	Landscape	p. 178
Lampropeltis zonata multifasciata	coast mountain kingsnake			y	y	SC	SSC	3	5	Landscape	p. 197
Lampropeltis zonata parvirubra	San Bernardino Mtn. kingsnake		y	y		S	SSC	2	5	Landscape	p. 197
Lampropeltis zonata pulchra	San Diego Mtn. kingsnake	y				S	SSC	2	5	Landscape	p. 197
Thamnophis sirtalis concinnus	so. coast red-sided garter snake	p	p		p			6	1.1	Site-specific	p. 144
Thamnophis elegans elegans	mountain garter snake		y					6	5	Landscape	p. 197
Thamnophis hammondii	two-striped garter snake	y	y	y	y	S	SSC	2	1	Landscape	p. 144
Crotalus ruber ruber	red diamond rattlesnake	y	y			SC	SSC	3	3	Landscape	p. 180
Birds											
Pelecanus occidentalis californicus	California brown pelican				y	FE	CE	1	6	Min influence	p. 161
Charadrius alexandrinus	snowy plover				p	FT	SSC	1	6	Site specific	p. 161
Charadrius montanus	mountain plover				w	PT	SSC	3	17	Min influence	p. 165
Brachyramphus marmoratus	marbled murrelet				y	FT	CE	1	6	Site specific	p. 162
Gymnogyps californianus	California condor	h	h	h	y	FE	CE	1	16.1	Site specific	p. 119
Aquila chrysaetos	golden eagle	y	y	y	y		SSC	3	16.1	Landscape	p. 119
Haliaeetus leucocephalus	bald eagle	w	y	w	w	FT	CE	1	14	Site specific	p. 157
Pandion haliaetus	osprey	y	y	y	y		SSC	3	14	Min influence	p. 158
Accipiter striatus	sharp-shinned hawk	y	y	y	y		SSC	3	5	Landscape	p. 198
Accipiter cooperii	Cooper's hawk	y	y	y	y		SSC	3	1	Landscape	p. 145
Accipiter gentilis	northern goshawk	t	y	y	y	S	SSC	2	5	Site specific	p. 198
Buteo albonotatus	zone-tailed hawk	y	y					6	8	Landscape	p. 214
Buteo swainsoni	Swainson's hawk	t	t	p	p	S	CT	1	17	Min influence	p. 171
Falco peregrinus anatum	American peregrine falcon	y	y	y	y	FE	CE	1	16.1	Site specific	p. 121
Falco mexicanus	prairie falcon	y	y	y	y		SSC	3	16.1	Landscape	p. 121
Dendragapus obscurus	Mt. Pinos blue grouse				h/p			6	5.2	Site specific	p. 199
Callipepla californica	California quail	y	y	y	y			4	16	Landscape	p. 318
Oreortyx pictus	mountain quail	y	y	y	y			4	16	Landscape	p. 318
Alectoris chukar	chukar	p	y	p	y			4	8	Landscape	
Meleagris gallopavo	wild turkey	y	y		y			4	4	Landscape	p. 319
Columba fasciata	band-tailed pigeon	y	y	y	y			4	4	Landscape	p. 320
Zenaida macroura	mourning dove	y	y	y	y			4	16	Landscape	
Coccyzus americanus occidentalis	yellow-billed cuckoo				p	S	CE	1	1.1	Min influence	p. 145
Otus flammeolus	flammulated owl	y	y	y	y			6	5.1	Landscape	p. 200
Otus kennicottii	western screech owl	y	y	y	y			6	2	Landscape	p. 184
Glaucidium gnoma	northern pygmy owl	y	y	y	y			6	4	Landscape	p. 191
Athene cunicularia hypogaeae	burrowing owl	p	p		p	SC	SSC	3	17	Min influence	p. 170
Strix occidentalis occidentalis	California spotted owl	y	y	y	y	S	SSC	2	4	Site specific	p. 189
Asio otus	long-eared owl	y	y	y	y		SSC	3	2	Landscape	p. 185
Aegolius acadicus	northern saw-whet owl	y	y	y	y			6	5	Landscape	p. 200
Chordeiles minor	common nighthawk		y	y				6	8	Site specific	p. 214
Cypseloides niger	black swift	p	y	y	p		SSC	3	1	Site specific	p. 146
Stellula calliope	calliope hummingbird	p	y	y	y			6	13	Landscape	p. 209
Sphyrapicus thyroideus	Williamson's sapsucker		y	y	y			6	5.2	Landscape	p. 201
Picoides albolarvatus gravirostris	white-headed woodpecker	y	y	y	y			6	5	Landscape	p. 202
Empidonax traillii extimus	southwestern willow flycatcher	y	y	y	y	FE		1	1.1	Site specific	p. 147

Scientific Name	Common Name	CNF[1]	SBNF	ANF	LPNF	Fed.[2]	CA[3]	Spp. Type	Hab. Grp.	Conservation Category	Page Num.
Empidonax wrightii	gray flycatcher		y	p				6	8	Landscape	p. 214
Progne subis	purple martin	y	y	y	y		SSC	3	4	Landscape	p. 191
Tachycineta bicolor	tree swallow	y	y	y	y			6	1	Landscape	p. 150
Gymnorhinus cyanocephalus	pinyon jay		y	p	y			6	8	Landscape	p. 215
Pica nuttalli	yellow-billed magpie				y			6	2	Landscape	p. 183
Campylorhynchus brunneicapillus	coastal cactus wren	p	h/p	y		S	SSC	2	3.1	Min influence	p. 177
Polioptila californica	California gnatcatcher	y	p			FT	SSC	1	3.1	Site specific	p. 175
Catharus ustulatus	Swainson's thrush	y	y	y	y			7	1.1	Site specific	p. 150
Catharus guttatus	hermit thrush	w	y	y	y			6	5.2	Landscape	p. 202
Lanius ludovicianus	loggerhead shrike	y	y	y	y	SC	SSC	3	17	Landscape	p. 171
Toxostoma bendirei	Bendire's thrasher		y				SSC	3	18	Min influence	p. 219
Toxostoma lecontei	Le Conte's thrasher		y	p	p		SSC	3	18	Min influence	p. 220
Anthus spinoletta	American (water) pipit	w	p/w	w	w			6	7	Site specific	p. 210
Cinclus mexicanus	American dipper	h/p	y	y	y			6	1.2	Landscape	p. 151
Vireo bellii pusillus	least Bell's vireo	y	p	p	y	FE	CE	1	1.1	Site specific	p. 152
Vireo vicinior	gray vireo	y	y	y			SSC	3	8	Landscape	p. 215
Vireo solitarius cassinii	solitary vireo (Cassins)	y	y	y	y			6	4	Landscape	p. 192
Vireo solitarius plumbeus	solitary vireo (Plumbeus)		y	y				6	8	Landscape	p. 216
Vireo gilvus	warbling vireo	y	y	y	y			7	1	Landscape	p. 153
Vermivora virginiae	Virginia's warbler	t	y	y	t		SSC	3	5	Landscape	p. 202
Dendroica petechia brewsteri	yellow warbler	y	y	y	y		SSC	3	1.1	Landscape	p. 153
Oporornis tolmiei	Macgillivray's warbler	t	y	y	p			6	13.1	Landscape	p. 209
Geothlypis trichas	common yellowthroat	y	y	y	y			6	1.1	Landscape	p. 153
Icteria virens	yellow-breasted chat	y	y	y	y		SSC	3	1.1	Landscape	p. 154
Aimophila ruficeps canescens	rufous-crowned sparrow	y	y	y	y	SC	SSC	3	3.1	Landscape	p. 177
Amphispiza belli belli	Bell's sage sparrow	y	y	y	y	SC	SSC	3	3	Landscape	p. 179
Melospiza lincolnii	Lincoln's sparrow	w	y	y	y			6	13	Landscape	p. 210
Piranga falva	hepatic tanager		y				SSC	3	8	Landscape	p. 217
Piranga rubra	summer tanager	t	t	y			SSC	3	18	Min influence	p. 220
Carduelis lawrencei	Lawrence's goldfinch	y	y	y	y			7	1.1	Landscape	p. 154

Mammals

Sorex monticolus parvidens	dusky shrew (San Bernardino)		y	y				6	1.2	Landscape	p. 156
Macrotus californicus	California leaf-nosed bat	p	p			S	SSC	2	18	Min influence	p. 221
Myotis yumanensis	Yuma myotis bat	y	y	y	y			3	16	Landscape	p. 121
Myotis evotis	long-eared myotis bat	y	y	y	y	SC		3	5	Landscape	p. 203
Myotis thysanodes	fringed myotis bat	y	y	y	y	SC		3	5	Landscape	p. 203
Myotis volans	long-legged myotis bat	y	y	y	y	SC		3	5	Landscape	p. 203
Myotis ciliolabrum	western small-footed myotis bat	y	y	y	y	SC		3	16	Landscape	p. 122
Lasiurus blossvillii	western red bat	y	p		y	S	SSC	2	1	Landscape	p. 156
Euderma maculatum	spotted bat	y	y	y	y	SC	SSC	3	16	Landscape	p. 122
Corynorhinus townsendii	Townsend's big-eared bat	y	y	y	y	S	SSC	2	16	Site specific	p. 122
Antrozous pallidus	pallid bat	y	y	y	y	S	SSC	2	16	Landscape	p. 122
Eumops perotis californicus	western mastiff bat	y	y	y	y	SC	SSC	3	16	Landscape	p. 123
Lepus californicus bennettii	San Diego black-tailed jackrabbit	p	y	h/p		SC	SSC	3	17.1	Min influence	p. 170
Tamias obscurus davisi	California chipmunk		y					6	16	Landscape	p. 123
Tamias speciosus callipeplus	Mt. Pinos lodgepole chipmunk				y	S		2	5.2	Landscape	p. 210
Tamias speciosus speciosus	lodgepole chipmunk		y	y				6	5.2	Landscape	p. 210
Ammospermophilus nelsoni	San Joaquin antelope squirrel				p		CT	1	17.2	Min influence	p. 165
Spermophilus mohavensis	Mohave ground squirrel		p	p		SC	CT	1	18	Min influence	p. 222
Spermophilus lateralis	golden-mantled ground squirrel		y					6	5	Landscape	p. 204
Glaucomys sabrinus californicus	San Bernardino flying squirrel		y			S	SSC	2	5	Landscape	p. 204
Perognathus longimembris brevinasus	Los Angeles pocket mouse		p	p		S	SSC	2	17.1	Min influence	p. 167
Perognathus longimembris pacificus	Pacific pocket mouse	p				FE	SSC	1	17.1	Min influence	p. 168
Perognathus alticola alticola	SB white-eared pocket mouse		h/p	p		S	SSC	2	5.1	Site specific	p. 206
Perognathus alticola inexpectatus	Tehachapi pocket mouse			h/p	y	S	SSC	2	8	Landscape	p. 217
Chaetodipus fallax	San Diego pocket mouse	y	y	y		SC	SSC	3	3	Landscape	p. 181
Dipodomys ingens	giant kangaroo rat				p	FE	CE	1	17.2	Min influence	p. 165
Dipodomys stephensi	Stephens' kangaroo rat	y	p			FE	CT	1	17.1	Min influence	p. 168
Dipodomys merriami parvus	San Bernardino kangaroo rat		y	p		FE	SSC	1	17.1	Site specific	p. 168
Neotoma lepida intermedia	San Diego desert woodrat	y	y	y	y	SC	SSC	3	8	Landscape	

Scientific Name	Common Name	C N F[1]	SB N F	A N F	LP N F	Fed.[2]	CA[3]	Spp. Type	Hab. Grp.	Conservation Category	Page Num.
Neotoma fuscipes luciana	Monterey dusky-footed woodrat				y	SC	SSC	3	6	Landscape	p. 162
Erethizon dorsatum	porcupine		y	h/p				6	5	Landscape	p. 206
Vulpes macrotis mutica	San Joaquin kit fox				t	FE	CT	1	17.2	Min influence	p. 166
Ursus americanus	black bear		y	y	y			4	16	Landscape	p. 328
Bassariscus astutus	ringtail	y	y	y	y			6	1	Landscape	p. 157
Taxidea taxus	American badger	y	y	p	y		CR	3	16	Site specific	p. 124
Spilogale gracilis	western spotted skunk	y	y	y	y	SC	SSC	3	16	Landscape	p. 124
Enhydra lutris nereis	southern sea otter				y	FT		1	6	Min influence	p. 162
Puma (Felis) concolor	mountain lion	y	y	y	y			5	16	Landscape	p. 330
Sus Scrofa	wild pig			p	y			4	16	Landscape	
Eumetopias jubatus	Steller (northern) sea lion				y	FT		1	6	Min influence	p. 163
Equus caballus	wild horse				y			5	2	Landscape	p. 331
Equus asinus	wild burro		y					5	8	Landscape	p. 332
Cervus elaphus nannodes	tule elk				y			5	17	Min influence	p. 326
Odocoileus hemionus	mule deer	y	y	y	y			4	16	Landscape	p. 320
Ovis canadensis cremnobates	Peninsular bighorn sheep		y			FE	CT	1	8	Site specific	p. 217
Ovis canadensis nelsoni	Nelson's bighorn sheep		y	y	y			5	16	Site specific	p. 324

Plants

Scientific Name	Common Name	C N F[1]	SB N F	A N F	LP N F	Fed.[2]	CA[3]	Spp. Type	Hab. Grp.	Conservation Category	Page Num.
Botrychium crenulatum	scalloped moonwort		y	p		SC/S		2	13.1	Site specific	p. 281
Thelypteris puberula sonorensis	Sonoron maiden fern		y	p	y			6	1.1	Landscape	p. 228
Cupressus forbesii	Tecate cypress	y				SC/S		2		Landscape	p. 47
Cupressus sargentii	Sargent cypress				y			6		Landscape	p. 56
Cupressus stephensonii	Cuyamaca cypress	y				SC/S		2		Landscape	p. 45
Abies bracteata	Santa Lucia fir				y			6		Landscape	p. 58
Pinus attenuata	knobcone pine		y		y			6		Landscape	p. 60
Oreonana vestita	woolly mountain-parsley		y	y				6	7	Landscape	p. 291
Perideridia gairdneri gairdneri	Gairdner's yampah	p		p	y			6	6	Landscape	p. 308
Perideridia parishii parishii	Parish's yampah		y					6	13.1	Landscape	p. 283
Podistera nevadensis	Sierra podistera		h/p					6	7	Min influence	p. 291
Sanicula maritima	adobe sanicle				y	S	CR	2	12	Site specific	p. 311
Antennaria marginata	white-margined everlasting		h					6	5	Min influence	p. 262
Artemisia palmeri	San Diego sagewort	y						6	1.1	Landscape	p. 228
Aster greatae	Greata's aster		p	y				6	3.2	Landscape	p. 250
Baccharis vanessae	Encinitas baccharis	y				FT	CE	1	3	Site specific	p. 241
Calycadenia villosa	dwarf calycadenia				y	S		2	2	Site specific	p. 234
Chaenactis parishii	Parish's chaenactis	y	y					6	3.2	Landscape	p. 251
Cirsium loncholepis	La Graciosa thistle				y	PE	CT	1	1.1	Site specific	p. 230
Ericameria cuneata macrocephala	Laguna Mtns. goldenbush	y						6	8	Landscape	p. 298
Ericameria palmeri palmeri	Palmer's goldenbush	p						6	1.1	Min influence	p. 232
Erigeron breweri bisanctus	pious daisy		y	y				6	3.2	Landscape	p. 252
Erigeron breweri jacinteus	San Jacinto Mtns. daisy		y	y				6	7	Landscape	p. 287
Erigeron parishii	Parish's daisy		y			FT		1	10	Site specific	p. 303
Erigeron uncialis uncialis	limestone daisy		y			S		2	10		p. 303
Eriophyllum lanatum hallii	Fort Tejon woolly sunflower				y	SC/S		2	2	Landscape	p. 238
Eriophyllum lanatum obovatum	so. Sierra woolly sunflower		y					6	5	Landscape	p. 263
Geraea viscida	sticky geraea	y						6	8	Landscape	p. 298
Grindelia hirsutula hallii	San Diego gumplant	y						6	13.1	Landscape	
Helianthus nuttallii parishii	Los Angeles sunflower		h					6	13.1	Min influence	p. 281
Hemizonia floribunda	Tecate tarplant	p				SC/S		2	1.1	Min influence	p. 233
Hemizonia mohavensis	Mojave tarplant	y	y	p		SC/S	CE	1	1	Landscape	p. 226
Hemizonia pungens laevis	smooth tarplant	p						6	1.1	Min influence	
Holocarpha virgata elongata	graceful tarplant	y						6	2	Landscape	
Hulsea californica	San Diego sunflower	y						6	5	Landscape	p. 267
Hulsea vestita callicarpha	beautiful hulsea	y	y					6	5	Landscape	p. 267
Hulsea vestita gabrielensis	San Gabriel Mtns. sunflower		p	y	y			6	16	Landscape	p. 314
Hulsea vestita parryi	Parry's sunflower		y					6	16	Landscape	p. 314
Hulsea vestita pygmaea	pygmy hulsea		y					6	7	Landscape	p. 290
Layia heterotricha	pale-yellow layia				y	SC/S		2	16	Site specific	p. 315
Layia ziegleri	Ziegler's tidy-tips		y					6	13	Landscape	p. 277
Lessingia glandulifera tomentosa	Warner Springs lessingia	y				SC/S		2			

Scientific Name	Common Name	C N F[1]	SB N F	A N F	LP N F	Fed.[2]	CA[3]	Spp. Type	Hab. Grp.	Conservation Category	Page Num.
Machaeranthera asteroides lagunensis	Laguna Mtns. aster	y	p			SC/S	CR	2	13	Site specific	p. 277
Machaeranthera canescens ziegleri	Ziegler's aster		y			S		2	5	Landscape	p. 268
Malacothrix saxatilis arachnoidea	Carmel Valley cliff-aster				y	S		2	3.2	Landscape	
Pentachaeta exilis aeolica	slender pentachaeta				y	SC/S		2	2	Site specific	p. 238
Pyrrocoma uniflora gossypina	Bear Valley pyrrocoma		y			SC/S		2	13.2	Site specific	p. 285
Raillardiopsis muirri	Muir's raillardella				y	S		2	6	Landscape	p. 308
Senecio bernardinus	San Bernardino ragwort		y			SC/S		2	13.2	Site specific	p. 286
Senecio ganderi	Gander's ragwort	y				SC/S	CR	2	9	Site specific	p. 261
Senecio ionophyllus	Tehachapi ragwort		y	y				6	5	Landscape	p. 270
Stylocline masonii	Mason neststraw			y	y			6	8	Site specific	p. 299
Syntrichopappus lemmonii	Lemmon's syntrichopappus		y	y	p			6	8	Landscape	p. 300
Taraxacum californicum	California dandelion		y			FE		1	13.1	Site specific	p. 284
Berberis nevinii	Nevin's barberry	y	h/p	y		FE	CE	1	3	Site specific	p. 241
Plagiobothrys uncinatus	hooked popcorn-flower				y	SC/S		2	3.2	Landscape	p. 255
Arabis breweri pecuniaria	San Bernardino rock cress		y			SC/S		2	7	Site specific	p. 287
Arabis dispar	pinyon rock cress		y					6	8	Site specific	p. 292
Arabis johnstonii	Johnston's rock cress		y					6	3.2	Landscape	p. 246
Arabis parishii	Parish's rock cress		y			SC/S		2	11	Landscape	p. 271
Arabis shockleyi	Shockley's rock cress		y			S		2	10	Site specific	p. 302
Caulanthus amplexicaulis barbarae	Santa Barbara jewelflower				y	SC/S		2	12	Site specific	p. 310
Caulanthus californicus	California jewelflower				p	FE	CE	1	8	Min influence	p. 293
Caulanthus simulans	Payson's jewelflower	y	y			SC/S		2	8	Landscape	p. 296
Lepidium flavum felipense	Borrego Valley pepper-grass	p						6	8	Min influence	
Lepidium virginicum robinsonii	Robinson's pepper-grass	y						6	3	Landscape	p. 244
Lesquerella kingii bernardina	San Bern. Mtns. bladderpod		y			FE		1	10	Site specific	p. 305
Rorippa gambellii	Gambel's water cress	p	p			FE		1	1.1	Min influence	p. 233
Sibaropsis hammittii	Hammitt's clay-cress	y				S		2	2		p. 238
Streptanthus bernardinus	Laguna Mtns. jewel-flower	y	y	p				6	5	Landscape	p. 270
Streptanthus campestris	southern jewel-flower	y	y		y	S		2	8	Landscape	p. 299
Thelypodium stenopetalum	slender-petaled thelypodium		y			FE	CE	1	13	Site specific	p. 278
Opuntia basilaris brachyclada	short-joint beavertail	p	y	y		SC/S		2	8	Site specific	p. 299
Downingia concolor brevior	Cuyamaca Lake downingia	p					CE	1	13	Site specific	p. 276
Githopsis diffusa filicaulis	Mission Canyon bluecup	p				SC/S		2			
Arenaria macradenia kuschei	Forest Camp sandwort			y		SC/S		2	3.2	Landscape	p. 247
Arenaria paludicola	marsh sandwort		p			FE	CE	1	13.1	Site specific	p. 279
Arenaria ursina	Big Bear Valley sandwort		y			FT		1	11	Site specific	p. 271
Atriplex parishii	Parish's brittlescale		p			SC/S		2	16	Min influence	p. 312
Calystegia peirsonii	Pierson's morning-glory			y				6	16	Landscape	p. 314
Dudleya abramsii affinis	San Bernardino Mtns. dudleya		y			SC/S		2	8	Site specific	p. 297
Dudleya cymosa crebrifolia	San Gabriel River dudleya			y				6	3.2	Site specific	p. 252
Dudleya cymosa ovatifolia	Santa Monica Mtns. dudleya	y		p		FT		1	3	Site specific	p. 244
Dudleya densiflora	San Gabriel Mtns. dudleya			y		C/S		2	1.1	Site specific	p. 231
Dudleya multicaulis	many-stemmed dudleya	y		y		SC/S		2	3.1	Landscape	p. 245
Dudleya viscida	sticky dudleya	y				SC/S		2	3.1	Landscape	p. 245
Sedum niveum	Davidson's stonecrop		y			S		2	5	Landscape	p. 269
Arctostaphylos cruzensis	La Cruz manzanita				y	SC/S		2	6	Site specific	p. 307
Arctostaphylos edmundsii	Little Sur manzanita				y	SC/S	CR	2	3	Site specific	p. 239
Arctostaphylos hooveri	Hoover's manzanita				y			6			
Arctostaphylos luciana	Santa Lucia manzanita			y	y	SC/S		2	3.2	Landscape	p. 246
Arctostaphylos obispoensis	Bishop manzanita				y			6			
Arctostaphylos otayensis	Otay manzanita	p						6	9	Min influence	p. 256
Arctostaphylos peninsularis peninsularis	peninsular manzanita		p			S		2	3.2	Min influence	p. 246
Arctostaphylos pilosula	Santa Margarita manzanita				y	SC/S		2	3.2	Site specific	p. 247
Arctostaphylos rainbowensis	Rainbow manzanita	y				S		2	3.2	Site specific	p. 247
Arctostaphylos refugioensis	Refugio manzanita				y	SC/S		2	3.2	Landscape	p. 247
Tetracoccus dioicus	Parry's tetracoccus	y				SC/S		2	9	Site specific	p. 261
Astragalus albens	Cushenbury milk-vetch		y			FE		1	10	Site specific	p. 302
Astragalus bicristatus	crested milk-vetch		y	p		S		2	5	Landscape	p. 262
Astragalus brauntonii	Braunton's milk-vetch	p		p		FE		1	10	Site specific	p. 239
Astragalus deanei	Dean's milk-vetch	y				SC/S		2	1.1	Landscape	p. 230
Astragalus douglasii perstrictus	Jacumba milk-vetch	y				SC/S		2	8	Landscape	p. 292
Astragalus lentiginosus antonius	San Antonio milk-vetch		p	y		SC/S		2	5	Site specific	p. 262
Astragalus lentiginosus coachellae	Coachella Valley milk-vetch		p			FE		1	18	Min influence	p. 306

Scientific Name	Common Name	CNF[1]	SBNF	ANF	LPNF	Fed.[2]	CA[3]	Spp. Type	Hab. Grp.	Conservation Category	Page Num.
Astragalus lentiginosus sierrae	Big Bear Valley milk-vetch		y			SC/S		2	8	Landscape	p. 292
Astragalus leucolobus	Big Bear Valley woollypod	p	y	y	p	S		2	8	Landscape	p. 292
Astragalus oocarpus	San Diego milk-vetch	y				SC/S		2	16	Site specific	p. 312
Astragalus pachypus jaegeri	Jaeger's milk-vetch	y	p			SC/S		2	16	Site specific	p. 312
Astragalus tricarinatus	triple-ribbed milk-vetch		p			FE		1	18	Min influence	p. 306
Lupinus excubitus johnstonii	interior bush lupine			y				6	5	Landscape	
Lupinus ludovicianus	San Luis Obispo County lupine				y	SC/S		2	2	Site specific	p. 238
Marina orcuttii orcuttii	California marina		y			SC/S		2	8	Landscape	p. 299
Rupertia rigida	Parish's rupertia	y	y					6	16	Landscape	p. 316
Thermopsis californica semota	velvety false lupine	y				SC/S		2	16	Landscape	p. 278
Thermopsis macrophylla	Santa Ynez false lupine				y	SC/S	CR	2	3.2	Site specific	p. 256
Quercus dumosa	Nuttall's scrub oak				y	SC/S		2	3	Landscape	p. 244
Quercus engelmannii	Engelmann oak	y		y				6		Landscape	p. 42
Quercus lobata	valley oak				y			6		Landscape	p. 41
Gentiana fremontii	moss gentian		y					6		Site specific	
Swertia neglecta	pine green-gentian		y	y	y	S		2	8	Landscape	p. 300
Ribes canthariforme	Moreno currant	y	p			SC/S		2	3.2	Site specific	p. 256
Phacelia exilis	Transverse Range phacelia		y					6	16	Landscape	p. 315
Phacelia mohavensis	Mojave phacelia		y					6	16	Landscape	p. 316
Phacelia suaveolens keckii	Santiago Peak phacelia	y				SC/S		2	3.2	Site specific	p. 255
Juglans californica californica	Southern Calif. black walnut		y	y	y			6		Landscape	p. 44
Acanthomintha ilicifolia	San Diego thorn-mint	y				FT	CE	1	9	Site specific	p. 256
Lepechinia cardiophylla	heart-leaved pitcher sage	y				S		2	3.2	Landscape	p. 253
Lepechinia fragrans	fragrant pitcher sage		p	y				6	3.2	Landscape	p. 253
Lepechinia ganderi	Gander's pitcher sage	y						6	16	Landscape	p. 253
Monardella cinerea	gray monardella		p	y				6	7	Landscape	p. 291
Monardella hypoleuca lanata	felt-leaved monardella	y				S		2	9	Landscape	p. 261
Monardella linoides oblonga	flax-like monardella				y	S		2	5	Site specific	p. 268
Monardella macrantha hallii	Hall's monardella	y	y	y		S		2	16	Landscape	p. 315
Monardella nana leptosiphon	San Felipe monardella	y	y			SC/S		2	5	Landscape	p. 268
Monardella viridis saxicola	rock monardella		y	y		S		2	3.2		p. 254
Satureja chandleri	San Miguel savory	y				S		2	16	Landscape	p. 316
Scutellaria bolanderi austromontana	southern skullcap	y	y			S		2	1	Landscape	p. 228
Limnanthes gracilis parishii	Parish's meadowfoam	y				SC/S	CE	1	13.1	Landscape	p. 282
Eremalche parryi kernensis	Kern mallow				p	FE		1	2	Min influence	p. 236
Malacothamnus aboriginum	Indian Valley bush mallow	y			p			6	3.2	Site specific	p. 253
Malacothamnus davidsonii	Davidson's bush mallow			y	p			6	3.1	Site specific	p. 246
Malacothamnus palmeri lucianus	Arroyo Seco bush mallow				y			6	3.2	Landscape	p. 254
Sidalcea hickmanii anomala	Cuesta Pass checkerbloom				y	SC/S	CR	2	12	Landscape	p. 311
Sidalcea hickmanii hickmanii	Hickman's checkerbloom				y	S		2	3.2	Landscape	p. 256
Sidalcea hickmanii parishii	Parish's checkerbloom		y	p	y	C/S	CR	2	5	Site specific	p. 270
Sidalcea pedata	bird-footed checkerbloom		y			FE	CE	1	13.1	Site specific	p. 284
Abronia nana covillei	Coville's dwarf abronia		y			S		2	8	Site specific	p. 300
Clarkia delicata	delicate clarkia	y				S		2	9	Landscape	p. 260
Orobanche valida valida	Rock Creek broomrape			y	y	SC/S		2	3.2	Site specific	p. 254
Canbya candida	pygmy poppy		p	y		S		2	8	Site specific	p. 293
Eriastrum densifolium sanctorum	Santa Ana River woollystar		h/p			FE	CE	1	1.1	Site specific	p. 231
Eriastrum hooveri	Hoover's eriastrum				y	FT		1	2	Landscape	p. 236
Leptodactylon jaegeri	San Jacinto prickly phlox		y			S		2	7	Site specific	p. 290
Linanthus concinnus	San Gabriel linanthus		p	y		SC/S		2	5	Site specific	p. 268
Linanthus floribundus hallii	Santa Rosa Mtns. linanthus		y			S		2	8	Landscape	p. 298
Linanthus killipii	Baldwin Lake linanthus		y			SC/S		2	11	Site specific	p. 274
Linanthus orcuttii	Orcutt's linanthus	y		p		SC/S		2	16	Landscape	p. 315
Navarretia peninsularis	Baja navarretia	p	y	p	y	S		2	13.1	Landscape	p. 283
Phlox dolichantha	Big Bear Valley phlox		y			SC/S		2	5	Landscape	p. 269
Chorizanthe blakleyi	Blakley's spineflower				y	S		2	3.2	Landscape	p. 251
Chorizanthe breweri	Brewer's spineflower				y	S		2	12	Site specific	p. 310
Chorizanthe parryi parryi	Parry's spineflower		p			SC/S		2	3	Min influence	p. 243
Chorizanthe polygonoides longispina	long-spined spineflower	y	y			SC/S		2	3.2	Landscape	p. 251
Chorizanthe procumbens	prostrate spineflower	y	p	p				6	9	Landscape	p. 260
Chorizanthe rectispina	straight-awned spineflower				y	SC/S		2	3	Landscape	p. 243
Chorizanthe xanti leucotheca	white-bracted spineflower		y					6	8	Landscape	p. 297

Scientific Name	Common Name	CNF[1]	SBNF	ANF	LPNF	Fed.[2]	CA[3]	Spp. Type	Hab. Grp.	Conservation Category	Page Num.
Dodecahema leptoceras	slender-horned spineflower	y	y			FE	CE	1	1.1	Site specific	p. 230
Eriogonum butterworthianum	Butterworth's buckwheat				y	SC/S	CR	2	3.2	Landscape	p. 253
Eriogonum foliosum	leafy buckwheat	p	h/p					6	8	Min influence	p. 298
Eriogonum kennedyi alpigenum	southern alpine buckwheat		y	p	y	S		2	7	Landscape	
Eriogonum kennedyi austromontanum	southern mountain buckwheat		y			FT		1	11	Site specific	p. 272
Eriogonum microthecum corymbosoides	San Bernardino buckwheat		y	p				6	10	Landscape	p. 303
Eriogonum microthecum johnstonii	Johnston's buckwheat		y	y		SC/S		2	7	Site specific	p. 289
Eriogonum ovalifolium vineum	Cushenbury buckwheat		y			FE		1	10	Site specific	p. 303
Eriogonum umbellatum minus	alpine sulfur-flowered buckwheat		y	y				6	7	Landscape	
Oxytheca caryphylloides	chickweed oxytheca		y	p	p			6	5	Landscape	p. 289
Oxytheca emarginata	white-margined oxytheca		y			S		2	3.2		p. 255
Oxytheca parishii abramsii	Abram's oxytheca				y	S		2	3.2	Landscape	p. 255
Oxytheca parishii cienegensis	Cienega Seca oxytheca		y			SC/S		2	5	Site specific	p. 269
Oxytheca parishii goodmaniana	Cushenbury oxytheca		y			FE		1	10	Site specific	p. 305
Claytonia lanceolata peirsonii	Peirson's spring beauty		y	y		SC/S		2	7	Site specific	p. 287
Lewisia brachycalyx	short-sepaled lewisia	p	y					6	13.1		
Androsace elongata acuta	California androsace	y	y		y			6	16	Landscape	p. 312
Delphinium hesperium cuyamacae	Cuyamaca larkspur	y	y			SC/S	CR	2	13.1	Landscape	p. 281
Delphinium hutchinsonae	Hutchinson's larkspur				y	SC/S		2	6	Site specific	p. 308
Delphinium inopinum	unexpected larkspur				y	S		2	8	Landscape	p. 297
Delphinium parryi purpureum	Mt. Pinos larkspur				y			6			
Ceanothus cyaneus	Lakeside ceanothus	y				SC/S		2	3.2	Landscape	p. 250
Ceanothus ophiochilus	Vail Lake ceanothus	y				FT	CE	1	3.2	Site specific	p. 251
Horkelia truncata	Ramona horkelia	y				S		2	9	Landscape	p. 261
Horkelia wilderae	Barton Flats horkelia		y			SC/S		2	5	Site specific	p. 267
Horkelia yadonii	Santa Lucia horkelia				y			6	13	Landscape	p. 276
Ivesia argyrocoma	silver-haired ivesia		y			SC/S		2	11	Site specific	p. 273
Ivesia callida	Tahquitz ivesia		y			SC/S	CR	2	5	Landscape	p. 267
Potentilla rimicola	cliff cinquefoil		y			S		2	7	Site specific	p. 291
Galium angustifolium gabrielense	Borrego bedstraw		p	y				6	16	Landscape	p. 314
Galium angustifolium jacinticum	San Jacinto Mtns. bedstraw		y			S		2	5	Site specific	p. 263
Galium californicum luciense	Cone Peak bedstraw				y	SC/S		2	6	Site specific	p. 308
Galium californicum primum	California bedstraw		y			SC/S		2	5	Site specific	p. 263
Galium grande	San Gabriel bedstraw			y		SC/S		2	16	Site specific	p. 314
Galium hardhamiae	Hardham's bedstraw				y	S		2	12	Landscape	p. 311
Galium jepsonii	Jepson's bedstraw		p	y				6	5	Landscape	p. 263
Galium johnstonii	Johnston's bedstraw	p	y	y				6	5	Landscape	p. 266
Populus tremuloides	quaking aspen		y					6		Landscape	p. 59
Boykinia rotundifolia	round-leaved boykinia	p	y	y	h/p			6	1	Landscape	p. 226
Heuchera abramsii	Abrams's alumroot		p	y				6	7	Landscape	p. 289
Heuchera brevistaminea	Mt. Laguna alumroot	y						6	8	Landscape	p. 298
Heuchera elegans	urn-flowered alumroot		p	y				6	5	Landscape	p. 266
Heuchera hirsutissima	shaggy-haired alumroot		p			S		2	7	Min influence	p. 289
Heuchera parishii	Parish's alumroot		y			S		2	5	Landscape	p. 267
Heuchera rubescens versicolor	San Diego County alumroot	y						6	3.2	Landscape	p. 253
Castilleja cinerea	ash-gray Indian paintbrush		y			FT		1	11	Site specific	p. 272
Castilleja gleasonii	Mt. Gleason Indian paintbrush			y		SC/S	CR	2	5	Site specific	p. 262
Castilleja lasiorhyncha	San Bern. Mtns. owl's-clover	p	y			SC/S		2	13	Landscape	p. 276
Castilleja montigena	Heckard's Indian paintbrush		y					6	5	Landscape	p. 263
Castilleja plagiotoma	Mojave Indian paintbrush		y	y	p			6	8	Landscape	p. 293
Cordylanthus eremicus eremicus	desert bird's-beak		p					6	8	Min influence	p. 297
Mimulus clevelandii	Cleveland's bush monkeyflower	y						6	5	Landscape	
Mimulus exiguus	San Bern. Mtns. monkeyflower		y			SC/S		2	13	Site specific	p. 277
Mimulus purpureus	purple monkeyflower		y			SC/S		2	13	Landscape	p. 278
Pedicularis dudleyi	Dudley's lousewort				y	SC/S	CR	2	1.1	Site specific	p. 233
Penstemon californicus	California beardtongue	p	y			S		2	8	Site specific	p. 255
Fremontodendron mexicanum	Mexican flannelbush	p				FE	CR	1	9	Min influence	p. 260
Viola aurea	golden violet		y	p	p			6	8	Min influence	p. 300
Viola pinetorum grisea	grey-leaved violet		h/p			S		2	7	Min influence	p. 291
Carex obispoensis	San Luis Obispo sedge				y	S		2	12	Site specific	p. 309
Juncus duranii	Duran's rush		y					6	13.1	Landscape	p. 282
Allium munzii	Munz's onion	y				FE	CT	1	3	Site specific	p. 239

Scientific Name	Common Name	CNF[1]	SBNF	ANF	LPNF	Fed.[2]	CA[3]	Spp. Type	Hab. Grp.	Conservation Category	Page Num.
Allium parishii	Parish's onion		y					6	10	Landscape	p. 302
Brodiaea filifolia	thread-leaved brodiaea	y	p	p		FT	CE	1	9	Site specific	p. 258
Brodiaea orcuttii	Orcutt's brodiaea	y				SC/S		2	9	Landscape	p. 260
Calochortus clavatus gracilis	slender mariposa lily			y				6	3.2	Landscape	p. 250
Calochortus dunnii	Dunn's mariposa lily	y				SC/S	CR	1	9	Landscape	p. 260
Calochortus obispoensis	San Luis mariposa lily				y	S		2	12	Landscape	p. 308
Calochortus palmeri munzii	Munz's mariposa lily		y			SC/S		2	13	Site specific	p. 274
Calochortus palmeri palmeri	Palmer's mariposa lily		y	y	y	SC/S		2	13	Site specific	p. 274
Calochortus plummerae	Plummer's mariposa lily		y	y	p	SC/S		2	3.2	Site specific	p. 250
Calochortus striatus	alkali mariposa lily		y	p		SC/S		2	13	Landscape	p. 274
Calochortus weedii intermedius	intermediate mariposa lily	y				SC/S		2		Landscape	
Calochortus weedii vestus	late-flowered mariposa lily				y	SC/S		2	3.2	Landscape	p. 250
Chlorogalum pomeridianum minus	dwarf soaproot				y			6	12	Site specific	p. 310
Chlorogalum purpureum reductum	Camatta Canyon amole				y	PT	CR	1	2	Site specific	p. 234
Fritillaria falcata	talus fritillary				y	SC/S		2	12	Site specific	p. 311
Fritillaria ojaiensis	Ojai fritillary				y	SC/S		2	16	Landscape	
Fritillaria viridea	San Benito fritillary				y	SC/S		2	12	Landscape	p. 311
Lilium humboldtii ocellatum	ocellated Humboldt lily	y	y	y	y			6	1	Landscape	p. 227
Lilium parryi	lemon lily	y	y	y		SC/S		2	13.1	Site specific	p. 282
Muilla coronata	crowned muilla		y					6	8	Landscape	p. 299
Nolina cismontana	chaparral beargrass	y				S		2	3	Landscape	p. 338
Nolina interrata	Dehesa nolina	p					CE	1	9	Min influence	p. 261
Malaxis monophyllos brachypoda	adder's-mouth		y	p		S		2	13.1	Site specific	p. 282
Piperia leptopetala			y					6	5	Landscape	p. 269
Muhlenbergia californica	California muhly		y	y				6	1	Landscape	p. 228
Poa atropurpurea	San Bernardino blue grass	y	y			FE		1	13.1	Site specific	p. 283

Appendix B: Common and Scientific Names

Common names and scientific names of other (nonemphasis) species mentioned in text.

Common Name	Scientific Name
Alvord oak	*Quercus alvordiana*
arroyo willow	*Salix lasiolepis*
basin sagebrush	*Artemisia tridentata*
beavertail cacti	*Opuntia basilaris*
bedstraw	*Galium angustifolium* ssp. *angustiofolium*
big cone Douglas fir	*Pseudotsuga macrocarpa*
big sagebrush	*Artemis tridentata*
birch-leaf mountain-mahogany	*Cercocarpus betuloides* var. *betuloides*
black bush	*Coleogyne ramosissima*
black oak	*Quercus kelloggii*
blue oak	*Quercus douglasii*
broad cottonwood	*Populus* spp.
brown-headed cowbird	*Molothrus ater*
buck brush	*Ceanothus cuneatus* var. *cuneatus*
bullfrog	*Rana catesbeiana*
cactus	*Cactaceae*
California bay	*Umbellularia californica*
California buckwheat	*Eriogonum fasciculatum*
California juniper	*Juniperus californicus*
California newt	*Taricha torosa*
California sagebrush	*Artemisia californica*
California western sycamore	*Plantanus racemosa*
canyon live oak	*Quercus chrysolepis*
cattails	*Typhaceae*
chamise	*Adenostoma fasciculatum*
cheat grass	*Bromus tectorum*
coast live oak	*Quercus agrifolia*
coast redwood	*Sequoia sempervirens*
Coulter pine	*Pinus coulteri*
creosote bush scrub	*Larrea*
cupleaf ceanothus	*Ceanothus greggii* var. *perplexans*
curl leaf mountain mahagony	*Cercocarpus ledifolius*
dandelion	*Taraxacum officinale*
desert scrub	*Salvia eremostachya*
digger pine	*Pinus sabiniana*
European starling	*Sturnus vulgaris*
Fremont cottonwood	*Populus fremontii* ssp. *fremontii*
French broom	*Genista monspessulana*
fritillaria	*Fritillaria pinetorum*
giant cane	*Arundo donax*
gray/foothill pine	*Pinus sabiniana*
hairgrass	*Deschampsia danthoides*
incense cedar	*Calocedrus decurrens*
Indian paintbrush	*Castilleja Martinii; C.pruinosa*
interior live oak	*Quercus wislizenii*
Jeffrey pine	*Pinus jeffreyi*
Joshua tree	*Yucca brevifolia*
juniper	*Juniperus* spp.

Common Name	**Scientific Name**
knobcone pine	*Pinus attenuata*
leather oak	*Quercus durata*
limber pine	*Pinus flexilis*
lodgepole pine	*Pinus contorta* ssp. *murrayana*
lousewort	*Pedicularis semibarbata*
manzanita	*Arctosaphylos* ssp. *parryana*
mondardella	*Mondardella nan* ssp. *tenuiflora*
monkey flower	*Mimulus aurantiacus*
Muir's hairstreak butterfly	*Mitoura muiri*
mule fat scrub	*Baccharis salicifolia*
Muller's oak	*Qodurata mulleri*
native mustards	*Bassica*
Nevin's barberry	*Berberis nevinii*
oat grass	*Avena* spp.
onion, garlic	*Allium burewii*
Pacific madrone	*Arbutus menziesii*
pinyon pine	*Pinus monophylla*
plantain	*plantago erecta; plantago ovata*
ponderosa pine	*Pinus ponderosa*
prickly phlox	*Leptodactylor Californicum*
red fir	*Abies magnifica*
red shank	*Adenostoma sparsifolium*
red-eared slider	*Trachemys scripta elegans*
redwood	*Sequoia sempervirens*
rock cress	*Arabis johnstonii*
rushes	*Juncaeae*
sage	*Salvia* spp.
San Diego bedstraw	*Galium natallii*
scrub oak	*Quercus berberidifolia*
sedges	*Carex* spp.
shore pine	*Pinus contorta*
straw	*Keckiella antirrinoides*
sugar pine	*Pinus lambertiana*
sulfer flower	*Eriogonum umbellatum*
sunflower	*Helianthus* spp.
sycamore	*Platanacus racemosa*
tamarisk	*Tamarix* spp.
tan oak	*Lithocarpus densiflorus*
Tidy tips	*Lavia platyglossa*
toyon	*Heteromeles arbutifolia*
Tucker oak	*Quercus john-tuckeri*
western juniper	*Juniperus occidentalis* var. *occidentalis*
white alder	*Alnus rhombifolia*
white fir	*Abies concolor*
white sage	*Salvia apiana*
white thorn	*Ceanthus leucodermis*
wild buckwheat	*Eriogonum; E. wrightii*
willow	*Salix* spp.
wood rat	*Neotoma* spp.
woodland star	*Lithophragma tenellum*
wooly Indian paintbrush	*Castilleja foliosa*
yellow pine	*Pinus lambertiana*

Data on analysis watersheds and their associated streams: The major streams along the central and southern California coast organized by primary and analysis watersheds, with information on stream miles by elevation, amount of public land in the watershed, roadedness, and occurrences of native aquatic species and problem non-native species. Watersheds and tributaries are listed hierarchically and roughly in the order they occur from north to south. Figures begin on page 394.

Codes for column headings and table values:

y = present in last 5 years

y* = a highly significant or large population (based on existing info.)

y′ = hybrids present

h = historically occurred

p = potentially occurs

n = absent in repeated surveys

E = recently extirpated

Aquatic Species:

Herps

CRLF = California red-legged frog

MYLF = mountain yellow-legged frog

ARTO = arroyo toad

SWPT = western pond turtle

Fish

SASU = Santa Ana sucker

UTST = unarmored threespine stickleback

SOST = southern steelhead

Non-Native Species:

MF = mosquitofish

WF = warmwater fish (sunfish, bass, bluegill, catfish, carp, goldfish)

BUFR = bullfrogs

ACFR = African clawed frogs

CF = crayfish

AR = arundo

TK = tamarisk

PRIMARY WATERSHEDS	Stream miles (% on public land)			Percent w'shed on public land	Percent w'shed w/n 250m of road	Road along stream	Flow Regime	Sensitive Aquatic Species							Problem Non-native Species				
Analysis Watersheds Major Tributaries	<1000 ft elev	1000–3000 ft elev	>3000 ft elev					CR LF	MY LF	AR TO	SW PT	SA SU	UT ST	SO ST	WF	BU FR	AC FR	AR	TK
Santa Lucia Range – includes north half of the Los Padres NF (Monterey & San Luis Obispo Counties)																			
CARMEL RIVER																			
Lower Carmel (below Los Padres Dam)	18.0 (2%)			2%	63%		regulated							y*	y	y			
Upper Carmel (above Los Padres Dam)	6.4 (0%)	12.7 (67%)	0.7 (100%)	49%	29%	no	natural							h					
Miller Fk, Carmel River		5.8 (87%)	2.1 (76%)				natural				y			h					
MONTEREY COAST DRAINAGES																			
Little Sur River	8.5 (14%)	6.2 (80%)		60%	21%	no	natural				y			y					å
Big Sur River	10.3 (80%)	5.7 (100%)		93%	15%	no	natural	y			y			y					
North Fk, Big Sur R.		5.6 (100%)	1.2 (100%)			no	natural	y			y			y					
South Fk, Big Sur R.		6.2 (100%)	0.3 (100%)			no	natural	y			y			y					
So. Monterey Coast (S of Big Sur)				81%	29%		natural							y*					
Big Creek	2.1 (100%)	3.1 (100%)	1.5 (100%)				natural							y					
Devil's Canyon	1.9 (100%)	3.1 (100%)	1.7 (100%)				natural							y					
Willow Creek	2.6 (100%)	2.2 (100%)					natural							y					
SALINAS RIVER																			
Lower Salinas R. (below S.Margarita R)	141.2 (7%)	14.8 (6%)		10%	57%	yes	altered			h				h					
Arroyo Seco River	26.0 (1%)	17.3 (94%)		60%	36%	yes	natural				y			p					
Tassajara Creek		8.2 (100%)	0.5 (100%)				natural							p					
Santa Lucia Creek		8.9 (100%)	1.7 (100%)				natural												
Vaqueros Creek	5.9 (8%)	5.1 (72%)	0.5 (100%)				natural												
Reliz Canyon	11.6 (0%)	4.8 (28%)					natural												
San Antonio River (above SA Dam)	27.2 (100)	20.5 (100)	1.1 (100%)	64%	60%	yes	natural			y	y			h	y	y			
Nacimiento River (above Nac. Dam)	24.3 (5%)	24.1 (100)		48%	52%	yes	natural				y*			h	y				
Estrella River	25.9 (0%)	1.8 (0%)		10%	51%	yes	altered												
San Juan Creek		56.3 (5%)					altered												
Trout Creek																			
Upper Salinas R. (above S.Margarita R)		24.2 (9%)		51%	37%		natural				y								
SAN LUIS OBISPO COAST DRAINAGES																			
North SLO Coast (N of Morro Bay)																			
San Carpoforo Creek	6.9 (11%)	3.4 (84%)					natural	y			y			y	n	n	n		
Arroyo de los Chinos	2.7 (0%)	1.1 (0%)					natural	y			n			n	n	n	n		
Arroyo de la Cruz	10.7 (0%)						natural	y			y			y	n	n	n		
Arroyo Laguna	4.2 (0%)						natural	y			y			y	n	n	n		
Arroyo del Puerto	3.3 (0%)	0.8 (0%)					natural	y			y			y	n	y	n		
Broken Bridge Creek	2.3 (0%)	0.3 (0%)					natural	y			y			n	n	n	n		
Little Pico Creek	3.9 (0%)						natural	y			y			y	n	n	n		
Pico Creek	5.3 (0%)	3.4 (0%)					natural	y			y			y	y	n	n		
Arroyo del Padre Juan	2.6 (0%)						natural	y			n			n	n	n	n		
San Simeon Creek	5.6 (0%)					partial	natural	y			y			y	n	y	n		
Santa Rosa Creek	13.1 (0%)	1.8 (0%)				yes	natural	y			y			y	y	y	n		

Green Valley Creek	7.3 (0%)						natural	y			y				y	y	n		
Ellysly Creek	4.0 (0%)					yes	natural	y			y			h/p	n	n	n		
Villa Creek	10.3 (0%)	0.8 (0%)				partial	natural	y			y			y	n	y	n		
Cayucos Creek	8.1 (0%)					yes	natural	y			y			y	y	y	n		
Little Cayucos Creek	3.0 (0%)					partial	natural	h/E			h/E			n	n	n	n		
Willow Creek	3.9 (0%)					partial	natural	h/?			y			n	n	n	n		
Old Creek	8.7 (0%)	1.7 (0%)				yes	natural	h/E			y			h/E	y	y	n		
Toro Creek	7.8 (0%)	2.7 (1%)				partial	natural	y			y			h	n	n	n		
South SLO Coast (S of Morro Bay)				11%	64%		natural												
Morro Creek	9.1 (13%)	3.8 (0%)				yes	natural	h/p		h				p					
East Fk, Morro Ck	0.1 (100%)	1.5 (100%)																	
Chorro Creek	9.7 (25%)					yes	natural	y			y			p					
San Bernardo Ck	5.3 (0%)	1.6 (39%)				partial	natural												
San Luisito Ck	5.2 (0%)	1.8 (50%)				partial	natural												
San Luis Obispo Creek	15.5 (0%)	0.6 (0%)				yes	natural	h/p						y	y				
Arroyo Grande Ck (below Lopez R)	13.0 (4%)					yes	altered							y					
Up Arroyo Grande (above Lopez R)	7.6 (1%)	1.4 (0%)		43%	29%	yes	natural												
Lopez Canyon	3.1 (0%)	12.3 (45%)				partial	natural	y											
Huff's Hole Ck	2.2 (25%)	3.1 (100%)				no	natural				y								
Western Transverse Ranges – includes south half of the Los Padres NF (Santa Barbara & Ventura Counties)																			
SANTA MARIA/CUYAMA RIVER																			
Santa Maria R. (below Twitchell Res.)	28.4 (0%)			3%	73%	yes	regulated												
Lower Cuyama R (below Cottonwd)	9.2 (0%)	64.2 (14%)		48%	39%	yes	altered	y*			y				y				
Pine Canyon	0.3 (0%)	11.5 (63%)				partial	natural	p											
Huasna River	18.3 (0%)	2.2 (0%)		27%	40%	no	altered												
Trout Creek		6.0 (23%)				no	natural	y											
Stone Creek	0.4 (0%)	10.6 (57%)					natural	y											
Alamo Creek	8.9 (6%)	14.4 (60%)		65%	39%		natural	y			y*				y				
Upper Cuyama R (above Cottonwd)		6.7 (67%)	15.0 (58%)	90%	18%	yes	natural	y*		y?	y				y				
Quatal Canyon		0.9 (43%)	15.6 (81%)				natural												
Santa Barbara Cyn		5.5 (20%)	9.6 (88%)				natural												
Sisquoc River (above Cuyama confl.)	10.0 (0%)	31.9 (83%)	7.0 (100%)	87%	12%	no	natural	y		y	y			y	y				y
Manzana Creek		15.5 (92%)	3.9 (100%)				natural	y*			y*								
La Brea Creek	7.1 (5%)	0.5 (70%)		86%	27%	yes	natural				y								
North Fk, La Brea	0.1 (0%)	14.1 (83%)					natural	y			y								
South Fk, La Brea	0.2 (0%)	13.6 (85%)	2.1 (100%)				natural												
SANTA YNEZ RIVER																			
L. Santa Ynez (below Cachuma Res)	46.5 (1%)			16%	75%	yes	regulated				y			y	y	y		y	y
M. Santa Ynez (Gibralter to Cachuma)	13.7 (13%)	9.8 (93%)		64%	33%	partial	regulated	y		y	y				y	y		y	y

PRIMARY WATERSHEDS	Stream miles (% on public land)			Percent w'shed on public land	Percent w'shed w/n 250m of road	Road along stream	Flow Regime	Sensitive Aquatic Species							Problem Non-native Species				
Analysis Watersheds Major Tributaries	<1000 ft elev	1000–3000 ft elev	>3000 ft elev					CR LF	MY LF	AR TO	SW PT	SA SU	UT ST	SO ST	WF	BU FR	AC FR	AR	TK
Santa Cruz Ck	3.6 (0%)	10.3 (36%)				partial	altered	y			y				y				
West Fk, Santa Cruz		3.3 (100%)	1.3 (100%)				natural												
East Fk, Santa Cruz		1.9 (100%)	4.7 (100%)				natural				y*								
Up. Santa Ynez (above Gibralter Res)		17.5 (87%)	0.1 (100%)	98%	22%	yes	altered	y		y	y				y	y			
Mono Creek		16.2 (80%)	10.1 (100)			no	natural	y		y*	y				y				
Indian Creek		11.3 (84%)	1.9 (100%)			no	natural	y		y	y*				y				
Agua Caliente Canyon		7.5 (100%)	5.0 (100%)				natural				y								
Santa Ynez Hdwater							natural												
SANTA BARBARA COAST DRAINAGES																			
Santa Barbara Coast				31%	70%	yes	natural												
Gaviota Creek	6.4 (55%)	0.8 (0%)					altered						y	y					
Arroyo Hondo Creek	2.3 (23%)	0.7 (100%)					altered							y					
Canada del Refugio	4.5 (15%)	2.4 (95%)					altered							y					
Tajiguas Creek	4.0 (0%)	1.4 (0%)					altered	y											
Canada del Corral	3.5 (1%)	2.4 (100%)					altered							y					
Gato Creek	3.3 (0%)	2.4 (88%)	0.4 (100%)				altered							y					
Dos Pueblos Creek	4.2 (0%)	2.9 (85%)	0.2 (100%)				altered							y					
Carpenteria Creek	5.0 (0%)	3.0 (55%)	0.1 (100%)				altered							y					
Rincon Creek	4.4 (11%)	4.6 (100%)	1.3 (100%)			yes	altered	y						p					
VENTURA RIVER																			
Ventura River	15.6 (3%)	0.4 (0%)		49%	52%	yes	altered	y			y			y	y				
Matilija Creek		9.6 (27%)	3.2 (100%)			yes	altered	y			y			h	y				
Coyote Creek	9.1 (4%)	3.7 (99%)					natural							h					
SANTA CLARA RIVER																			
Lower Santa Clara (below Francisq.)	44.4 (0%)	3.3 (0%)		10%	71%	yes	altered				y				y				
Hopper Canyon	5.1 (0%)	7.2 (46%)	1.5 (100%)			no	natural							y					
Santa Paula Creek	5.9 (0%)	5.9 (49%)	3.0 (100%)	62%	38%	partial	natural				y			h					
Lower Sespe Ck (below Timber Ck)	8.0 (0%)	20.4 (98%)		85%	21%	no	natural			p	y	y		y	y	y			
Upper Sespe Creek (above Tule Ck)			15.0 (79%)	97%	17%	partial	natural			y	y								
Mid. Sespe Ck (Tule to Timber)		5.2 (75%)	9.1 (89%)				natural			y*	y			y	y	y			
Piedra Blanca Creek			8.9 (98%)			no	natural												
Lower Piru Ck (Piru L. to Pyramid L.)		23.5 (82%)		81%	25%	no	regulated	y		y*	y*	y			y	y			
Agua Blanca Creek		11.2 (100)	4.3 (100%)			no	natural												
Upper Piru Ck (above Pyramid L.)		7.3 (100%)	31.4 (90%)	80%	28%	partial	natural			y	y*				y	y		y	
Lockwood Creek			11.7 (65%)			partial	natural												

CENTRAL VALLEY DRAINAGES																			
Buena Vista (North of Mt. Pinos)				36%	41%														
Cuddy Creek			15.0 (16%)				natural												
San Emigdio Creek		7.1 (0%)	8.5 (28%)				natural												
Liebre/Sawmill and Western San Gabriel Mountains - Angeles NF (Los Angeles County)																			
SANTA CLARA RIVER																			
Upper Santa Clara (Soledad Cyn)		30.0 (8%)	2.8 (1%)	33%	64%	yes	altered	h			y	y*	y*		y	y	y	y	
Castaic Creek (above Castaic Lake)		14.2 (52%)	2.3 (100%)	92%	25%	no	natural	h		y*	y								y
Fish Canyon		8.4 (97%)	3.5 (100%)				natural			y	y								y
Elizabeth Lake Cyn		16.9 (79%)	2.6 (29%)	85%	40%	yes	altered	p									y		
San Francisquito Cyn		20.1 (46%)	1.7 (53%)	79%	55%	yes	natural	y				y	y*				y	y	y
Bouquet Canyon		17.3 (48%)	2.9 (9%)	68%	61%	yes	altered	p										y	
Aliso Canyon		1.6 (0%)	7.3 (75%)	91%	47%	yes	natural	h			y								
DESERT-FLOWING DRAINAGES																			
Amargosa Creek		4.0 (0%)	8.1 (0%)	11%	66%		natural	y*		y	y						y		
Little Rock Ck (above L. Rock Res.)		0.9 (0%)	19.7 (94%)	97%	20%	yes	natural		y*	y*					y				
Santiago Creek			6.4 (100%)			no	natural			p									
South Fk, Little Rock Ck			6.6 (100%)			no	natural												
Big Rock Creek			10.8 (38%)	61%	52%	yes	natural												
Sheep Creek			8.0 (35%)	64%	69%		altered												
Mescal Creek			5.3 (78%)				natural												
LOS ANGELES RIVER											h				y				
Pacoima Creek		10.6 (75%)	11.0 (100)	97%	48%	partial	natural				y				y	y		y	
Lower Big Tujunga Ck (below Res)		14.3 (40%)		75%	53%	yes	regulated	h		p		y*	y*			y		y	
Little Tujunga Creek		5.8 (24%)				yes	natural				y							y	
Upper Big Tujunga Ck (above Res)		5.7 (100%)	10.0 (100)	98%	37%		natural			y									
Mill Creek		0.5 (100%)	6.8 (79%)				natural		h										
Alder Creek			4.6 (83%)				natural			y									
Arroyo Seco Creek		10.7 (75%)	3.4 (100%)	62%	63%	no	natural	h		y	h								
SAN GABRIEL RIVER																			
Lower San Gabriel R (below West Fk)	6.6 (4%)	7.4 (66%)		79%	40%	yes	regulated	h			y				y	y	y	y	y
Fish Canyon	1.2 (1%)	5.6 (90%)	0.5 (100%)			no	natural		h										
Upper San Gabriel R ("East Fork")		11.6 (81%)	8.6 (100%)	98%	17%	yes	natural		y	y	y	y*			y	y		y	
Cattle Canyon		4.1 (91%)	3.6 (100%)			no	natural		h			y							
Iron Fork			5.7 (100%)			no	natural		y*										
Fish Fork			7.5 (100%)			no	natural		y										
Prairie Fork			4.7 (100%)			partial	natural		y*										
Upper West Fork (above Cogswell R)		6.0 (100%)	5.3 (100%)	100%	27%	yes	natural		h		y								
Devils Canyon		2.8 (100%)	7.6 (100%)				natural		p										

PRIMARY WATERSHEDS	Stream miles (% on public land)			Percent w'shed on public land	Percent w'shed w/n 250m of road	Road along stream	Flow Regime	Sensitive Aquatic Species							Problem Non-native Species				
Analysis Watersheds Major Tributaries	<1000 ft elev	1000–3000 ft elev	>3000 ft elev					CR LF	MY LF	AR TO	SW PT	SA SU	UT ST	SO ST	WF	BU FR	AC FR	AR	TK
Lower West Fork (below Cogswell R)		9.7 (100%)		100%	24%	yes	altered		h		y*	y*			y				
Bear Creek		5.7 (100%)	4.9 (100%)				natural		h			y							
North Fork, San Gabriel R		4.2 (100%)	0.4 (100%)			yes	natural		h	y					y	y		y	
Santa Anita Canyon	0.3 (0%)	4.3 (85%)	1.7 (100%)	65%	44%	no	natural												
Eaton Canyon	0.6 (0%)	5.0 (73%)	1.2 (100%)				natural												
Sawpit Canyon		3.5 (24%)	1.0 (100%)				natural												
San Dimas Creek		6.8 (69%)	1.2 (100%)	68%	62%	yes	natural	h							y	y		y	
Big Dalton Canyon		3.9 (29%)					altered				p				y				
Little Dalton Canyon		4.1 (78%)	0.4 (100%)				natural												
Eastern San Gabriel, San Bernardino & Jacinto Mountains - San Bernardino NF (San Bernardino & Riverside Counties)																			
SANTA ANA RIVER																	y		
L. Santa Ana (7 Oaks Dam to Prado D)	28.9 (40%)	9.0 (2%)		6%	92%		regulated					y			y	y	y	y	y
San Antonio Canyon		3.2 (29%)	6.3 (69%)	79%	32%	yes	natural											y	
Cucamonga Canyon		2.8 (34%)	4.7 (100%)	64%	41%		natural												
Day Canyon		2.1 (0%)	4.0 (58%)			no	natural		h/p										
Deer Canyon		1.5 (0%)	3.5 (99%)				natural												
Lytle Creek		10.9 (43%)	0.3 (9%)	77%	47%	yes	altered												
North Fork, Lytle Ck		0.0 (0%)	11.7 (86%)			yes	natural	h											
Middle Fork, Lytle Ck		0.1 (0%)	7.2 (93%)			yes	natural	h											
South Fork, Lytle Ck		0.3 (100%)	4.6 (100%)			no	natural												
Cajon Wash		9.3 (42%)	8.6 (22%)	81%	62%	yes	altered											y	y
Crowder Canyon		0.0 (100%)	4.1 (78%)			yes	natural												
Lone Pine Canyon		1.6 (74%)	9.2 (76%)			yes	natural												
Cleghorn Canyon		0.4 (86%)	3.1 (97%)				natural												
East Twin Creek		5.7 (25%)	0.7 (100%)	59%	59%													y	
Waterman Canyon		3.7 (0%)	0.4 (51%)			yes	natural		h									y	
Strawberry Creek		2.3 (49%)	2.2 (100%)															y	
Mid. Santa Ana (Bear Ck to 7-Oaks)		7.8 (64%)	2.2 (38%)	79%	42%		altered												
Alder Ck		0.7 (100%)	2.8 (100%)				natural												
Hemlock Ck		0.3 (100%)	3.8 (100%)				natural												
Keller Ck		0.4 (100%)	3.4 (84%)				natural												
Plunge Creek		5.7 (58%)	0.9 (100%)			no	natural		h										
Little Mill Creek		1.6 (100%)	4.5 (44%)				natural												
Fredalba Creek		0.8 (100%)	3.0 (100%)																

City Creek		3.6 (34%)				yes	natural		y										
West Fk, City Ck		2.6 (76%)	2.4 (100%)				natural												
East Fk, City Ck		1.6 (79%)	2.9 (100%)				natural												
Mill Creek		5.8 (0%)	12.3 (31%)	71%	35%	yes	natural		h										
Mountain Home Ck			3.9 (69%)				natural												
Bear Creek			9.2 (97%)	74%	62%		altered												
Siberia Creek			4.3 (84%)				natural		p										
Upper Santa Ana (above Bear Ck)			17.2 (88%)	94%	44%	yes	natural												
Barton Creek			4.6 (77%)				natural		h/y										
South Fk, Santa Ana			4.8 (100%)				natural												
Fish Creek			5.2 (100%)				natural												
San Timoteo Wash		17.4 (0%)		8%	78%		altered												
Little San Gorgonio Ck		5.8 (0%)	7.5 (22%)				natural												
Oak Glen Creek		10.1 (0%)	5.1 (0%)			partial													
MOJAVE RIVER																			
West Fk, Mojave (below Silverw'd)		0.6 (0%)	5.7 (7%)	68%	63%		regulated	h		y						y			
West Fk, Mojave (above Silverw'd)			6.3 (29%)			partial	natural	h								y			
Grass Valley Creek			9.7 (40%)				natural												
East Fk of West Fk, Mojave			6.9 (55%)					h											
Houston Creek			2.4 (75%)				altered												
Seeley Creek			3.2 (54%)			partial													
Deep Creek			22.3 (87%)	81%	58%		altered	h		y*						y			
Holcomb Creek			15.5 (96%)	98%	57%	partial	natural												
Crab Creek			5.5 (99%)				natural												
Green Valley Creek			3.7 (61%)				altered												
Hooks Creek			3.0 (28%)				natural												
Little Bear Creek			2.9 (62%)				altered												
BALDWIN LAKE BASIN																			
Baldwin Lake				64%	78%														
Shay Creek			5.8 (48%)				altered						y*						
Caribou Creek			7.1 (79%)				natural												
DESERT PLAYA W'SHEDS																			
Lucerne Lk Drainages				82%	50%														
Crystal Creek			1.9 (62%)				natural												
Arrastre Creek			10.8 (98%)	92%	37%		natural												
WHITEWATER RIVER																			
San Gorgonio River		18.0 (0%)	9.4 (39%)	36%	47%	yes													
Snow Creek (San Jac)		3.7 (50%)	3.4 (70%)			no	natural		h/p										
Millard Canyon		5.4 (0%)	5.5 (27%)				natural												
Twin Pines Creek (San Jac)		1.8 (0%)	4.5 (53%)				natural												

PRIMARY WATERSHEDS	Stream miles (% on public land)			Percent w'shed on public land	Percent w'shed w/n 250m of road	Road along stream	Flow Regime	Sensitive Aquatic Species							Problem Non-native Species				
Analysis Watersheds Major Tributaries	<1000 ft elev	1000–3000 ft elev	>3000 ft elev					CR LF	MY LF	AR TO	SW PT	SA SU	UT ST	SO ST	WF	BU FR	AC FR	AR	TK
Upper Whitewater River	5.1 (0%)	11.4 (44%)	2.3 (89%)	55%	25%		altered			y									
North Fork, Whitewater			5.8 (100%)				natural												
Middle Fork, Whitewater			6.5 (63%)				natural												
South Fork, Whitewater			11.4 (79%)				altered												
Mission Creek	4.7 (0%)	10.1 (0%)	6.7 (66%)							p									
North Fork, Mission Ck			5.6 (51%)				natural												
South Fork, Mission Ck			5.0 (70%)				natural												
Palm Canyon	7.8 (0%)	6.6 (35%)	7.1 (78%)	41%	23%														
Tahquitz Creek	4.2 (0%)	1.9 (0%)	6.5 (60%)																
Andreas Canyon	2.0 (0%)	3.0 (0%)	3.7 (50%)						h/p										
Murray Canyon	1.3 (0%)	3.4 (8%)	4.4 (62%)																
Deep Canyon	1.2 (0%)	5.2 (0%)	6.3 (77%)	77%	26%														
Horsethief Creek			7.9 (95%)																
SAN JACINTO RIVER																			
Lower San Jacinto (below Bautista Ck)		37.3 (8%)		15%	76%		regulated												
Bautista Creek		11.6 (24%)	5.4 (96%)	78%	43%	yes	natural			h/p									y
Lion Canyon			3.9 (96%)																
Up San Jacinto (Hemet L.to Bautista)		7.1 (4%)		72%	48%	yes	altered												
Indian Creek		5.2 (26%)	5.2 (94%)			no	altered		y										
North Fk, San Jacinto		1.7 (0%)	10.7 (70%)			no	natural		y										
Black Mtn. Creek			2.0 (100%)				natural		y										
Fuller Mill Creek			2.9 (50%)			partial	natural		y										
Strawberry Creek		0.5 (79%)	8.0 (31%)			yes	altered												
South Fk, San Jacinto		3.4 (12%)	7.3 (89%)			no	altered			p					y				y
Garner Valley			10.0 (36%)	73%	48%	yes	altered												
Herkey Creek			7.7 (43%)			yes	natural												
Santa Ana Mountains, Chino Hills, San Diego Ranges - Cleveland NF (Riverside, San Diego, Orange Counties)																			
SANTA ANA RIVER																			
Coastal Santa Ana R. (below Prado)	30.0 (3%)			9%	93%		regulated												
Santiago Ck (below Res.)	12.9 (0%)					yes	regulated												
Upper Santiago Ck	5.0 (0%)	10.7 (46%)	2.0 (100%)	49%	56%	no	altered												
Black Star Canyon	0.7 (0%)	2.7 (48%)					natural												
Silverado Canyon	0.5 (0%)	8.3 (34%)	1.4 (100%)			yes	natural												
Aliso Canyon (Chino Hills)	6.1 (95%)	0.9 (100%)									y						y	y	
Eastside Santa Ana Mt Strms (Coldwater, Bedford, Mayhew,..)				40%	65%														

SAN JUAN CREEK																			
San Juan Creek	17.9 (37%)	61.8 (13%)		48%	59%	yes	natural	h		y				h	y	y	y	y	y
Bell Canyon	7.3 (100%)	5.9 (75%)				yes	natural			y									
Trabuco Creek	14.3 (47%)	7.1 (64%)		32%	75%	yes	natural	h		y	h				y				
SAN MATEO CREEK																			
San Mateo Creek	15.0 (100)	7.8 (99%)		69%	47%		natural	h		y*	y*			h	y	y		y	y
Devil's Canyon	2.3 (100%)	5.1 (90%)					natural			y	y				y	y			
Christianitos/Talega Cks	6.2 (42%)						natural			y						y			
Tenaja Creek		4.9 (77%)					natural				y				y	y			
San Onofre Creek	10.1 (100)	3.6 (100)					natural	h		y*									
SANTA MARGARITA RIVER																			
Santa Margarita River	28.3 (77%)	1.4 (54%)		43%	77%	partial	altered			y*	y			h	y	y	y	y	y
De Luz Creek	12.1 (40%)	2.2 (17%)				partial	natural	h		y				h	y	y		y	y
Roblar Creek	4.0 (100%)	2.8 (56%)					natural												
Murrieta Creek	2.3 (0%)	9.2 (0%)		6%	77%	yes	altered				y				y	y		y	y
Lower Temecula Ck (below Vail L)	0.8 (0%)	11.2 (0%)		15%	67%	yes	altered			p	y				y	y		y	y
Upper Temecula Ck (above Vail L)		21.2 (3%)	4.5 (33%)	55%	49%	yes	altered			y*					y	y			
Arroyo Seco Creek		10.3 (34%)	1.5 (100%)				natural			y									
SAN LUIS REY RIVER																		y	
L San Luis Rey (below Couser C)	21.3 (0%)			10%	90%	yes	altered			y					y	y		y	
M San Luis Rey (Wohl. Div. to Couser)	16.1 (0%)	4.9 (12%)		14%	63%	yes	altered	h		y				y*	y	y			
Pauma Creek	1.7 (0%)	3.3 (39%)	2.3 (0%)			no	natural	h	h							y			
Pala Creek	4.6 (1%)	4.2 (18%)				partial	natural	h		y						y			
U San Luis Rey (Henshaw to Wohl.D)		10.8(17%)		34%	53%	yes	regulated								y	y			
Hdw, San Luis Rey (above Henshaw)		9.4 (1%)	6.4 (100%)	32%	50%		natural			p				y*	y	y			
West Fork, San Luis Rey		4.3 (1%)	5.4 (90%)			no	natural			y	y				y	y			
North Fork, San Luis Rey		6.5 (1%)	6.4 (100%)				natural	h		y									
Agua Caliente Creek		7.7 (0%)	9.3 (63%)				altered			y									
San Ysidro Creek		0.3 (0%)	10.0 (0%)				natural												
SAN DIEGUITO RIVER																			
San Dieguito River (below Hodges Res)	18.5 (0%)			2%	84%	yes	regulated			p	y				y	y			
L Santa Ysabel (Sutherland to Hodges)	13.1 (18%)	7.6 (55%)		21%	68%	yes	regulated	h		y					y	y			y
Temescal Creek		9.8 (33%)	0.1 (0%)			partial	natural			y*						y			
Guejito Creek	2.3 (0%)	10.6 (1%)	0.7 (0%)			partial	natural			y*									
Up Santa Ysabel (above Sutherland Res)		8.7 (0%)	8.0 (0%)	2%	58%		natural	h							y	y			
SAN DIEGO RIVER											y								
Lower San Diego (below El Cap. Dam)	31.8 (15%)			19%	85%	yes	regulated	h		p					y	y			
San Vicente Ck	5.1 (0%)						altered	h		y						y			
Upper San Diego (above El Cap. Dam)	10.8 (13%)	8.5 (92%)	2.1 (28%)	42%	56%		natural	h		y	y				y	y			y
Cedar Creek	0.4 (0%)	6.3 (95%)	5.6 (7%)			no	natural			y	y				y				y
Boulder Creek	0.4 (60%)	6.5 (81%)	5.1 (64%)			no	regulated	h			y				y	y			

PRIMARY WATERSHEDS	Stream miles (% on public land)			Percent w'shed on public land	Percent w'shed w/n 250m of road	Road along stream	Flow Regime	Sensitive Aquatic Species							Problem Non-native Species				
Analysis Watersheds Major Tributaries	<1000 ft elev	1000–3000 ft elev	>3000 ft elev					CR LF	MY LF	AR TO	SW PT	SA SU	UT ST	SO ST	WF	BU FR	AC FR	AR	TK
Conejos Creek	1.0 (0%)	9.1 (27%)	0.9 (98%)				natural												
SWEETWATER RIVER																			
L Sweetwater (Loveland to Sweetwater)	25.0 (0%)	1.3 (100%)		2%	78%	yes	regulated			y					y	y	y	y	y
Up Sweetwater (above Loveland Res)		13.5 (46%)	18.7 (70%)	56%	66%	partial	natural			p	y				y	y		y	y
OTAY RIVER																			
Otay River							regulated	h							y	y			
Dulzura Creek	11.9 (3%)						altered	h								y			
TIJUANA RIVER/COTTONWOOD CREEK																			
Tijuana River							altered	h							y	y			
Lower Cottonwood (below Barrett L)	9.8 (11%)	4.0 (5%)		42%	52%	partial	regulated	h		y	p				y	y			y
Potrero Creek	0.4 (0%)	10.7 (9%)					natural			y									
Lower Pine Valley Ck		12.4 (83%)	6.4 (94%)	77%	45%		natural	h		y*	y*				y	y			
Upper Pine Valley Ck			10.6 (66%)	89%	53%	yes	natural	h		y*	p				y				
Noble Creek			4.9 (88%)				natural	p		y	y								
Laguna Meadow							natural	p											y
Upper Cottonwood (above Morena)			16.9 (31%)	71%	42%	yes	natural	h		y*	p				y	y			
Cottonwood Ck (betw'n Barrett, Morena)		9.4 (51%)	0.2 (0%)				regulated	p			y				y	y			y
Kitchen Creek			8.9 (68%)			yes	natural	h		y	?								
Morena Creek			5.6 (46%)			yes	natural			y					y				
La Posta Creek			19.8 (28%)			partial	natural												
DESERT-FLOWING DRAINAGES																			
Coyote Creek	4.7 (0%)	14.0 (2%)	2.1 (88%)	61%	29%		natural												
Borrego Palm Canyon	2.4 (0%)	4.0 (46%)	7.3 (40%)				natural	h											
San Felipe Creek		10.3 (0%)	3.9 (0%)	64%	35%		natural	h		y									
Banner Creek		5.3 (5%)	5.0 (4%)			yes	natural												
Vallecito Creek		11.4 (0%)				yes	natural												