# 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.

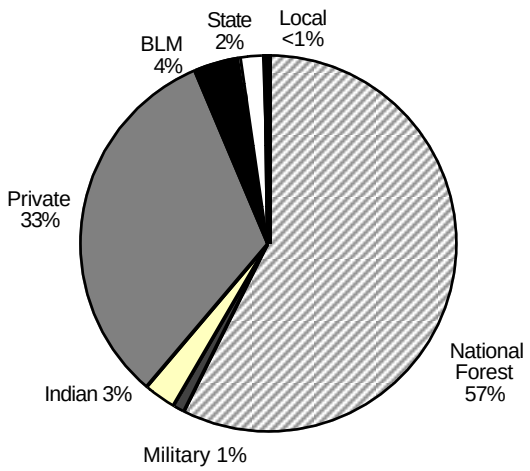
Although the SCMFA is broad and comprehensive in subject matter and geographic scope, there are many opportunities to further expand the analyses based on these data. This type of assessment is an ongoing process. Thus, identifying data gaps and future information needs is as important a task as gathering 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.

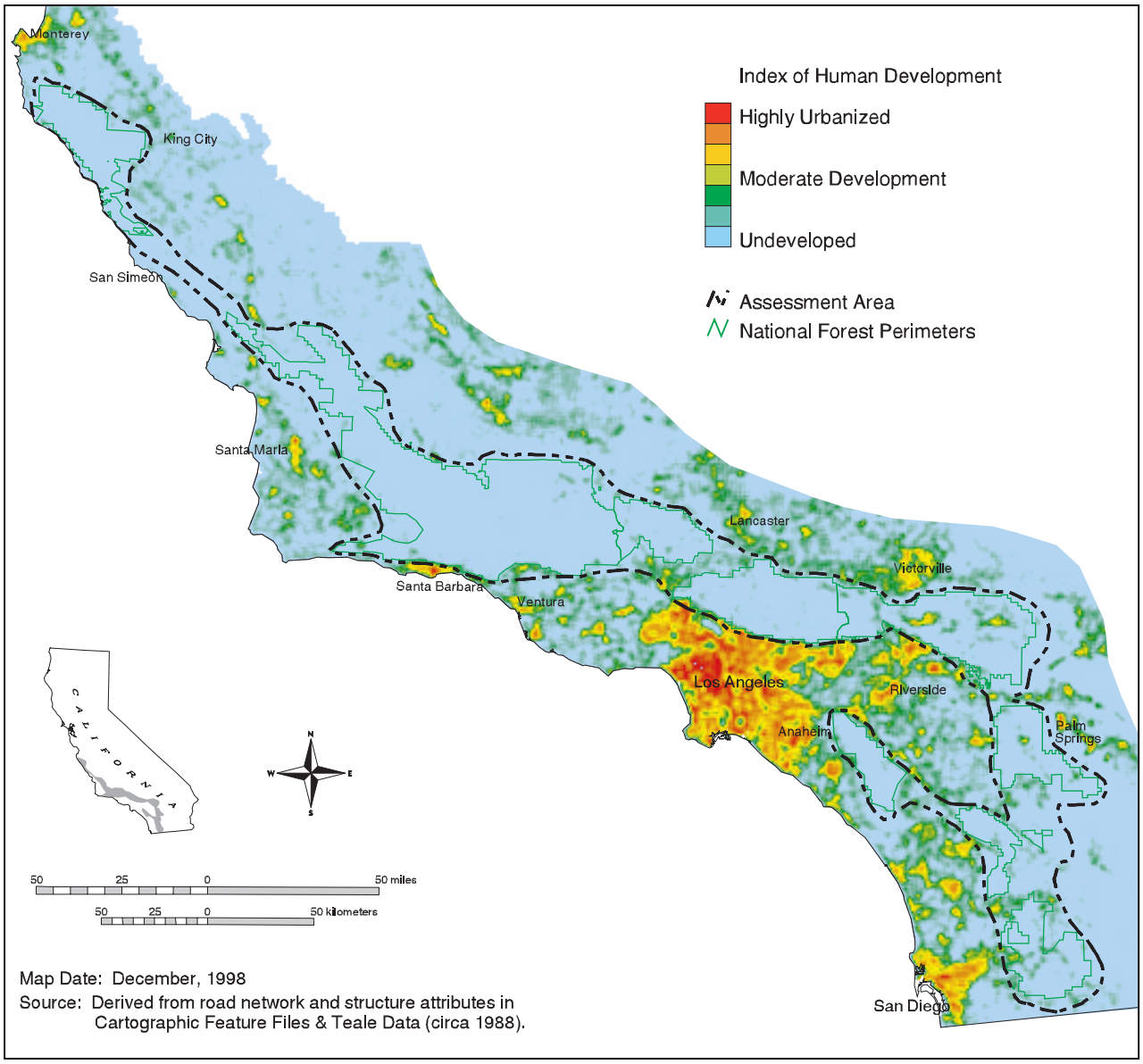
Geographically, these coastal mountains are identifiable as distinct ranges or groups of ranges. In recognition of the many differences among these mountain ranges, we divided the assessment area into nine distinct regions (fig. 1.5). The boundaries of these regions correspond closely with one or more 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.



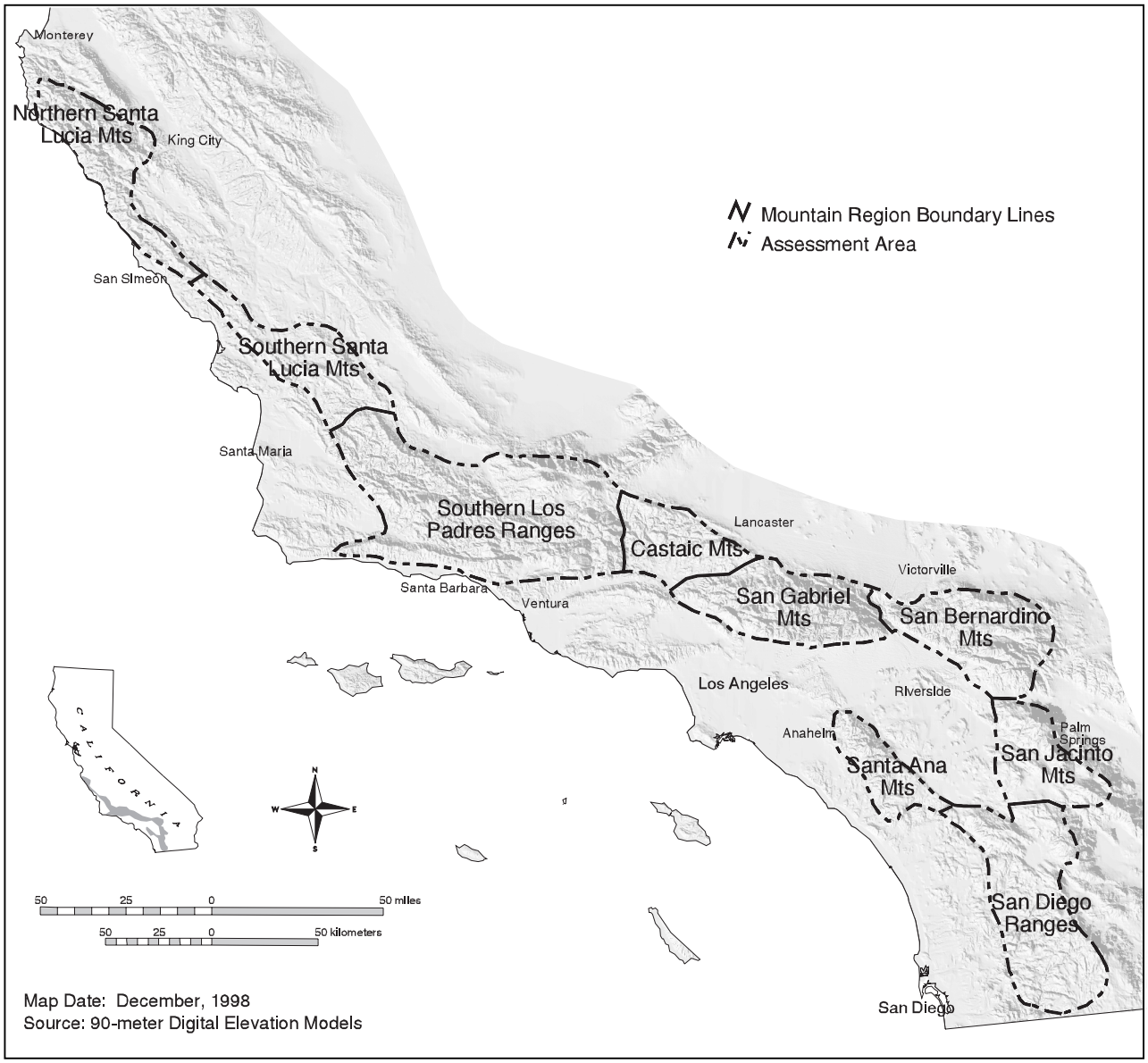



**Figure 1.5.** The nine mountain regions within the assessment area. See text for a description of each.

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.

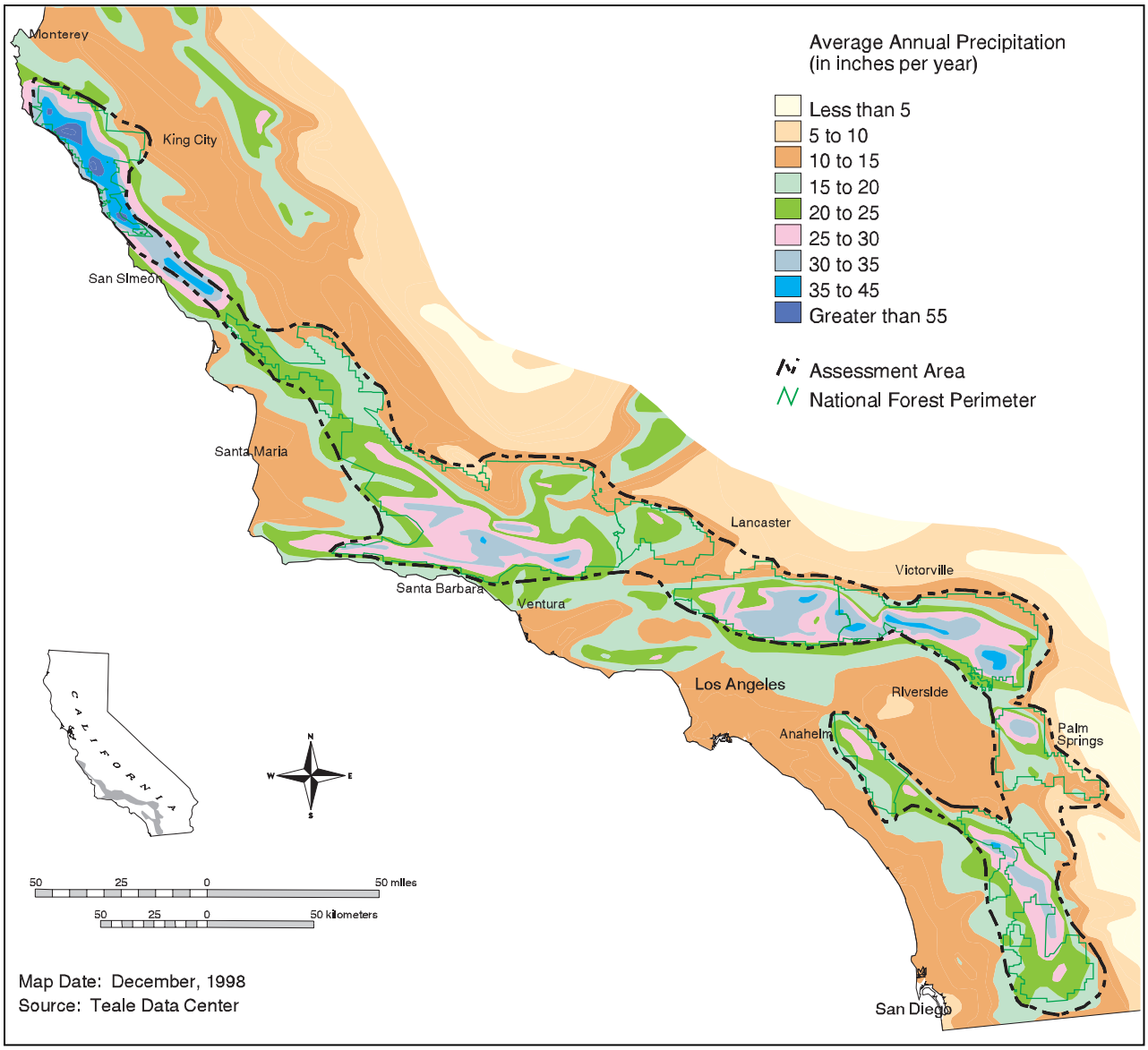
Vegetation maps for the four southern California national forests were developed by Janet Franklin and associates at San Diego State University. These maps use the CALVEG series-level classification system (USDA Forest Service 1981). In forest types, the maps also include labels for percent canopy cover, 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.

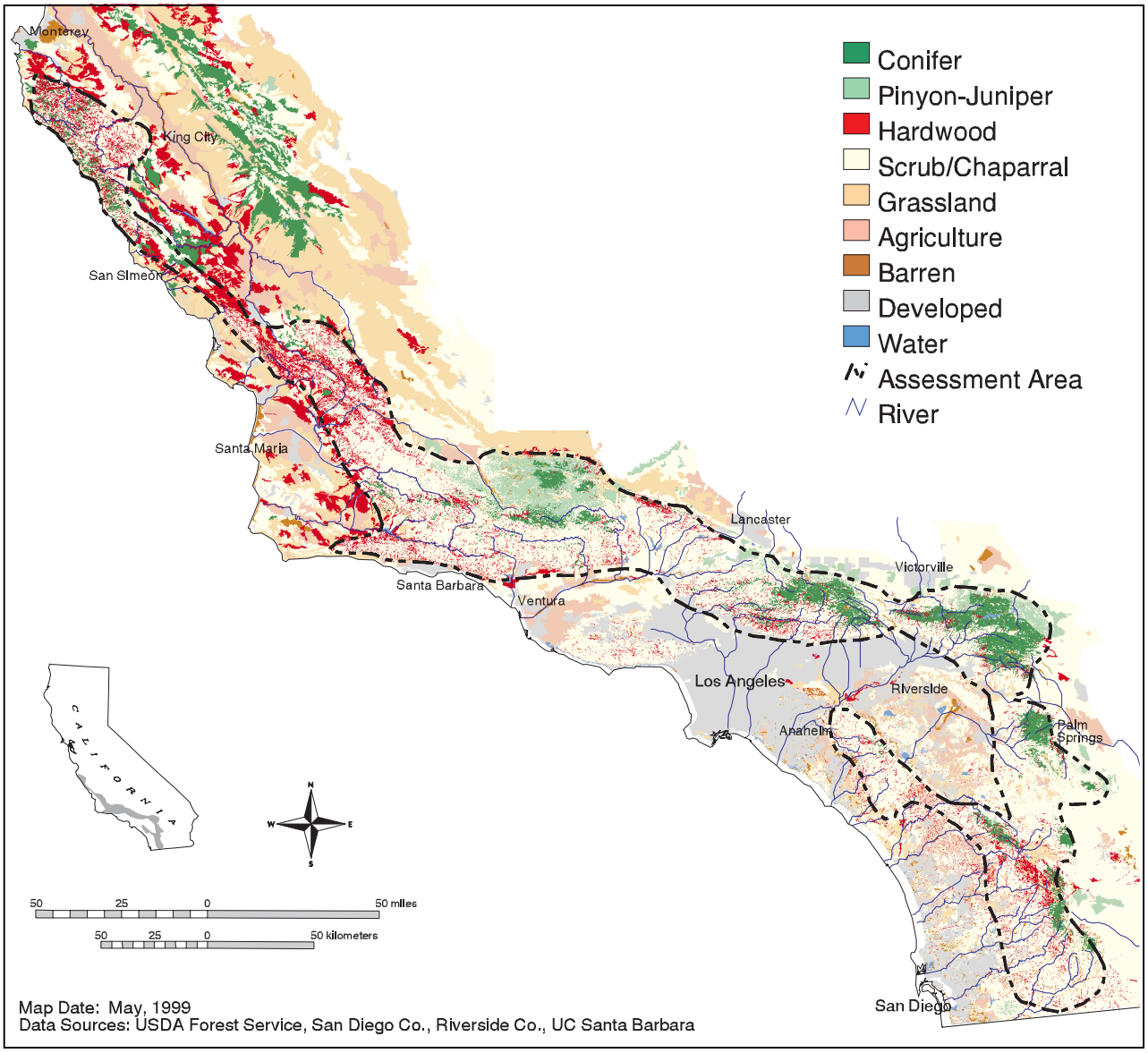
**Figure 1.6.** Average annual precipitation in southern California for the period from 1961 to 1990. Notice the strong influence that elevation (see fig. 1.3) has on precipitation. Latitude, steepness of terrain, and proximity to the ocean are also important factors.



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).