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Flora and Ecology of the Santa Monica Mountains

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Preface

The Santa Monica Mountains, with their rich flora and fauna, are a globally significant example of the diverse Mediterranean-climate ecosystem, designated as one of the world's biodiversity "hotspots." The threats to this biodiversity are great, including impending development, fragmentation, invasive species, increasing fire frequency, nitrogen deposition, altered hydrology, climate change, and the interacting and cascading effects of all of these factors. The 150,000-acre Santa Monica Mountains National Recreation Area, the nation’s largest urban park, provides crucial open space in one of the United States’ largest urban areas. In this network of city, county, state, federal, and private landholders, the conservation challenges are immense, while the opportunities for education and volunteerism provide hope.

These proceedings are the product of the Southern California Botanists’ one-day annual symposium held at California State University, Fullerton, on October 28, 2006. It provides a valuable cross-section of both baseline floristic and ecological information, and it is our hope that it will be an important reference for the region.

Denise A. Knapp

Acknowledgments

Thank you to Kerry Knudsen, who had the brilliant idea to have a regionally-themed symposium focusing on the Santa Monica Mountains in 2006, and made the initial contacts with the National Park Service, Santa Monica Mountains National Recreation Area. John Tiszler was instrumental in coordinating the speakers and authors for this symposium and proceedings. The Southern California Botanists Board of Directors (see next page for list) contributes substantial time planning and orchestrating the annual symposium, and California State University, Fullerton allows the use of their facilities annually. Thank you also to the Catalina Island Conservancy for allowing the editor to work on this proceedings, which provides valuable information for Catalina Island as well.
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SANTA MONICA MOUNTAINS: BIOGEOGRAPHY AND CULTURAL HISTORY

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ABSTRACT: The Santa Monica Mountains of southern California are a small but rugged anticlinal mountain range bordered on the south by the Pacific Ocean and extending 70 km from the Oxnard plain (Ventura County) in the west to the City of Los Angeles in the east. They are 5 to 21 km wide and crest at an average 450 to 600 m (948 m maximum) elevation. They experience a typical wet winter – dry summer Mediterranean-type climate with high year-to-year precipitation variability. Despite their location within the second largest population center in the nation, the Santa Monicas retain 80% native vegetation cover and are vegetationally very diverse, containing some of the best remaining chaparral and coastal sage scrub in coastal southern California. The gentle climate and biologic richness of the Santa Monica Mountains made them attractive to native Chumash and Gabrielino/Tongva peoples and their occupation is marked by over 1,000 archeological sites. Europeans also found the surrounding valleys and Los Angeles Basin attractive for settlement, and the explosive growth of the Los Angeles area in the last century threatens the ecological integrity of the Santa Monicas. In response to this threat the Santa Monica Mountains National Recreation Area (61,000) was created in 1978 and today approximately half the lands (30,000 ha) within it are protected by public and private parks and conservation agencies. Still, many threats to the integrity of the ecosystem remain. Some threats come from loss of habitat and connectivity due to development of private lands within the mountains. Others, such as the occurrence of overly frequent fires leading to vegetation type conversion, are exogenous, arising in the surrounding urbanized environment.

KEYWORDS: Chumash, climate, Gabrielino, geography, geology, land management history, native peoples, Santa Monica Mountains, conservation threats, Tongva, vegetation, wildlife

INTRODUCTION

The Santa Monica Mountains are a unique natural island within urbanized coastal southern California. They bisect the City of Los Angeles, separating downtown from the San Fernando Valley, and include the entire city of Malibu. It is estimated that 17 million people live within one hour’s drive of the range. Despite the extensive urban development surrounding and within the Santa Monica Mountains, they retain much of their natural character, with greater than 80% of the land cover containing native vegetation. The mountains contain some of our best remaining stands of coastal sage scrub and chaparral, as well as live oak woodlands, valley oak savanna, and coastal salt marsh (Figure 1). The high habitat diversity, coastal situation, and moderate Mediterranean climate were attractive to aboriginal peoples; their occupation is evidenced by over 1,000 identified archeological sites. These same characteristics were attractive to European
Figure 1a. Chaparral in Mugu State Park.  

Figure 1b. Typical coastal sage scrub.  

Figure 1c. Chaparral with oak riparian corridor. Note housing development in the distance.
ranchers and more recently to the movie industry. The Santa Monica Mountains serve as a backdrop or location for countless movies and television shows. The ecological and recreational values of the mountains have been widely recognized and much of the land is protected as county, state and federal parkland within the Santa Monica Mountains National Recreation Area. This paper presents an introduction to the biogeography of the Santa Monica Mountains, a summary of their cultural history, and a brief overview of preservation challenges.

**DISCUSSION**

The Santa Monica Mountains, together with the four northern Channel Islands, form the southwestern-most portion of a series of east-west trending mountains that make up the Transverse Ranges of Southern California. The Santa Monicas are a low range from 5 to 21 km wide, extending from the Oxnard plain approximately 70 km east to the Los Angeles River. They are bordered by the Pacific Ocean and the Los Angeles Basin on the south, and the San Fernando Valley and the Simi Hills on the north (Figure 2).

The Santa Monica Mountains are small but rugged, with elevations varying from sea level to 948 m at Sandstone Peak near the western end of the range. The crest of the range and the long ridges that extend southward toward the coast from this crest are generally 450-600 m in elevation. Streams that drain the south face of the range generally flow in deeply incised canyons, while the northern flank of the range is drained by short steep canyons that descend to the San Fernando and Conejo Valleys at about 300 m elevation. The only exception to this pattern of drainage is antecedent Malibu Creek, which originates in the Simi Hills to the north and cuts through the range to Santa Monica Bay in the south. Major streams flow year-round, at least at a subsurface level, but with greatly reduced volumes during the summer drought period. There are no natural lakes, but streams, springs, and seeps are common.

**Geology**

The geologic structure of the Santa Monica Mountains is that of a broad anticline, pushed upward and uplifted beginning about 3 million years ago in response to pressures from the interactions between the Pacific and North American Plates. The process of mountain uplifting, which continues today, has been accompanied by the formation of fault planes, the most notable of these being the Malibu Coast Fault that runs along the southern margin of the range.

The oldest rocks of the Santa Monica Mountains are slates exposed at the eastern end of the range above Pacific Palisades. These slates were originally formed as shales when mud was deposited on the floor of a shallow ocean during the Cretaceous period (144 to 65 mybp) and later metamorphosed into slate as plutonic granitic rock pushed up from the mantle. Approximately 25 to 10 million years ago a shallow ocean basin again covered the region, depositing thick beds of sandstones and shales. Major volcanic activity during this period led to basalt flows and breccias, particularly in the western half of the range where there are extensive extrusive volcanic formations.

Most of the summits along the crest of the Santa Monica Mountains are somewhat flattened, apparently remnants of a Cenozoic erosion surface reduced to low relief prior to the most recent uplift events (Dibblee 1982).

The Simi Hills (Figure 3) are geologically distinct, but closely related low mountains laying parallel and north of the Santa Monica Mountains, connecting to the Santa Monica Mountains proper through a series of hills west of Calabasas. They are generally considered part of the Santa
Figure 2. General land and topographic relief in the Santa Monica Mountains area.
Figure 3. The Simi Hills several months after the 2005 Topanga Fire.

Monica Mountains ecoregion and are included in the Santa Monica Mountains National Recreation Area. They form a northeast-trending ridge of approximately 24 km in length between the San Fernando Valley and the Oxnard Plain and separate the San Fernando Valley on the southeast from Simi Valley on the north. The Simi Hills are eroded from resistant, thick-bedded sandstone strata dipping north and have an average elevation of about 600 m over their length.

Climate

The Santa Monica Mountains, like all of southern California, have a Mediterranean-type climate characterized by mild, wet winters and hot, dry summers. During the summer, a marine layer of fog is common along the coast during the morning hours, but dissipates by early afternoon (Figure 4). Inland valleys may be fog-shrouded early in the morning, but as temperatures increase the fog dissipates until it crests the mountains and is vaporized or pushed out to sea. The coastal zone is classified as Mediterranean cool summer with fog in the Köppen system of climate classification, defined as areas with more than 30 days per year of dense fog. Inland of the coastal fog belt the climate is Mediterranean warm summer where the average temperature of the warmest month exceeds 22°C.

Figure 4. View of the Santa Monica Mountains with the marine fog layer that is common during the summer months.
While the mean annual precipitation at the base of the Santa Monica Mountains in west Los Angeles is about 440 mm, slightly higher than that in downtown Los Angeles, rainfall in wetter years around the base of the mountains is commonly 600-700 mm (Huffman 1998). Mean annual rainfall along the Malibu coast of the range is about 300 mm. Higher areas of the mountains receive about 625 mm in an average year, and received as much as 1,500 mm in the wet winter of 2004-05. On average, 86% of the Santa Monica Mountains’ rainfall occurs between November and March, with the majority (47%), concentrated in January and February, falling in large storms that last for several days. The dry season typically extends from May through October. Significant rainfall during the summer months of June, July and August is a rare event. Evaporation generally exceeds precipitation from April to November (Keeley 2000).

The most significant feature of the regional rainfall pattern in addition to its unusual seasonal distribution is its high degree of variability and unpredictability. Long periods may occur between storms in a single season, and enormous variation exists among total rainfall amounts between years. At the UCLA weather station, the lowest rainfall year (1990, 130 mm) is approximately one third the normal annual mean of 430 mm, while the highest rainfall year (1984, 1040 mm) is almost 250% of the normal annual mean. Multiple years of low rainfall and extended drought punctuated by moderate to extremely wet years are not uncommon. Additional variation in rainfall pattern occurs with respect to geographic location.

December through March are the coolest months and July through October the hottest months in the Santa Monica Mountains. Along the immediate coast both winter and summer temperature extremes are moderated, but as one moves inland to the interior canyons and valleys, temperatures become higher in summer and lower in winter. Mean monthly maximum summer temperatures can vary 10-20 °C between UCLA at the base of the mountains on the coastal side and Canoga Park on the inland valley side (Raven et al. 1986). Winter night temperatures average as much as 10°C colder four km inland from the immediate coast (Boorse et al. 1998). Coastal sites rarely freeze, while inland sites often experience freezing nights between December-February with lows down to –8°C (Boorse et al. 1998). The frequency and duration of freezing events in the Santa Monica Mountains have been shown to affect chaparral species’ distributions and plant dieback (Boorse et al. 1998, Langan et al. 1997).

Wind speeds vary in intensity and duration throughout the year within and adjacent to the Santa Monica Mountains. During summer days airflow is generally directed inland from the west, southwest, south and southeast. At night, airflow patterns reverse and travel toward the ocean. The Santa Monica Mountains periodically experience extreme foehn-type winds locally called Santa Ana winds. These winds result from a regional, large-scale weather pattern caused by the atmospheric pressure differential between a Great Basin high-pressure cell and a Pacific Coast trough of low pressure. Santa Ana winds average 30-50 km hr⁻¹ and maximum gusts over 160 km hr⁻¹ have been recorded. In the Santa Monica Mountains these winds are funneled through the north-south canyons and are therefore predominantly north or northeasterly winds. Relative humidity levels at the coast may be well below 10% under these conditions.

Santa Ana winds have been identified as the primary drivers of the wildfire regime in southern and central California shrublands (Moritz, 1997, Keeley and Fotheringham 2001). Although Santa Ana winds can occur in any month, they predominate from September to December. The major fires in the Santa Monica Mountains coincide with this peak of Santa Ana activity when vegetation is dry and temperatures high. A second small peak of Santa Ana wind activity occurs in March, but this is usually a time of cool temperatures and high moisture and does not create the severe fire conditions that occur during the fall Santa Ana winds.
Vegetation

Although the Santa Monica Mountains and Simi Hills are surrounded by a heavily urbanized environment, most of these ranges remain covered by natural or semi-natural vegetation with only about 13% of the area occupied by urban or suburban development (Figure 5). The distribution and composition of plant communities are determined mainly by the amount and seasonality of available water, temperature conditions, and light. These factors, in turn, are influenced by elevation, aspect, slope, soil type, proximity to the ocean, and fire history (Rundel and Gustafson 2005). The history of local human land use is also a significant factor. Extensive cattle ranching was carried out in many parts of the area in the 19th and early 20th centuries.

Several approaches to classifying plant assemblages in the Santa Monica Mountains have been published. Munz (1959) identified seven plant communities: coastal strand, coastal salt marsh, freshwater marsh, coastal sage scrub, chaparral, valley grassland, and southern oak woodland. Raven et al. (1986) in the Flora of the Santa Monica Mountains used much the same categories, adding riparian woodland and several wetland habitats.

More recently, Franklin (1997) developed a vegetation map of the Santa Monica Mountains that identified 12 communities (Figure 5), which are derived from 26 vegetation associations identified by the California Natural Diversity Database classification system (Holland 1986). The most recent classification, based on the Manual of California Vegetation (Sawyer and Keeler-Wolf 1995) and field sampling of over 3,900 stands of vegetation, defined 84 vegetation alliances or unique stands and 204 associations or phases (Keeler-Wolf et al. 2006, plus see this volume).

Shrublands

Chaparral is the major vegetation type in the Santa Monica Mountains and Simi Hills (>54% total vegetated area, based on Franklin 1997), generally occurring above 300 m on steep mountain slopes, but in some areas extending to lower elevations. Most of this is characterized as northern-mixed chaparral with Ceanothus species as dominants or co-dominants. Chamise and redshank (Adenostoma) chaparral occur only infrequently (< 3% total vegetated area). The second most common vegetation type is coastal sage scrub (~20% total vegetated area). It occurs on drier sites and lower elevations than chaparral, especially on coastal, south-facing slopes of the Santa Monica Mountains and on inland areas of the Simi Hills (Rundel 2007). Characteristic plants include black and purple sage (Salvia mellifera and S. leucophylla), California sagebrush (Artemisia californica), coast goldenbush (Isocoma menziesii) and ashy-leaf buckwheat (Eriogonum cinereum). The ubiquitous laurel sumac (Malosma laurina) is often emergent in this type, where it is able to extend its root systems deep into vertical strata layers to tap groundwater pools. The coastal sage scrub community, generally occurring on shallow soils and in recently eroded areas, plays an important role in soil stabilization.

One of the characteristic elements of chaparral and coastal sage vegetation of the Santa Monica Mountains, and an important contributor to their floristic diversity, is the abundant growth of a post-fire ephemeral flora that occurs in the first one to three years following fire. Annual herbs comprise more than three-fourths of the total post-fire species richness, areal cover, and biomass. Some of these annuals are fire-following specialists, which persist in inter-fire years only in the seed bank. Other species, while more abundant following fire, may persist in canopy gaps, on disturbed sites, or in xeric margins.
Figure 5. Vegetation and cover types of the Santa Monica Mountains and Simi Hills (Franklin 1997).
Woodlands
Coast live oak woodland (3% of total vegetated area), characterized by coast live oak (*Quercus agrifolia*), is found on more mesic sites on north slopes, in shaded ravines, canyon bottoms and along streams. Coast live oak woodland can vary from a mostly closed canopy to a more open canopy on drier sites, often with a rich understory of vines, herbaceous perennials and shrubs. Frequent associates include hollyleaf redberry (*Rhamnus ilicifolia*), California bay laurel (*Umbellularia californica*), coffeeberry (*Rhamnus californica*) and poison oak (*Toxicodendron diversilobum*). When coast live oak woodland occurs along stream courses in conjunction with riparian tree species it is considered to be riparian woodland. It also intergrades with northern mixed chaparral on north-facing slopes, while *Q. agrifolia* can form an oak savanna with scattered individuals in grassland. Live oaks are evergreen with deep taproots that can reach to the water table.

Riparian woodland (1.7% of total area) occurs along canyon and valley bottoms with perennial or intermittent streams in nutrient rich soils, or within the drainages of steep slopes. The riparian community has high plant species diversity (Rundel and Sturmer, 1998). Dominant species are coast live oak (*Quercus agrifolia*) and sycamore (*Platanus racemosa*) while associated or locally dominant species include arroyo willow (*Salix lasiopsis*), black willow (*Salix laevigata*), alder (*Alnus rhombifolia*), California black walnut (*Juglans californica*), Mexican elderberry (*Sambucus mexicana*), California bay laurel (*Umbellularia californica*) and mule fat (*Baccharis salicifolia*). Riparian woodland is a particularly important plant community because of its limited area, critical resources for animal populations, role in geomorphic stabilization, and its high biodiversity.

California walnut woodland with *Juglans californica* (0.2% of total area) is most commonly found on the north-facing slopes of the Santa Monica Mountains and in small stands in the Simi Hills on deep soils with high clay content (Quinn 1990). Walnut woodlands in the Santa Monica Mountains can occur with an annual grassland, native herbaceous, or coastal sage scrub understory, or intermixed with north slope chaparral and oak woodland. Springs or subsurface water availability are generally present in these sites.

Valley oak savanna, also called valley oak woodland (0.7% of total vegetated area), is typically a grassland savanna with widely spaced *Quercus lobata*. In the Santa Monica Mountains coast live oak (*Q. agrifolia*) can grow with valley oak on hillside areas. Tree density may increase along bottomland riparian corridors where valley oaks are an important component of the riparian woodland. Valley oaks, which reach their southernmost extension in the Santa Monica Mountains, are not especially drought tolerant and need deep soils with available soil moisture for growth (Meyer, 2001). Typically, valley oaks in this community cover less than 10% of the ground area, with annual grasslands dominating the matrix below. Characteristic grasses include widespread alien species such as wild oats (*Avena fatua*), ripgut brome (*Bromus diandrus*), and black mustard (*Brassica nigra*), as well as remnant stands of native purple needlegrass (*Nassella pulchra*). Native wildflowers include a diverse assemblage of geophytes, in particular mariposa lilies (*Calochortus catalinae*) and blue dicks (*Dichelostemma capitatum*).

Grasslands and Coastal Habitats
Valley grassland and non-native annual grassland (4% of total vegetated area) in the Santa Monica Mountains are dominated by oats (*Avena* spp.) and ripgut brome (*Bromus diandrus*). Within the non-native annual grasslands, isolated stands of native grasses exist consisting primarily of purple needle grass (*Nassella pulchra*) and, to a lesser extent, foothill needlegrass (*Nassella lepida*). Native forbs are infrequent within the annual grasslands. On burning, the
grasslands generally go to mustards (*Brassica nigra* and *Hirshfeldia incana*) for several seasons before returning to annual grassland. The mustard seedbank appears to be long-lived, persisting through 10 or more years without burning. Most of the larger annual grasslands in the Santa Monica Mountains and Simi Hills have a history of grazing and agricultural use.

**Salt Marsh**

Coastal salt marsh (0.3% of total area) occurs in estuaries where semi-enclosed coastal waters have a free or periodic connection with the open ocean. The major areas of this community are at Malibu Lagoon and Point Mugu lagoon. Because stream flow is so low in summer, these areas are lagoons rather than estuaries for much of the year. Plants in this community adapt to high concentrations of salt by either using succulence to allow storage of salts in vacuoles or having salt glands to excrete excess salts. Characteristic plants are pickleweed (*Salicornia spp.*), marsh jaumea (*Jaumea carnosa*), salt grass (*Distichlis spicata*), and sea blite (*Sueda californica*). From Santa Barbara to the border with Mexico, approximately 75-90% of the original salt marsh habitat is estimated to have been lost (Zedler 1982). The isolation, rarity, and small extent of coastal salt marsh habitat make this community especially important in the Santa Monica Mountains.

**Coastal Dunes, Terraces and Bluffs**

Coastal communities (0.5%) occur on sand along the immediate coast. Much of this community has been lost to development or recreational uses. The habitat is characterized by strong winds, salt spray, fog, intense solar radiation, drought conditions and an infertile, unstable substrate (sand). It extends from above the high tide zone landward in a narrow band along the southwestern edge of the mountains east of Point Mugu. Characteristic dune plants include sand verbena (*Abronia umbellata*), silver beachweed (*Ambrosia chamissonis*), saltbush (*Atriplex leucophylla*), beach morning glory (*Calystegia soldanella*) and the alien iceplant or hottentot fig (*Carpobrotus edulis*).

**Wildlife**

The Santa Monica Mountains and Simi Hills support an abundant diversity of wildlife, which is reflective of the diversity of the vegetation. More than 450 vertebrate species have been reported, including 50 mammal, 384 bird (113 breeding bird), and 36 reptile and amphibian species. The relatively intact wildlife populations of the mountains are especially impressive considering their proximity to one of the largest urban areas in the United States. The continued maintenance of wildlife populations in the Santa Monica Mountains is dependent on the ability of public and private land managers to ensure adequate habitat for the most sensitive species. As urban development within the mountains climbs up canyons, expands in pockets of low lying land, tops ridges, and encroaches on habitat adjacent to protected public land, it continues to remove and fragment habitat available to wildlife.

**Occupation by Native Peoples**

The Santa Monica Mountains have been at the center of complex human interactions for thousands of years. Archeological site density in the Santa Monica Mountains is very high, with more than 1,000 known archeological sites representing pre-contact and historic native occupations.

At the time of historic European contact, the Santa Monica Mountains were occupied by Native Americans of two tribal affiliations, the Chumash and Gabrielino/Tongva (King 2000). The
Chumash held much of the south-central California coast, including the northern Channel Islands, as well as inland portions of the Coast and Peninsular ranges. Archeological and linguistic data suggest that the Chumash culture may have evolved in place for more than 9,000 years. The western and central Santa Monica Mountains comprised the southernmost extent of Chumash settlement. The Chumash population at the time of contact is estimated to have been in the range of 15,000 to 20,000 people, perhaps 1,300 of whom resided in the Santa Monica Mountains region. Historical records document at least six coastal and 10 interior Chumash villages in the Santa Monica Mountains region. Village populations ranged from perhaps 15 to 400 individuals, and coastal villages were, on average, somewhat larger than those of the interior. Each village had associated resource extraction sites in its respective territory, often distinctive from their living areas.

At historic contact, the Chumash did not practice traditional agriculture, living rather as hunter-gatherers on the great diversity of plant, animal and insect life found in the region. Villages along the coast were particularly adept at the extraction of marine resources, including dozens of fish species, marine mammals, and a variety of molluscs. Terrestrial animals utilized included large mammals (deer and pronghorn), small mammals, reptiles and various birds. Plant foods assumed particular significance among the Chumash, with geophyte bulbs, roots of yucca, small seeds, acorns and other nuts, fruits, and greens being the chief staples. The Chumash had extensive knowledge of the seasonal availability of plant foods, and were able to harvest virtually year-round. Although not traditional agriculturalists, the Chumash engaged in a variety of resource management activities, of which fire was the most important. Intentional burning was conducted in order to spur the growth of desired plant species, facilitate hunting, reduce fuel loads, and for many other purposes. It appears, however, that the Chumash did not burn extensively in the Santa Monica Mountains and that most vegetation conversion around villages may have instead been a result of fuel gathering.

At European contact, the territory of the Gabrieleno/Tongva encompassed the Los Angeles Basin and portions of the adjacent mountain ranges and the southern Channel Islands, including the easternmost Santa Monica Mountains. The Gabrieleno/Tongva residing in the Santa Monica Mountains were members of a distinct Western Tongva group, whose territory also included the southern San Fernando Valley, southern Channel Islands, downtown Los Angeles and San Pedro. On the basis of archeological and other evidence, the Gabrieleno/Tongva appear to have arrived in the region between 2,500 and 3,000 years ago. Nine historic Western Tongva villages have been identified in the Santa Monica Mountains region. Most of these villages were located in the interior, and populations ranged from about 10 to 360 inhabitants. Subsistence practices among the Gabrieleno/Tongva were similar to those of the Chumash, with extensive utilization of both marine and terrestrial resources.

**Euro-American History**

*The Spanish Era*

Sporadic Spanish contact with the Santa Monica Mountains began in the 1500s with exploratory voyages along the Pacific coast. The first Euro-American accounts of the Santa Monica Mountains came from the explorations of the Spaniard Juan Cabrillo, who anchored in the small bay of Malibu Lagoon in October 1542, claimed the land for the King of Spain and named it "Pueblo de las Canoas" (Town of the Canoes), because of the many impressive Chumash canoes which came to his ships to greet him. Nevertheless, a sustained Spanish presence in the region
was not established until the late 1700s. Three Franciscan Missions—San Gabriel (founded in 1771), San Buenaventura (founded in 1782) and San Fernando (founded in 1797)—and the Los Angeles Pueblo (established in 1781) were the important economic and social centers in the region. With the mission era, agricultural lands were cleared and cattle and sheep ranching became a major land use.

In an effort to strengthen its hold on Alta California, Spain offered land grants to private citizens for economic development. These ranged from hundreds to many thousands of acres in size. Seventeen such grants were established within and adjacent to the Santa Monica Mountains, most of which served as cattle ranches (or ranchos). Local Native Americans were quick to relocate to ranchos and find employment as cowboys or vaqueros; abandonment of several native villages in the Santa Monica Mountains between 1770 and 1800 (prior to Mission recruitment) might be attributable to this phenomenon.

The Mexican Era
When Mexico won its independence from Spain in 1821, Mexican officials and land speculators pressed for distribution of mission property. During the 1820s and 1830s, the Mexican government passed legislation to both diminish the influence of the Franciscans and distribute mission lands to settlers, and by 1834 all of the mission lands were secularized and opened to occupation. In addition, the Mexican government continued the Spanish practice, begun decades earlier, of granting private individuals large tracts of land.

California Statehood
In 1850, California was admitted to the Union and Los Angeles began to take form as a city. Congress passed the California Land Act in 1851, establishing a three-person Land Claims Commission and a complex legal mechanism to determine the legitimacy of Hispanic land claims. The indefinite boundaries of the unsurveyed landholdings, the lack of documentation in the possession of the claimants, and both the expenses of the legal fees and the time necessary to establish title in the courts often delayed confirmation of landholdings, sometimes for decades. In addition, title to the former rancho concessions was frequently clouded by the host of American newcomers who, taking advantage of a process burdened with confusion and delay, simply settled on the land and were later looked upon favorably by the non-Hispanic courts.

By the 1870s, the demand for land in California prompted the subdivision of many of the larger landholdings, although cattle ranching continued. Since the latter decades of the 19th century, the rapid subdivision and re-subdivision of land, often punctuated by claims and counter-claims, has been an enduring characteristic of much of the California landscape, including pockets of the Santa Monica Mountains.

The rapid post-war expansion of Los Angeles brought increased recognition of the ecological and recreational value of the Santa Monica Mountains. Governments began to purchase parklands in the 1960’s and 1970’s and in 1978, in response to a grassroots movement, Congress established the Santa Monica Mountains National Recreation Area with the intent to preserve the area’s scenic, natural and historic setting.

Land Preservation
Today the boundary of the Recreation Area includes 61,000 hectares in the Santa Monica Mountains and Simi Hills. Approximately 30,000 hectares are protected as local, state and federal
parks, including Topanga, Malibu, Leo Carillo and Mugu State Parks, Ahmanson Ranch (Mountains Recreation and Conservation Authority), Cold Creek Canyon (Mountains Restoration Trust), Circle X Ranch, Zuma Canyon and Cheeseboro/Palo Comado Canyons (National Park Service). Although parkland continues to be acquired, it is intended that much of the Recreation Area remain private lands. This creates a complicated intermix of developed and natural areas within the mountains that, with the impinging pressures and environmental changes resulting from surrounding urbanization, present challenges for the protection and management of these valuable natural areas. Following is a brief discussion of some challenges both common to southern California and particular to the Santa Monica Mountains.

**Management Challenges**

The coastal and foothill regions of Southern California form a critical area within California contributing to the state’s designation as one of the select group of 25 global biodiversity hotspots. Whether one measures biodiversity in terms of numbers of plant and animal species present or by conservation significance as measured by numbers of designated rare and endangered species, coastal Southern California rates higher than any other part of California or the continental United States (Rundel 2002). It is here in Southern California that the influences of the Mediterranean-climate regime combine with a diverse topography and dynamic fire cycles to produce mosaics of a wide variety of habitat types including the chaparral, oak woodlands and savannas, coastal sage shrub, grasslands, riparian woodlands, wetlands, and coastal marshes found in the Santa Monica Mountains.

Both the spatial and temporal scales of habitat occurrence and dynamics have been critical factors in the evolution of our biodiversity. Remarkably, this biodiversity exists adjacent to the second largest urban center in the nation. As our urban core expands and suburban outlying areas are developed, enormous threats to biodiversity arise. Six of the ten counties in the continental United States with the largest numbers of threatened and endangered plant and animal species are in California, including San Diego, Los Angeles, San Bernardino, and Santa Barbara Counties (Rundel 2002).

Threats to biodiversity in the Santa Monica Mountains and all of California are real. We know of at least 21 animal species and 34 plant species that have become extinct in recent decades. Another 17 animal species once common in California have been extirpated from the state, although they survive elsewhere. These include charismatic species such as the California grizzly bear, our state animal which was once common in the Santa Monica Mountains, as well as the gray wolf. Nearly two-thirds of California’s native fish species are extinct, endangered or in significant decline.

Many parts of the Santa Monica Mountains exist as islands of natural habitat within an urban sea. The existence of this habitat and open space with dramatic views so close to (indeed, within) the Los Angeles metropolitan area makes the mountains especially desirable to many in the region who are seeking a less-urbanized lifestyle. In recent years development on private lands has proceeded rapidly despite regulatory efforts by local governments. This increased development and urban encroachment have become major threats to ecological viability across the region through their impact on habitat fragmentation and loss of connectivity. The impacts of habitat fragmentation on wildlife are many and varied and can profoundly affect the ability of remaining wildlands to support wildlife populations (Wilcox 1980, Shaffer 1981, Simberloff and Abele 1982).

Increased fire frequency associated with human activities can have a significant impact on vegetation structure. Although the plant communities of the Santa Monica Mountains are tolerant
of wildfire and resilient to a relatively wide variation in the fire return interval, chaparral and coastal sage scrub communities can be degraded by high fire frequencies with a short fire return interval (Keeley and Fotheringham 2003). Where fires are frequent, non-native herbaceous annual vegetation has been observed to increase and replace shrublands (Vogl 1977, Barro and Conard 1987, Haidinger and Keeley 1993, Beyers et al. 1994). This type conversion of shrubland to annual grassland has been widely observed throughout southern California (Keeley 1990, Keeler-Wolf 1995, Minnich and Dezzani 1998).

In human-dominated, fragmented landscapes, frequent fires near fragment edges may facilitate the invasion of edge-associated non-native plants and animals into natural areas. The openings and disturbed areas created after fires can accelerate invasions by disturbance-associated exotic plants, increase the entry of development-associated animal species into natural areas, and facilitate other types of human-caused habitat alteration due to the proliferation of social trails and off-road vehicle access routes (Sauvajot et al. 1998). This combination of frequent human-caused fires and disturbance-facilitated impact invasions along the urban-wildland interface may significantly alter the distribution and abundance of native wildlife in fragmented systems.

Large fires can also exacerbate the problems caused by habitat fragmentation. Fire can act as an extirpation mechanism, leading to the local disappearance of certain species from a burned area (Sauvajot 1995). In pristine systems, the long-term population impacts of such extinction events may be inconsequential because of the availability of nearby unburned habitat to serve as a recolonization source. However, if fire-induced extinctions occur in fragmented habitats, local populations may be eliminated entirely if the burn encompasses the entire habitat fragment. In addition, because local population sizes are already relatively small in habitat fragments, fire-associated mortality may actually push population levels below viability thresholds for some species. If the affected fragment is not close enough to recolonization sources, local extinctions can be permanent. Increased studies of metapopulation dynamics in the Santa Monica Mountains would provide important data for better understanding these impacts of habitat fragmentation.

**CONCLUSIONS**

The Santa Monica Mountains are a unique, biologically diverse natural preserve within the second most highly populated urban area in the nation. The Mountains also have a rich cultural heritage, beginning with their occupation by native peoples and extending to their present popularity as a filming location for the movie industry. The ecological, cultural and recreational values of the mountains have been widely recognized and, at the behest of the public, large areas as parkland have been protected by city, county, state and federal agencies and private organizations. These groups continue to acquire parkland or otherwise protect land through conservation and trails easements, with several large and ecologically significant additions made only within the last few years. However, much of the Santa Monica Mountains remain, and will remain, in private ownership while the area surrounding the mountains continues to develop and increase in population.

The internal ecological threats that may arise from development of private lands within the range and the exogenous threats that arise from the heavily populated areas surrounding the Santa Monica Mountains cannot be managed only through the acquisition of selected lands and administration of conservation easements. Many, if not most, of the decisions and actions that affect natural resource conservation in Santa Monica Mountains are made by private individuals and the many local government agencies that have jurisdiction around and within the mountains.
Effective programs for the management of natural ecosystems and protection of biodiversity in the Santa Monica Mountains must in the future rely not just on public park and conservation agencies, but on private/public partnerships as well. Proactive planning processes involving all of the stakeholders in the Santa Monicas will be the key to successful preservation and sustainability of our natural systems.

**LITERATURE CITED**


