Resource Description

2

Photos (clockwise): 1. Equestrian, San Gabriel River. NPS Photo. 2. Hiking, Puente Hills. NPS Photo. 3. Santa Fe Dam Recreation Area. NPS Photo. 4. Dried grasses and chaparral on a ridge in the San Gabriel Mountains. Photo © Gary Ferguson.

Chapter 2: Resource Description

Natural Resources

Climate

The Los Angeles region has a Mediterranean type climate associated with areas located between the 30th and 45th parallels of latitude and on western continental borders (Bailey 1966). These areas are affected by subtropical high pressure masses that create a drought environment during summer, but shrink in winter, allowing storms to enter along the coast. Only two percent of the earth's surface has this type of climate. Other locations with this climate include areas in southern Europe and North Africa on the Mediterranean Sea, Chile, South Africa, and Australia. The climate is highly affected by marine influences. Marine air keeps the coast cool in the summer and prevents it from getting very cold in the winter (Miller and Hyslop 1983).

At times, offshore winds from the east influence the climate. Between September and March, a high pressure system over the Great Basin, combined with a low pressure system to the southwest, creates warm, dry winds that circulate through the region. Known as the Santa Ana winds, these winds have a significant impact on the local climate. After the long dry summers, the Santa Ana winds contribute to the fire regime, which begins in the summer season and continues until the wet winter ensues.

The mountains and coastal ranges block the moist sea air, creating an arid, desert climate north of the San Gabriel Mountains. Since the mountain ranges and hills completely surround the valleys, temperature inversions create conditions where smog stays in the environment. The mountains and hills further this condition by preventing horizontal air movements. The San Gabriel Valley, with mountains to the north and hills to the south, is particularly impacted by smog (Miller and Hyslop 1983).

MICROCLIMATES

Although the Los Angeles region is known for its year-round mild climate, there are many different microclimates in the valleys, mountains, hills, and coastal areas of the study area. Average rainfall and temperature varies significantly throughout the study area based on the local microclimate. For example, average annual precipitation is 32.9 inches for the San Gabriel Mountains, 15.5 inches for the Los Angeles basin, and 7.8 inches for the Antelope Valley (LADPW 2006c). Within the study area, there are seven defined microclimates.

Semi-marine Climatic Zone

Areas south of the Puente-Chino Hills are under the influences of sea breezes from the coast. Frost is rare and summers are mild.

Air Drainage Thermal Climatic Zone

The Puente-Chino Hills are in this climate zone where summer temperatures are warmer than in the semi-marine climate zone. The topography of the hills drains cold air on winter nights, protecting this area from frost.

Valley Margin Climate

The high ground at the base of the surrounding hills and mountains of the San Gabriel Valley are located far enough from the ocean that they experience hot summer days while nights remain relatively cool.

Valley Floor Climate

On the San Gabriel Valley floor, summer days are hot and sunny and nights are relatively cool. In winter, the valley floor is subject to frost as cool air tends to collect on the valley floors.

Transitional Mountain Climate

The southern face of the San Gabriel Mountains is a transition zone between the valley margins and alpine climates. As elevation increases, precipitation increases and temperatures decrease.

Alpine Climate

Above 4,000 feet, the alpine environment is characterized by distinct seasonal differences in temperature and features the highest precipitation in the region. Winters are very cold and summer temperatures are still relatively high.

High Desert

At the northern base of the San Gabriel Mountains, the high desert climate of the Antelope Valley is characterized by less than ten inches of rainfall a year. Summers are extremely hot and winters are unusually cold (Miller and Hyslop 1983).

Topography

SAN GABRIEL MOUNTAINS

The San Gabriel Mountains are part of the Transverse Ranges geomorphic province which includes geologic structures along the southern California coastline that lie east-west or "transverse to" the prevailing northwest-trending character of the west coast. Additional mountain ranges within the Transverse Range province include the Santa Ynez Mountains, the Santa Monica Mountains, and the San Bernardino Mountains. The northern extent of the study area follows the San Andreas fault, which also serves as the boundary between the Transverse Ranges and the Mojave Desert geomorphic province (See Map: Topography).

The San Gabriel Mountains are about 50 miles long and 15 miles wide. With the exception of a small portion in San Bernardino County, most of the mountain range is within the study area. The San Gabriel Mountains are some of the highest and most rugged of all the mountains in the Transverse Ranges. The highest peak, located in the eastern portion of the mountains, is Mt. San Antonio. Also known as "Mt. Baldy" or "Old Baldy," this peak reaches a height of 10,064 feet. Mountains on the western end of the range are lower in elevation, around 4,000 to 6,000 feet in height.

The steep, high relief of the San Gabriel Mountains forms the dramatic mountainous backdrop of the Los Angeles basin. The San Gabriel Mountains rise quickly from the foothills; slopes are as steep as 65-70%. This can be attributed to the fact that the San Gabriel Mountains are a young mountain range growing at a rapid rate. They are considered one of the fastest growing mountain ranges in the world, rising as much as 2 inches per year (LADPW 2006b).

The San Gabriel Mountains and San Bernardino Mountains form the divide between the Pacific Ocean drainage area and rivers that drain to the Mojave Desert. Most of the mountains drain to the Pacific Ocean through the Santa Clara, Los Angeles, San Gabriel, and Santa Ana Rivers. The northeastern areas drain to the Mojave Desert.

LOS ANGELES BASIN

The mountains of the Transverse and Peninsular Ranges surround the Los Angeles basin, the low area that stretches south of the San Gabriel Mountains to the coast. The Los Angeles basin is a large flood plain and alluvial fan which lies at the northern extent of the Peninsular Ranges geomorphic province. The Puente-Chino Hills form an east-west chain that cuts through the Los Angeles basin extending from the Chino Hills west to Elysian Park in Los Angeles. This range separates the San Gabriel Valley and from the southern coastal plain of the basin that stretches west to the Pacific Ocean. Within the study area, the Puente-Chino Hills reach 1,388 feet at Workman Hill north of Whittier. The San Jose Hills, which lie north of the Puente-Chino Hills, are a smaller range that trends southwest. Buzzard Peak (1375 feet) is the highpoint of the San Jose Hills. Whittier Narrows is a natural gap between the Puente and Montebello Hills where the San Gabriel and Rio Hondo Rivers converge.

SOLEDAD BASIN/ SANTA CLARITA VALLEY

The Soledad basin lies at the northwestern base of the San Gabriel Mountains. On the north it is defined by the Sierra Pelona Range. The San Andreas fault and the San Gabriel fault bound the basin on its northeast and southwest borders. The upper Santa Clara River and its headwaters drain from both the San Gabriel Mountains and the Sierra Pelona Range into the Soledad basin and Santa Clarita Valley.

ANTELOPE VALLEY/MOJAVE DESERT

North of the San Gabriel Mountains lies the Antelope Valley, high desert terrain in the southernmost extent of the Mojave Desert. The Antelope Valley is comprised of a great alluvial fan which has been created by years of deposition from rivers in the San Gabriel Mountains. This area's topography is also characterized by the San Andreas rift zone which includes a series of northwest-trending trough-like valleys and bordered by linear ridges (Mattison and Barrows 2003). The California Aqueduct traverses the northernmost point of the study area where it crosses through the San Andreas rift zone.

South of the fault lies Lake Palmdale, a natural sag pond that was later modified to serve as a reservoir (Mattison and Barrows 2003). Big Rock, Little Rock, and Mescal creeks drain from the San Gabriel Mountains into the Antelope Valley and the Mojave Desert.

Geologic Resources

The assemblage of rocks in the study area is quite diverse with the San Gabriel Mountains featuring some of the oldest rocks in California. The region is experiencing active mountain-building and the San Gabriel Mountains are some of the fastest growing mountains in the world. This is contrasted with the Los Angeles basin which consists primarily of recent alluvium deposited across the basin by the series of


Topography
San Gabriel Watershed and Mountains Special Resource Study
National Park Service
U.S. Department of the Interior
Sierra Pelona Mountains
Antelope Valley/Mojave Desert
Soledad Basin
Palmdale
Acton
Santa Clarita
San Gabriel Mountains
Verdugo Mountains
San Fernando Valley
Santa Monica Mountains
Pasadena
Azusa
San Gabriel
San Gabriel Valley
Claremont
Pomona
Los Angeles
Santa Monica
San Jose Hills
Puente Hills
Chino Hills
Santa Fe Springs
Coastal Plain
Coyote Hills
Anaheim
Long Beach
Santa Monica Bay
Pacific Ocean
Elevation
Sea level or below
0 - 100 ft
100 - 200 ft
200 - 300 ft
300 - 400 ft
400 - 500 ft
500 - 600 ft
600 - 700 ft
700 - 800 ft
800 - 900 ft
900 - 1,000 ft
1,000 - 1,500 ft
1,500 - 2,000 ft
2,000 - 2,500 ft
2,500 - 3,000 ft
3,000 - 3,500 ft
3,500 - 4,000 ft
4,000 - 5,000 ft
5,000 - 10,000 ft
Study Area
Rivers and Creeks
0 1.5 3 6
Miles
National Park Service, Pacific West Region
Updated 9/2007
Source: USGS 30 meter digital elevation model
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rivers that run from the San Gabriel Mountains to the Pacific Ocean. This alluvium, which is thousands of feet deep in many locations, is a repository for petroleum resources. Hill formations on the Los Angeles basin are also relatively young and rich in petroleum.

The following section describes the geologic history of the region, rock formations, faults, and modern geological processes such as erosion, landslides, and earthquakes.

GEOLOGIC HISTORY

The geologic history of the San Gabriel Mountains and the Los Angeles basin involves vertical and lateral movements of great magnitude. The San Gabriel Mountains are a remarkable range that provides a window deep into the ancient crust of the earth and a key for understanding the evolution of the San Andreas fault in southern California. These movements are largely a result of plate tectonics. The San Andreas fault is the location where the Pacific Plate meets the North American Plate, also known as a transform plate boundary. When these plates collide or converge, they create geologic phenomena such as earthquakes, volcanic eruptions, and tsunamis. In addition to plate tectonics, the region has experienced geological changes from erosion, deposition, and volcanic activity (USGS 2006).

The following section provides an overview of the area's geologic history according to eras of the geologic time scale developed by the Geological Society of America.

Precambrian History (3800 – 543 million years ago)

The oldest rocks in California are associated with the early to middle eras of the Proterozoic age (2500 to 543 million years ago). These ancient rocks have been thrust to the surface areas of the San Gabriel Mountains by great periods of mountain-building. Although these rocks are not as old as the 3.6 billion-year old Archean rocks of the Lake Superior region, they do form part of the Precambrian craton generally found in the core of the North American continent (Norris and Webb 1990, Oakeshott 1971, Schoenherr 1992).

Paleozoic History (543-248 million years ago)

During the Paleozoic era, the Mojave region formed the continental margin. The lands that would one day form the San Gabriel Mountains and the Los Angeles basin were covered by the ocean. During this time, the sea level fluctuated across the Mojave region. Evidence of marine life is preserved in rocks of the eastern Mojave Desert (USGS 2006).

Mesozoic History (248-65 million years ago)

The great mountain systems of California began to form during the Mesozoic era when the Pacific Plate dove under the North American Plate, a process known as subduction. This rising caused a spreading of the Pacific Ocean floor which, in turn, pushed the Pacific Plate into the North American plate. This action also formed a series of volcanoes along the continental margin. The magma that intruded into the North American plate formed what is known as a batholith (a deep rock mass). This batholith forms the base of the southern Sierra Nevada, the Mojave region, and portions of the Peninsular Ranges (Schoenherr 1992).

Cenozoic History (65 million years ago to present)

The Cenozoic era brought long periods of erosion and sedimentation and the evolution of the San Andreas transform fault system. During the early Tertiary period (65 million years ago to approximately 1.8 million years ago), subduction of the Pacific Plate under the North American Plate continued and the southern California region experienced great uplifts and erosion.

Paleogene-Neogene Epochs (65 to 23 million years ago). During this early period of the Cenozoic era, the San Gabriel Mountains and Los Angeles basin lie beneath swampy sea-marshes and lagoons receiving sediment from the ancestral Nevadan mountains (Los Angeles Almanac 2005).

Paleocene-Eocene-Oligocene Epochs (34 to 24 million years ago). Uplift and erosion during this time period formed a landscape of rolling lowlands with a few mountains. West of the mountains were shallow embayments. Rivers and streams carried down sediments from the mountains depositing them on the continental margin and in offshore basins.

Micocene Epoch. During the early Miocene epoch, *(24 to 5 million years ago)* modern coastal California began to emerge. Seas spread more and more widely over the western Transverse Ranges and a deep trough developed in the Los Angeles basin and Channel Islands. About 16 million years ago, the San Gabriel Mountains began to elevate (McCulloh, Beyer, and Morin 2001; Oakeshott 1971; Schoenherr 1992).

The middle Miocene was a time of great volcanism in the Transverse Ranges. Some of the thickest rocks are associated with this epoch. The Glendora volcanics occur along the southern front of the San Gabriel Mountains (Oakeshott 1971). Paleomagnetic data in the volcanic rocks of this age found in the San Gabriel Mountains, Santa Monica Mountains, and Channel islands indicate that these features rotated about 90 degrees clockwise (Schoenherr 1992). This rotation, caused by the collision of the North American and Pacific plates, began about 20 million years ago.

Pliocene Epoch. During the Pliocene epoch *(5 - 1.8 million years ago)*, the Los Angeles basin subsided at an accelerated rate. As the Los Angeles basin continued sinking, sediments were deposited in as much as 6,000 feet of water. By the end of the epoch, more than 10,000 feet of sediment were deposited in the basin (Norris and Webb 1990).

Pleistocene Epoch. In the early Pleistocene epoch *(1.8 million - 8,000 years ago)*, the central Los Angeles basin continued to receive marine deposits as high sea-levels and inland bays covered the coastal plains and lowlands of southern California (Norris and Webb 1990).

By the middle Pleistocene the shoreline of the basin sea probably extended to the southern margin of the Santa Monica chain and along the Whittier fault zone (Norris and Webb 1990). This period also saw sea level rises associated with the melting of polar ice caps from an ice age that occurred 20,000 years ago, flooding the Los Angeles basin (Schoenherr 1992). The Los Angeles basin experienced more subsidence. However, the surrounding mountain ranges underwent considerable uplift. Dramatic uplifting continues in the region today (Norris and Webb 1990). The rapid uplift of the mountains caused erosion and created the dramatically steep slopes of the San Gabriel Mountains.

The thick marine sediments of the Los Angeles basin that were deposited during the Pliocene and Pleistocene epochs formed vast deposits of fossil fuels. The Los Angeles basin is California's most prolific oil producing district in proportion to its size (Yerkes, McCulloh, Schoellhamer and Vedder 1965; Norris and Webb 1990).

The modern rivers of the region also developed during the Pleistocene epoch. Major rivers of the Los Angeles basin predate the Puente-Chino and Repetto Hills. These hills are so young, geologically speaking, that they literally formed around the rivers. This is evident in the series of gaps found in the Los Angeles basin hill systems. Whittier Narrows is an excellent example of this kind of water gap. As the young Puente-Chino Hills began to rise, the smaller creeks in the basin which had drained to the ocean changed course and some became tributaries of the San Gabriel River. Because of the force of the San Gabriel River channel itself, the hills rose around the river forming Whittier Narrows (Sharp 1975). By the end of this time, the shoreline recedes to approximately where it is today.

Holocene Epoch. *(8,000 years ago to present.* Uplift of the mountains and deposition of alluvium continues to shape the landscape (USGS 2006).

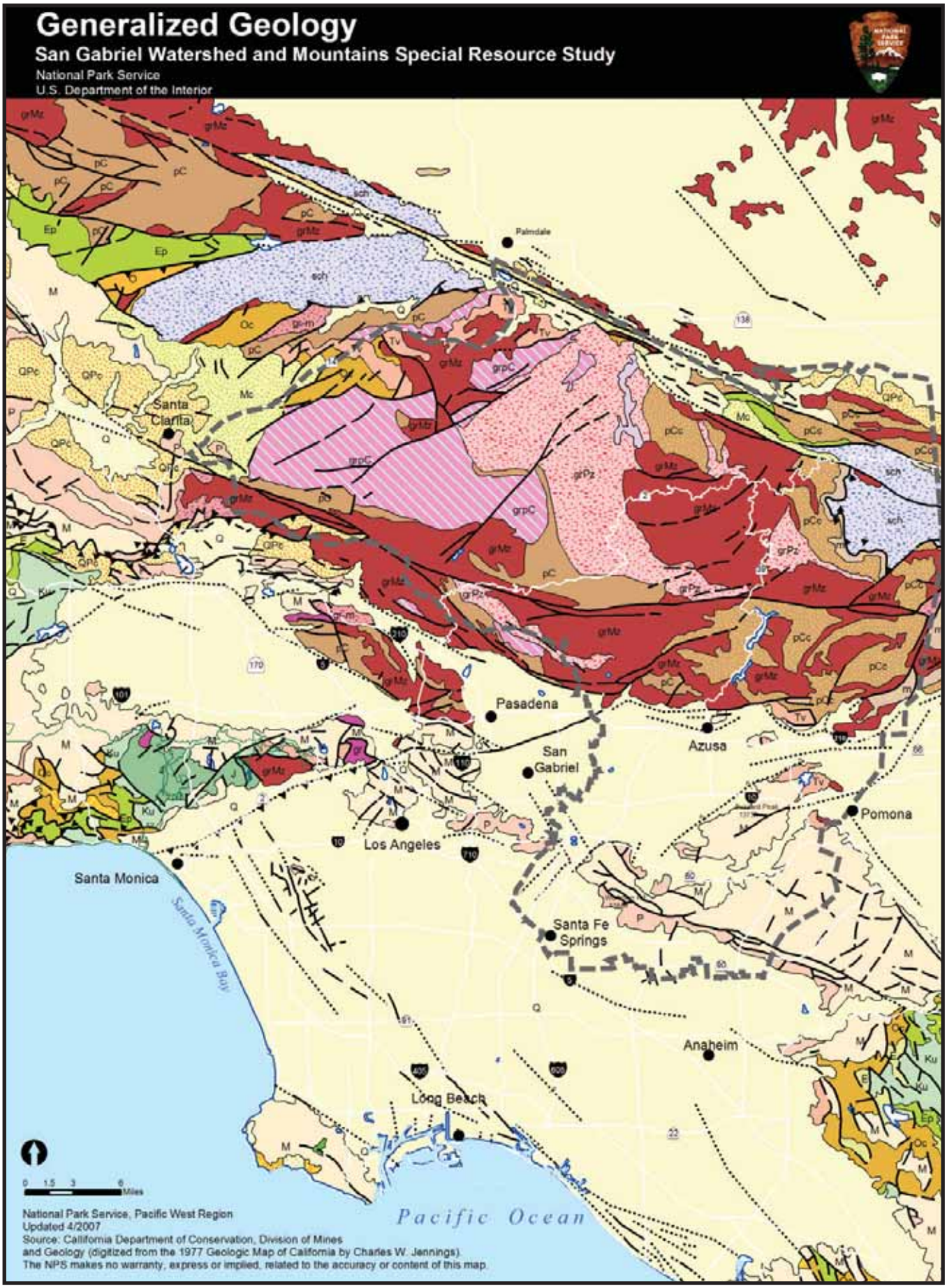
ROCK FORMATIONS

Rock formations in the study area, particularly in the San Gabriel Mountains, are quite diverse in age and composition. The following section highlights some of the major geologic formations and features of the study area.

The San Gabriel Mountains rock formations range from Precambrian igneous and metamorphic rocks to recent alluvium deposited by streams and rivers (see Map: Generalized Geology). Bedrock units in the San Gabriel Mountains are comprised primarily of crystalline basement rocks which range in age from the Precambrian to Mesozoic eras. Cenozoic beds are located only along the range's margins.

A significant geologic structure, the Vincent thrust, separates two distinct sets of crystalline basement rocks in the San Gabriel Mountains. During the

Mt. Lowe Pluton Unit with monzogranite or mylonitic dike. NPS photo.


Generalized Geology
San Gabriel Watershed and Mountains Special Resource Study
National Park Service
U.S. Department of the Interior
Palmdale
Santa Clarita
Pasadena
Azusa
San Gabriel
Pomona
Los Angeles
Santa Monica
Santa Monica Bay
Santa Fe Springs
Anaheim
Long Beach
Pacific Ocean
0 1.5 3 6 Miles
National Park Service, Pacific West Region
Updated 4/2007
Source: California Department of Conservation, Division of Mines and Geology (digitized from the 1977 Geologic Map of California by Charles W. Jennings).
The NPS makes no warranty, express or implied, related to the accuracy or content of this map.

Geology Legend

Cenozoic Era (65 million years ago to present)

- Qs - Extensive marine and nonmarine sand deposits
- Qls - Selected large landslides - early to late Quarternary
- Qrv - Holocene volcanic flow rocks
- Q - Pleistocene-Holocene alluvium
- Qg - Pleistocene-Holocene glacial till and moraines
- Qv - Quarternary volcanic flows
- P - Pliocene sandstone, siltstone, shale and conglomerate
- QPc - Pliocene and/or Pleistocene sandstone, shale, and gravel deposits
- M - Sandstone, shale, conglomerate, and breccia
- Mc - Miocene sandstone, shale, conglomerate, and fanglomerate
- Tc - Undivided tertiary sandstone, shale conglomerate, breccia, ancient lake deposits
- Tv - Tertiary volcanic flow rocks
- Tvp - Tertiary pyroclastic and volcanic mudflow deposits
- O - Oligocene sandstone, shale and conglomerate
- Oc - Oligocene sandstone, shale and conglomerate
- E - Eocene shale, sandstone, conglomerate, minor limestone
- Ti - Tertiary intrusive rocks; mostly shallow
- grCz - Cenozoic (tertiary) granitic rocks
- Ep - Paleocene sandstone, shale and conglomerate

Mesozoic Era (248 to 65 million years ago)

- Ku - Upper Cretaceous sandstone, shale, and conglomerate
- Kl - Lower Cretaceous sandstone, shale, and conglomerate
- Mzv - Undivided Mesozoic volcanic and metavolcanic rocks
- grMz - Mesozoic granite, quartz, monozonite, granodiorite and quartz diorite
- J - Jurassic shale, sandstone, m conglomerate, chert, slate, limestone; pyroclastic rocks
- KJf - Franciscan complex: Cretaceous and Jurassic sandstone w/ shale, chert, limestone, conglomerate
- um - Ultramafic rocks, mostly serpentine
- Tr - Triassic shale, conglomerate, limestone, dolomite, sandstone,slate
- K - Undivided Cretaceous sandstone, shale, and conglomerate
- gr-m - Granitic and metamorphic rocks, mostly gneiss. Mesozoic to Precambrian.
- gb - Gabbro and dark dioritic rocks, chiefly Mesozoic

Paleozoic Era (544 to 248 million years ago)

- Pm - Permian shale, conglomerate, limestone, dolomite, chert, hornfels
- sch - Schists of various types; mostly Paleozoic or Mesozoic age; some Precambrian
- m - Undivided pre-Cenozoic metasedimentary and metavolcanic rocks
- mv - Undivided pre-Cenozoic metavolcanic rocks
- gr - Undated granitic rocks
- C - Carboniferous marine sedimentary rocks
- ls - Limestone, dolomite, and marble whose age is uncertain but probably Paleozoic or Mesozoic
- D - Devonian marine sedimentary rocks
- Pz - Undivided Paleozoic metasedimentary rocks
- Pzv - Undivided Paleozoic metavolcanic rocks
- grPz - Paleozoic and Permo-Triassic granitic rocks
- Ca - Cambrian marine sedimentary rocks

Precambrian Era (4500 to 544 million years ago)

- pC - Conglomerate, shale, sandstone, limestone
- pCc - Complex of Precambrian igneous and metamorphic rocks
- grpC - Precambrian granite, syenite, anorthosite, and gabbroic rocks in the San Gabriel Mountains

- Tributaries
- Major Tributaries
- NPS Study Area
- Santa Monica Mountains NRA

late Cretaceous period (99 to 65 million years ago), the Vincent thrust fault brought upper and lower-plate masses together. This occurred on a regional scale; however, the event is best-exposed and most evident in the San Gabriel Mountains. Basement rocks of the Western San Gabriel Mountains consist primarily of rocks associated with the upper plate of the Vincent thrust while the eastern San Gabriel Mountains basement rocks are associated with the lower plate. Intruded throughout the San Gabriel Mountains are Mesozoic granitic rocks which make up nearly half of the range's basement rocks. Gneiss is the most widespread metamorphic rock in the San Gabriel Mountains (Ehlig 1982).

Western San Gabriel Mountains (including Soledad Basin)

Basement rocks exposed in the western San Gabriel Mountains, the upper-plate rocks of the Vincent thrust, include Mendenhall gneiss, augen gneiss, and the anorthosite-syenite-gabbro complex. Augen gneiss in the western San Gabriel Mountains have been dated as the oldest rocks in the Transverse Ranges (1.7 billion years). Triassic granitic rocks associated with the Mount Lowe plutonic suite are also exposed here (Dibblee 1982; Norris and Webb 1990). The anorthosite complex includes an anorthosite pluton, syenite, and mafic rocks of a Proterozoic age. This complex is rare, particularly in a relatively young geological landscape (Dibblee 1982).

Soledad basin contains various tertiary rock units. The marine Martinez formation of Paleocene age is the oldest sedimentary unit in the region. This formation is overlaid by the Oligocene Vasquez formation of andesite volcanic rocks, non-marine red beds, sedimentary breccia, claystone, mudstone, and limestone. The Vasquez formation is spectacularly displayed at Vasquez Rocks County Park just north of the study area (Weigand 1982).

Overlaying the Vasquez formation is the Miocene Tick Canyon formation, which is comprised of conglomerate sandstone and siltstone of fluvial origin (Oakeshott1971).

The most widespread formation in the Soledad basin is the Mint Canyon formation. These distinctive reddish beds of arkosic and conglomerate sandstone formed from silt deposits in an ancient Miocene lake. A considerable number of fossils have been identified in the Mint Canyon formation. The Miocene Castaic formation contains shallow marine sandstone and shale. This formation is distinctive as it contains about 100 species of fossils, mostly mollusks that are commonly associated with the Miocene epoch (Stanton 1966).

Younger tertiary formations include the Pliocene Towsley formation, which consists of interbedded marine siltstone, mudstone and conglomerate, and the non-marine Plio-Pleistocene Saugus formation, which contains arkosic sandstone, sandy conglomerate, and siltstone. The Pleistocene Pacoima formation contains non-marine silty sandstone and pebble boulder conglomerate (Wilson and Haydon 1998).

In the southwest corner of the mountains, the Tujunga Terrane, named for rocks exposed in lower Tujunga Canyon, contains basement rocks such as gneisses, late quartz diorite, and granodiorite-quartz, as well as metasedimentary rocks associated with the pre-Triassic Placerita formation.

Central San Gabriel Mountains

A main feature of the central San Gabriel Mountains is the Triassic Mount Lowe plutonic suite (also known as Lowe Granodiorite or the Lowe Igneous Pluton). This large pluton extends from upper Soledad basin to Little Rock Canyon. Isolated remnants are also found near Crystal Lake (Dibblee 1982). The Mount Lowe plutonic suite consists of four zones that include hornblende, potassium feldspar, garnet, and biotite (Joseph, Criscione, Davis, and Ehlig 1982).

A diversity of rock types occur along the active San Andreas fault zone. In the Little Rock Creek area, the non-marine Pliocene-Miocene Anaverde formation is exposed in terrain between the Little Rock fault and the San Andreas fault. The oldest rocks north of the San Andreas fault zone consist of Holcomb quartz monzonite that is exposed in the ridges of Little Rock fault and along the California Aqueduct west of Little Rock Wash.

Quaternary formations along the San Andreas fault zone include the Juniper Hills formation, crushed pebbly sandstone, and the Harold formation with its fine-grained, silty to sandy, moderately well-stratified fluvial, alluvial fan, and playa deposits.

Eastern San Gabriel Mountains

Most of the northeastern San Gabriel Mountains are characterized by lower plate rocks of the Vincent thrust. These include the Paleozoic or Mesozoic metamorphosed sedimentary and volcanic rocks known as Pelona schist. Two distinct blocks of the Pelona schist are separated by the Punchbowl strand of the San Andreas fault, the Blue Ridge block, and the Lytle Creek block. Pelona schist is overlain by Mylonitic metamorphic rocks of the Vincent thrust fault zone. This structure is well-exposed in eastern San Gabriel Mountains just

Photos (top to bottom): 1. Glendora Volcanics, Central San Gabriel Mtns 2. Augen gneiss boulder, Western San Gabriel Mnts 3. Anorthosite, Angeles Crest Highway, Western San Gabriel Mnts . NPS Photos.

south of the Punchbowl fault (Morton and Miller 2003 Dibblee 1982).

Between the Punchbowl and San Andreas faults are the tertiary Punchbowl and San Francisquito formations. The San Francisquito formation consists of marine sedimentary rock of Paleocene age. It is composed of shale in its upper part and sandstone in its lower part (Dibblee 1982). The lower Pliocene/upper Miocene Punchbowl formation, which overlays the San Francisquito formation, forms striking exposures known as the "Devil's Punchbowl" (Morton and Miller 2003). The scenic Devil's Punchbowl consists of magnificently exposed ridges and ravines etched into steeply tilted and folded sandstone. Movement along the San Andreas and Punchbowl faults down-dropped the Devil's Punchbowl formation into areas of older crystalline rocks.

Basement rocks of the southeastern San Gabriel Mountains include Mesozoic quartz diorite and monzonite and quartz diorite mylonite (Dibblee 1982). Also present in this area are Proterozoic garnet-pyroxene-bearing quartz, feldspathic gneiss, marble and calc-silicate rocks, Mesozoic, and Cretaceous granitic rocks.

The Glendora volcanics are exposed in areas along the southwestern front of the San Gabriel Mountains. Primarily comprised of rhyolite and basalt, flow rock and volcanic breccia and tuff, these volcanic rocks are the only Tertiary rocks in the San Gabriel Mountains on the south side of the range. The Glendora volcanics have been correlated with the El Modeno volcanics exposed on the northwest end of the Santa Ana Mountains (Weigand 1982).

Surficial alluvium of varying ages can be found overlaying basement and subjacent rocks in creek beds and valleys throughout the San Gabriel Mountains. Broad alluvial fans are prominent along the flanks of the San Gabriel Mountains. Many of the foothill communities south of the San Gabriel Mountains are located on these alluvial fans.

Los Angeles Basin

The Los Angeles basin is separated from the San Gabriel Mountains by the Sierra Madre fault zone. Basement rocks of the Los Angeles basin portion of the study area include Glendora volcanics and the Miocene Puente formation, both of which are exposed in the Puente and San Jose Hills. The Puente formation, primarily composed of sandstone, siltstone, and shale, is one of the most important oil-producing units of the Los Angeles basin (Morton and Miller 2003). The Puente formation is overlain by the Pliocene-Fernando formation, which consists of interbedded fine to coarse clastic marine strata.

Most of the Los Angeles basin area consists of alluvium, thousands of feet deep in some areas, compiled from years of deposits from rivers and streams. Petroleum exploration holes drilled thousands of feet below the surface have uncovered basement rocks beneath the alluvium. These basement rocks have been identified as the

Photos (top to bottom): 1. Pelona schist. Eastern San Gabriel Mountains. 2. Devil's Punch Bowl. Eastern San Gabriel Mountains. NPS photos.

Puente formation, Mountains Meadows dacite, Glendora volcanics, and Topanga volcanics.

The Oligocene Mountain Meadows dacite consists of biotite rhyolite, quartz latite, and dacite porphyry dikes and dike-form bodies. Outcrops of the Mountain Meadows dacite are exposed at the Mountain Meadows Country Club in Pomona. A recent investigation of the Oligocene Mountain Meadows dacite concluded that a subsurface region of the Mountain Meadows dacite in the northeastern Los Angeles basin ties together the northern Los Angeles basin, the San Gabriel Mountains, San Rafael Hills, and the Verdugo Mountains (McCulloh, Beyer, and Morin 2001).

MAJOR FAULTS IN THE STUDY AREA

A number of significant fault systems are located in the Los Angeles region and in the NPS study area (see Map: Regional Faults). The following section provides a short description of the study area's major faults. The San Gabriel Mountains are bounded by fault systems including the San Andreas fault system to the north and the Cucamonga-Sierra Madre fault complex to the south and southwest. On the east the mountains are bound by faults in the San Jacinto fault zone, an extension of the San Andreas fault system. The San Gabriel fault zone cuts through the heart of San Gabriel Mountains and extends northwest through the Sierra Pelona mountains.

Major faults in the Los Angeles Basin portion of the study area include the Raymond fault and the Whittier-Elsinore fault.

In addition to these major faults, the region contains blind thrust faults. Blind thrust faults are shallow-dipping reverse faults which lie below the earth's surface. While many of these faults remain unknown, two regional examples are the Elysian Park Thrust, which runs underneath downtown Los Angeles and the Northridge thrust fault, which ruptured in the 1994 Northridge earthquake.

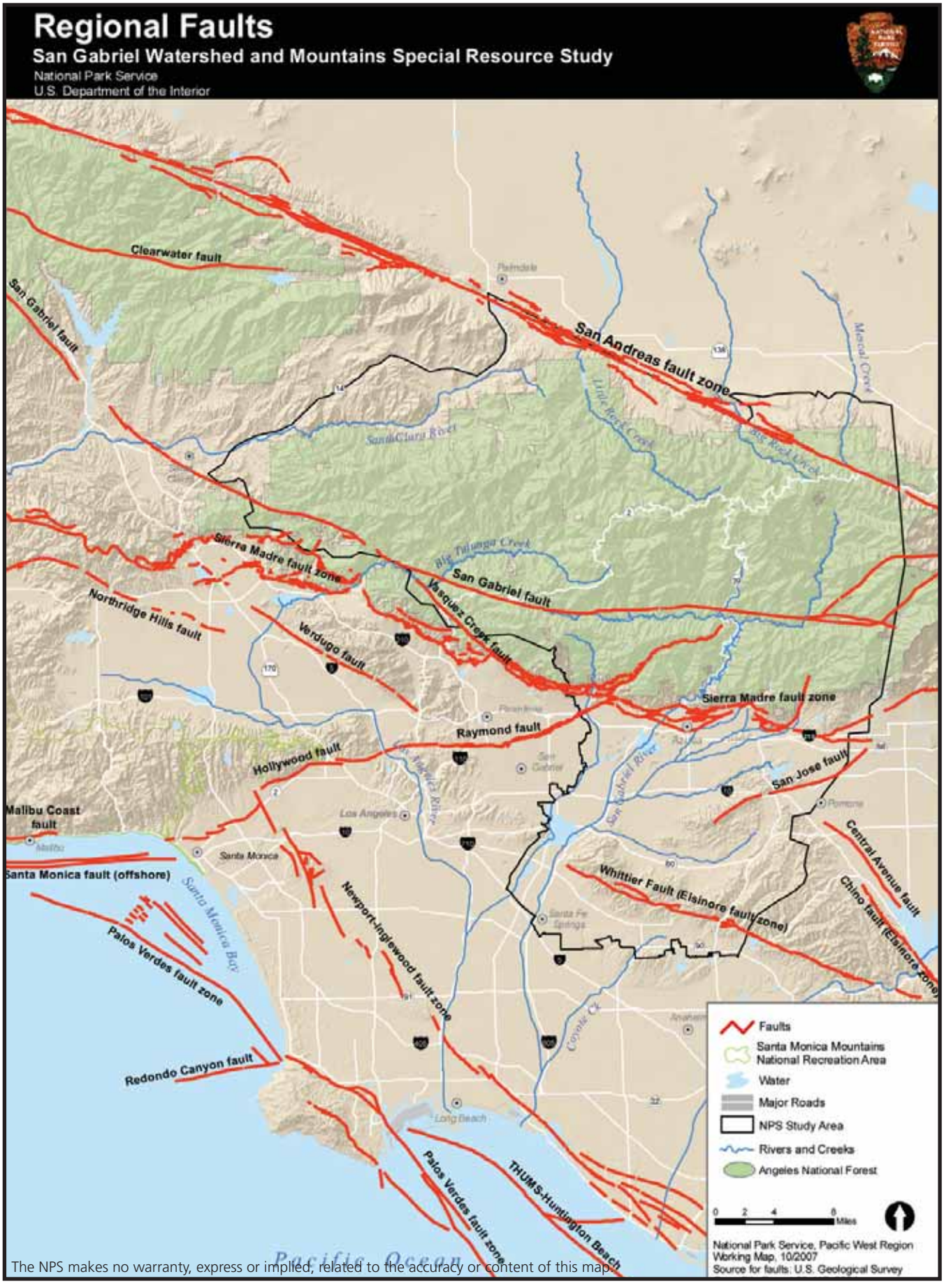
San Andreas Fault System

The San Andreas fault system formed along the translational boundary between the North American and Pacific Plates. As one of the few places on Earth where a transform-fault plate-boundary occurs on land rather than beneath the sea, the San Andreas fault system is one of the most studied structural features on the planet. Convergent transform movements are responsible for the mountain-building activities which continue to form the San Gabriel Mountains and other Transverse Ranges. Although the rate of movement varies over time, geologists believe that the Pacific Plate is currently moving northwest at a rate of almost 5 centimeters per year.

The unique assemblage of rocks in the San Gabriel Mountains has helped geologists determine the magnitude and rate of movement along the San Andreas fault. The Vincent Thrust has played a particularly important role in understanding plate tectonics and movement along the San Andreas fault. Remnants of the Vincent Thrust fault and the associated upper plate and lower plate rocks are located in the Orocopia and Chocolate Mountains, located 150 miles to the south on the opposite side of the San Andreas fault in Riverside and Imperial Counties. Correlations between Pelona Schist associated with the Vincent thrust and the Chocolate and Orocopia Mountain thrusts indicate that the central Transverse Ranges have been displaced by 100 to 150 miles (estimates vary) of movement along the main trace of the San Andreas fault. Cross-fault correlations with other distinct units such as the San Gabriel anorthosite, the Mount Lowe plutonic suite, Precambrian augen gneiss, and Cenozoic sedimentary and volcanic rocks have further strengthened this analysis (Norris and Webb 1990; Ehlig 1982; Nourse 2002).

Restoration of these ancient rock units of the San Gabriel Mountains along faults of the San Andreas system uniquely constrains overall displacements on the faults of the San Andreas system. In addition, debris shed from these distinctive rock units as they were exhumed and displaced record the

San Andreas fault, north of the San Gabriel Mountains. NPS photo.



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timing of movement along the faults. This body of information continues to grow as geologists learn more about the complex San Gabriel Mountains geologic units (Powell 1993).

Throughout the year the San Andreas fault experiences many small earthquakes as the Pacific Plate continues its journey north. Large earthquakes are also associated with this fault. Activity along the San Andreas fault zone has caused some of the largest landslides in California. Examples include Crystal Lake in the San Gabriel Mountains, Cow Canyon, Manker Flats, and Coldwater Canyon (USFS 2005).

Several miles north of the study area, the Fort Tejon earthquake of 1857 (8.0 magnitude) was one of the largest earthquakes experienced in southern California. An extensive rupture was accompanied by the greatest right-lateral offset yet observed on the San Andreas system, 9m /30ft (Norris and Webb 1990).

The **San Gabriel fault** is an older strand of the San Andreas fault system. Credited with defining the general east-west trend of Transverse Range structure, the San Gabriel fault strikes southeast from Frazier Mountain and enters the San Gabriel Mountains on the western end. It appears to be offset in the San Antonio Canyon by north-south trending San Antonio and Stoddard canyon faults, with the eastern segment terminating against the San Jacinto fault. The San Gabriel fault's wide crush zone has strongly affected topography and drainage. For example, the east and west forks of the San Gabriel River follow the fault for most of their lengths.

During the last 12 million years, the San Gabriel fault is estimated to have undergone about 60 kilometers/40 miles of right slip movement, which is thought to have ceased about 5 million years ago. The San Gabriel fault has also experienced varying degrees of vertical displacement. Along the southwest side of the Ridge Basin, vertical displacement is as much as 14,000 feet. The San Gabriel fault has experienced only minor activity in recent times (Norris and Webb 1990).

OTHER FAULT SYSTEMS

The **Sierra Madre fault zone** and its eastern counterpart, the Cucamonga fault, are steep, north dipping, front-range faults along which most uplift of the San Gabriel Mountains has occurred. Activity on this fault is very recent (Norris and Webb 1990).

The San Fernando earthquake of 1971 (6.6 magnitude) was one of the strongest earthquakes experienced in modern times. The earthquake caused over $500 million in property damage and 65 deaths. Although this earthquake was set off by the San Fernando fault zone to the west of the study area, seismologists have shown that the San Fernando earthquake defined a north-dipping reverse fault that corresponded to the surface breaks observed along segments of the Sierra Madre fault zone. The San Fernando earthquake alone caused a three-foot uplift of the San Gabriel Mountains (Norris and Webb 1990).

The **Vasquez Creek fault** runs along the south face of the San Gabriel Mountains between the San Gabriel fault and segments of the Sierra Madre fault zone near Pasadena. It is estimated that this fault has seen as much as 14 kilometers in right slip-movement.

Soledad Basin Faults

Numerous northeast-striking faults cut across the

Table 1: Significant Earthquakes Within or Near the Study Area

Date	Magnitude	Name, Location, or Region Affected	Loss of Life and Property
1857, Jan. 9	7.9	Great Fort Tejon earthquake	1 dead; damage from Monterey to San Bernardino County
1899, July 22	6.4	Wrightwood	Chimneys knocked down; landslides reported
1933, Mar. 11	6.4	Long Beach	115 dead; $40 million in property damage
1971, Feb. 9	6.6	San Fernando	65 dead; more than 2,000 injured; $505 million in losses
1987, Oct. 1	6.0	Whittier Narrows	8 dead; $358 million in property damage to 10,500 homes and businesses
1994, Jan. 17	6.7	Northridge	57 dead; more than 9,000 injured; about $40 billion in property damage

Source: California Geological Survey 2004.

sedimentary and basement rocks of the Soledad basin including the **Lone Tree** and **Soledad faults** (Wilson and Hernandez 2003).

The **Soledad fault** runs through Soledad basin where it brings the crystalline basement rocks of the San Gabriel Mountains in contact with tertiary rocks to the west.

Los Angeles Basin Faults

The **Raymond fault** extends north from the Santa Monica Mountains to the Sierra Madre-Cucamonga fault zone near Arcadia. This fault produces a very obvious south-facing scarp along much of its length. Early explorers noted springs all along the Raymond fault.

The **Elsinore fault zone** is one of the largest in southern California. It spans from the mountains east of San Diego northwest to the Los Angeles basin where it bifurcates into the **Chino fault** on the northeast and the **Whittier fault** on the southwest. The Whittier fault runs directly underneath the Puente Hills (Norris and Webb 1992).

The 1987 Whittier Narrows earthquake (6.0 magnitude) that struck the southern San Gabriel Valley and surrounding communities of southern California was caused by slip on a blind thrust fault near the northern end of the Whittier fault. It has been proposed that the event occurred on an extension of the recently recognized **Puente Hills thrust fault** system.

The **San Jose fault** runs beneath the San jose Hills trending northeast to the Sierra Madre-Cucamonga fault zone.

LANDSLIDES

Landslides form widespread and important physiographic elements in the highly fractured rocks of the San Gabriel Mountains. Some of the largest landslides in southern California (including Crystal Lake) are located in the Angeles National Forest. Large landslides are infrequent occurrences but demonstrate the potential hazards to development below unstable areas (USFS 2005).

EROSION AND DEBRIS FLOWS

The highly erosive steep slopes of the San Gabriel Mountains produce considerable amounts of sand, mud, and aggregate that form debris flows. Fire episodes clear steep slopes of vegetation. During the rainy season, the soil from these cleared slopes form debris flows which can be highly destructive to anything in its path.

Los Angeles County has constructed a series of massive debris basins along the San Gabriel Mountains foothills to protect foothill residents from debris flows. Even these giant basins can be ineffective in stopping debris flows.

MINERAL RESOURCES

The study area is rich in a variety of mineral resources. The map, Mineral Resources, provides an overview of the mineral commodities in the study area.

Petroleum

The study area overlies the Los Angeles and Ventura oil basins, geologic areas well known for their petroleum resources. The source of oil resources is primarily lower Pliocene and upper Miocene strata. The Miocene Puente formation is particularly rich in oil resources. The richness in oil resources is due to millions of years of sediment build-up. During the Miocene epoch, high organic content was trapped and preserved in sediments which led to the formation of petroleum.

The oldest producing field in California is in Pico Canyon just west of the study area near Newhall. Oil was collected here as early as 1850 (Norris and Webb 1992). In the 1920s, Los Angeles County was the world's fifth largest oil producer. Presently, oil production is not nearly as prevalent as it was almost a century ago. Substantial oil fields are located in the Puente and Montebello Hills. However, many of these fields are now inactive. Small-scale oil production still occurs in the Santa Clarita Valley and some portions of the Puente and Montebello Hills (Los Angeles County Department of Regional Planning 2008).

Sand and Aggregate

The highly erosive slopes of the San Gabriel Mountains provide a seemingly endless source of aggregate which is a necessary ingredient in building roads and concrete structures. Sand, gravel, and other rock products are the most significant mineral resources, exclusive of petroleum, in the Transverse Ranges (Morton 1982; Dibblee 1982). There are multiple sand and gravel operations in the study area. Some of the largest are located near the Santa Fe Dam in Irwindale, and in the Soledad basin. The Santa Clara River also has several aggregate mining operations.

San Gabriel Mountains

The San Gabriel Mountains are rich in both metallic and non-metallic mineral resources. Most notably, Placerita canyon, located on the northwestern slopes of the San Gabriel Mountains was the discovery site for gold in 1842. Both lode and placer gold are associated with the Vincent thrust. Placer gold has been harvested in Lytle Creek and the San Gabriel River (USFS 2005).

The two largest gold mines are the Allison Mine on the south flank of Iron Mountain and the Big Horn Mine on the east side of Mt. Baden-Powell (Ehlig 1982).

Old terranes in the western San Gabriel Mountains have also been mined for gold. Active gold mining still takes place near Acton where there are quartz vein gold deposits (Morton 1982). Historically, minor amounts of gold were obtained from the Mount Lowe plutonic suite southwest of Soledad Pass (Dibblee 1982).While small amounts of gold were mined in basement rocks prior to 1940, most have not been profitable.

Other Mineral Resources

Other known commodities in the San Gabriel Mountains include aluminum, asbestos, asphalt, barite, clays, beryllium, copper, diatomite, feldspar, graphite, iron, limestone products, manganese, mica, oil and gas, platinum, silica, slab rock, silver, titanium, tungsten, uranium, and zirconium (See Map: Mineral Resources).

PALEONTOLOGICAL RESOURCES

Paleontological resources are fossilized remains of non-human organisms. Many paleontological sites include remains of species that are now extinct. Southern California has important paleontologic (fossil) resources that are sought by collectors, universities, and museums. Some of these scientifically important fossil resources are being lost to rapid deterioration and decomposition when exposed on the surface, and others are being lost to unauthorized collecting.

Significant paleontological resources are associated with the Mint Canyon in Soledad basin, the Puente formation in the Puente Hills, and La Habra formations (SCAG 2008). Vertebrate fossils in the Mint Canyon formation indicate an age of late Miocene to early Pliocene. This fauna includes merychippus, hipparion, alticamelus, rhinoceroses, antelopes, and carnivores (Mount 1971). Fossils associated with the Puente formation include fish and leaves (SCAG 2008).

Water Resources

HISTORICAL ECOLOGY

Rivers and creeks in the study area, primarily in the Los Angeles basin, have undergone significant changes since European settlement. Because changes are most significant in the Los Angeles basin, this discussion focuses primarily on the pre-settlement hydrology of the Los Angeles basin.

Early explorers and surveyors provided detailed descriptions of water features on the Los Angeles basin. Rivers ran freely across the plain in braided channels. Cienegas (swampy areas), many of which were fed by springs, were abundant, creating lush wet areas throughout the landscape. A series of springs were associated with the feature we now know as the Raymond fault.

Rivers and creeks were wide, gravelly channels referred to as washes. Many were a half a mile wide or more. Within these wide beds, the channels would shift during times of flooding and heavy rains. At the base of the San Gabriel Mountains, the deep gravels and groundwater basins absorbed water draining from the mountains. Waterways would "disappear" into the gravels and rise to the surface south of Whittier Narrows (Crespi 2001). There are also many historical accounts of how the San Gabriel and Los Angeles Rivers often changed their courses, creating new channels during floods. Early maps show both an "Old" and "New" San Gabriel River. Coyote Creek, now a tributary to the Lower San Gabriel River, drained directly from the Puente Hills through the coastal plain to Los Alamitos Bay (Hall 1888).

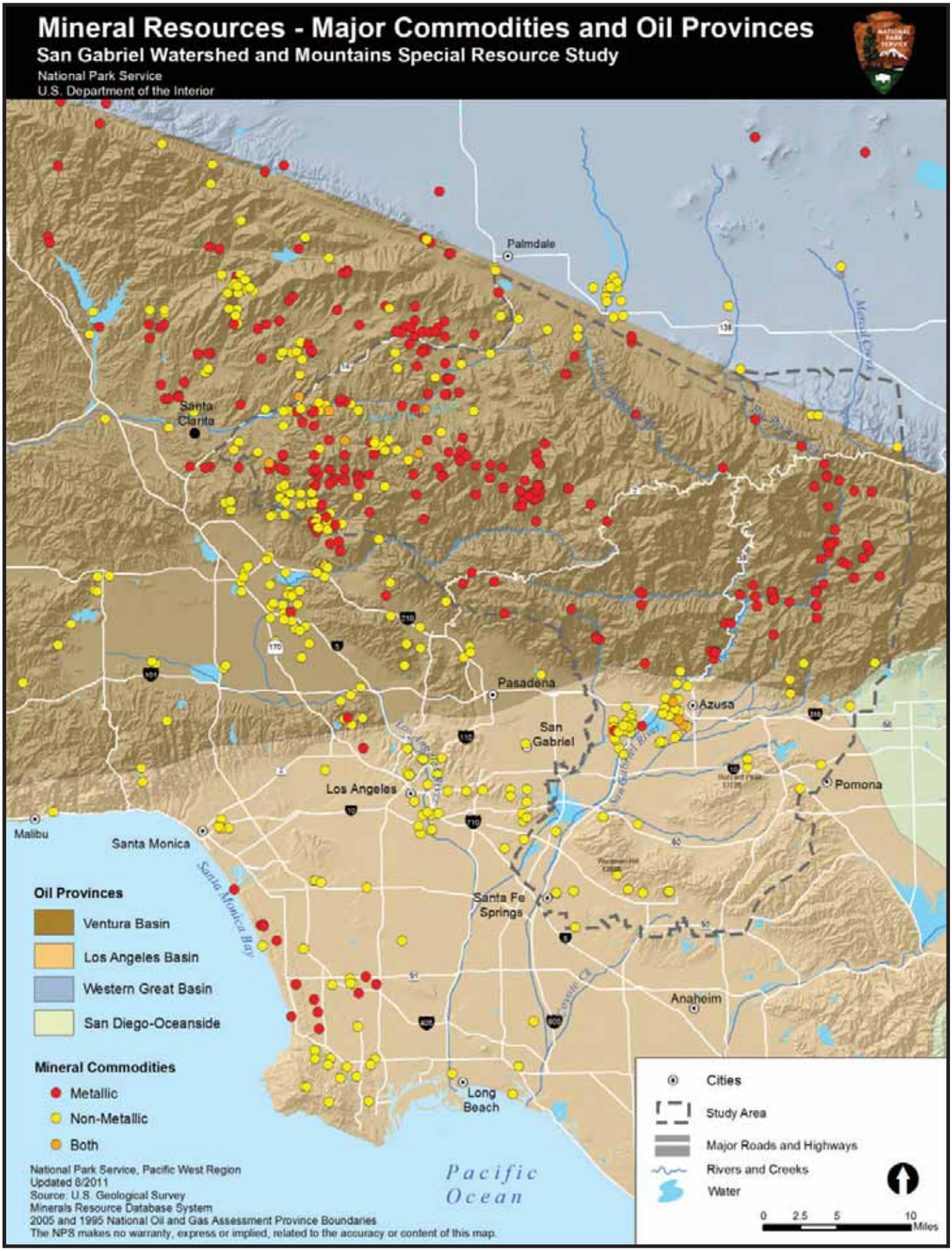
SURFACE WATER

The study area contains portions of five major watersheds in the Los Angeles region: the San Gabriel River watershed, the Los Angeles River watershed, the Santa Clara River watershed, the Antelope Valley watershed, and a very small portion of the Santa Ana River watershed. (See Map: Watersheds).

In the mountains and foothills, coastal watersheds feature natural streams with year-round flow and high quality habitat. Downstream, the urbanized Los Angeles basin features river systems that have been engineered to protect homes and businesses from flooding.

San Gabriel River Watershed

The San Gabriel River watershed encompasses 661 square miles. Its headwaters are in the San Gabriel Mountains and the river reaches the Pacific Ocean


Mineral Resources - Major Commodities and Oil Provinces
San Gabriel Watershed and Mountains Special Resource Study
National Park Service
U.S. Department of the Interior
Palmdale
Santa Clarita
Pasadena
Azusa
San Gabriel
Los Angeles
Pomona
Malibu
Santa Monica
Santa Fe Springs
Anaheim
Long Beach
Pacific Ocean
Oil Provinces
Ventura Basin
Los Angeles Basin
Western Great Basin
San Diego-Oceanside
Mineral Commodities
Metallic
Non-Metallic
Both
Cities
Study Area
Major Roads and Highways
Rivers and Creeks
Water
0 2.5 5 10
Miles
National Park Service, Pacific West Region
Updated 8/2011
Source: U.S. Geological Survey
Minerals Resource Database System
2005 and 1995 National Oil and Gas Assessment Province Boundaries
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at Los Alamitos Bay. The upper San Gabriel River subwatershed, Walnut Creek subwatershed, San Jose Creek subwatershed, and a small portion of the Coyote Creek watershed, are included in the study area. The upstream tributaries of the watershed have year-round flow provided by springs and still retain high quality habitat (California Coastal Conservancy 2001; California Regional Water Quality Control Board 2000).

There are 26 dams in the San Gabriel River watershed. Most of the major dams were built after the 1930, such as Cogswell Dam (1934), Morris Dam (1934), San Gabriel Dam (1939), Santa Fe Dam, and Whittier Narrows Dam (1957).The lower part of the river (the area generally below Santa Fe Dam) is channelized and developed for much of its length except at recharge basins where the bottom is gravelly.

Los Angeles River Watershed

The Los Angeles River watershed drains 830 square miles of land from the Santa Monica Mountains, the San Gabriel Mountains, and the Los Angeles basin, reaching the Pacific Ocean in Long Beach. Featuring one of the most extensive flood protection systems, virtually all of the main channel has been channelized and paved to protect downstream urban areas from flooding. Portions of the watershed in the San Gabriel Mountains have year-round water supplied by springs and support high quality habitat for plants and animals.

The study area contains only the northeastern portion of the watershed. This includes portions of the upper Tujunga, Pacoima, Arroyo Seco, and Rio Hondo subwatersheds. The upper watersheds are characterized by steep sloping channels that are some of the most prolific sediment-producing channels in the world. Major upstream dams within the study area include the Pacoima and Big Tujunga Dams.

The Rio Hondo River formerly meandered across the basin as a channel to the San Gabriel and Los Angeles Rivers. The Rio Hondo has now been engineered as a permanent tributary to the Los Angeles River for flood control purposes.

The Los Angeles River and San Gabriel River watersheds are hydrologically connected by the Rio Hondo River through the Whittier Narrows Reservoir. Much of the Rio Hondo River and its tributaries have been channelized and paved. Dams in the Rio Hondo drainage area include the Eaton, Sierra Madre, Big Santa Anita, and Sawpit Dams (LADPD 2006b; California Coastal Conservancy 2001).

Santa Clara River Watershed

The Santa Clara River is the largest river system in southern California that remains in a relatively natural state. Approximately 1,200 square miles of this watershed drains to the Santa Clara River Estuary in Ventura County. The only major dams in the watershed are located outside of the study area in the Sierra Pelona Range. No major dams have been located on the main river channel. The Santa Clara River is the last unchannelized riparian and wildlife corridor in the region, providing the primary remaining east-west biological connection between the San Gabriel Mountains and the Pacific Ocean (California Coastal Conservancy 2001).

Portions of the Upper Santa Clara River watershed are located in the study area where the Santa Clara River originates in the San Gabriel Mountains. The Upper Santa Clara River is a large ephemeral stream. As the river exits the confinement of the mountains, it has braided stream geomorphology characterized by the frequent shifting network of channels and the intervening bars, and the broad floodplain area, and typical of braided stream deposits (LADPW 2005).

Santa Ana River Watershed

The Santa Ana River watershed encompasses 2,800 square miles. Channelization of the river with high levee banks and other flood control measures characterize much of the main channel south of the mountains. The only portion of the watershed located within the study area is the San Antonio Creek in the far eastern end of the study area. Below San Antonio Dam, San Antonio Creek is channelized.

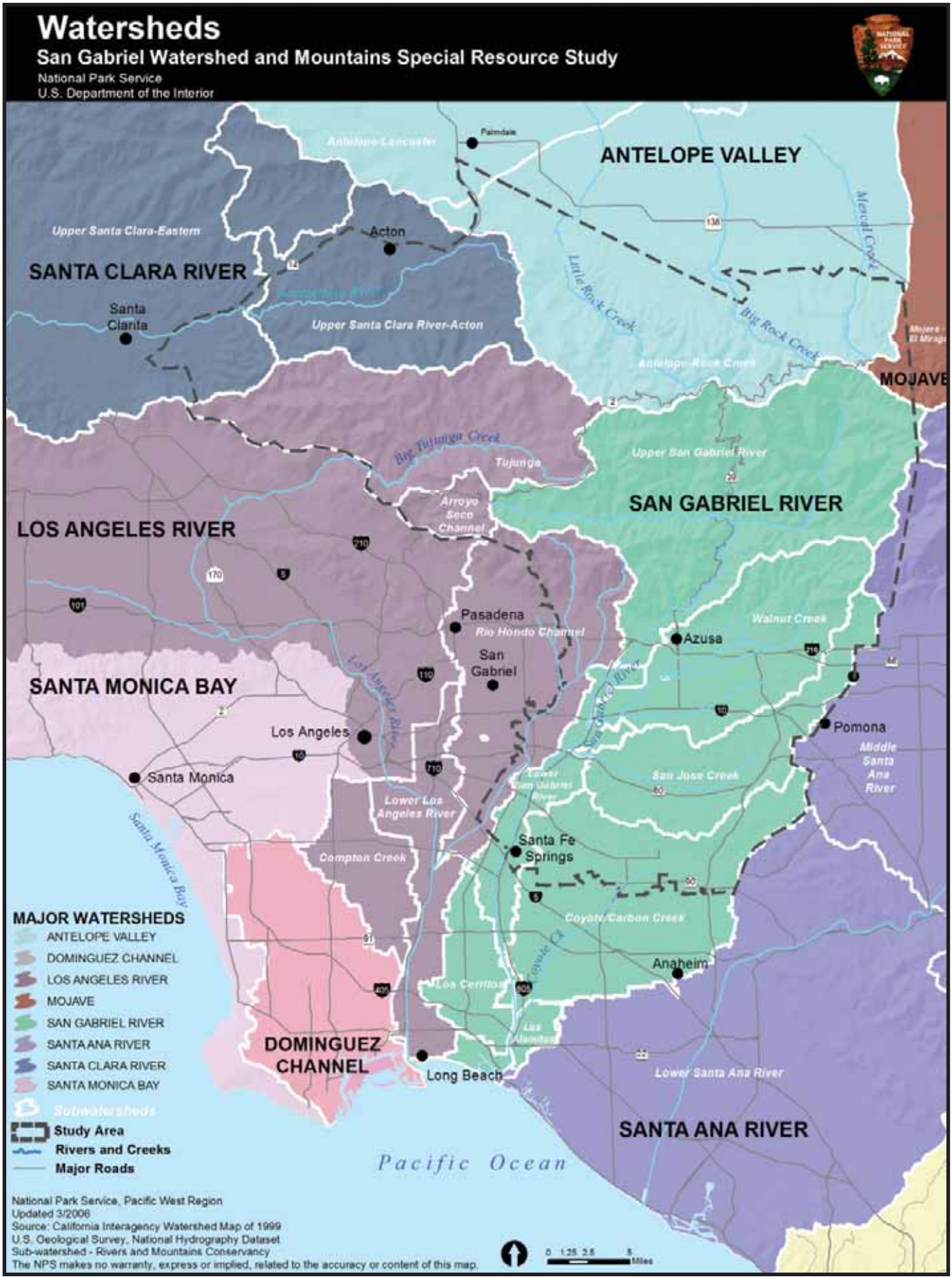
Antelope Valley Watersheds

Rivers that drain to the Antelope Valley include Little Rock, Big Rock, and Mescal Creeks. All of these creeks have intermittent flow. Little Rock and Big Rock Creek also have subsurface flow, important to dry lakes in the Mojave Desert (PCR Services Corporation 2000a). Little Rock Creek has its headwaters in Cooper Canyon and drains to the Mojave Desert. It is free-flowing and very scenic from its upper reaches to Little Rock Reservoir.

Lakes

The San Gabriel Mountains and San Andreas rift zone contain natural lakes. These lakes were formed by natural sag ponds on the San Andreas fault and by landslides in the mountains.

Una Lake is a natural sag pond, which is an enclosed depression formed where active or recent


Watersheds
San Gabriel Watershed and Mountains Special Resource Study
National Park Service
U.S. Department of the Interior
ANTELOPE VALLEY
SANTA CLARA RIVER
LOS ANGELES RIVER
SAN GABRIEL RIVER
SANTA MONICA BAY
DOMINGUEZ CHANNEL
SANTA ANA RIVER
MOJAVE
Palmdale
Acton
Santa Clarita
Pasadena
Azusa
San Gabriel
Los Angeles
Santa Monica
Pomona
Santa Fe Springs
Anaheim
Long Beach
Upper Santa Clara-Eastern
Upper Santa Clara River-Acton
Big Tujunga Creek
Tujunga
Arroyo Seco Channel
Upper San Gabriel River
Rio Hondo Channel
Walnut Creek
San Gabriel River
San Jose Creek
Middle Santa Ana River
Lower Los Angeles River
Compton Creek
Coyote/Carbon Creek
Lower Santa Ana River
Little Rock Creek
Big Rock Creek
Pacific Ocean
MAJOR WATERSHEDS
ANTELOPE VALLEY
DOMINGUEZ CHANNEL
LOS ANGELES RIVER
MOJAVE
SAN GABRIEL RIVER
SANTA ANA RIVER
SANTA CLARA RIVER
SANTA MONICA BAY
Subwatersheds
Study Area
Rivers and Creeks
Major Roads
National Park Service, Pacific West Region
Updated 3/2006
Source: California Interagency Watershed Map of 1999
U.S. Geological Survey, National Hydrography Dataset
Sub-watershed - Rivers and Mountains Conservancy
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Miles

fault movement along the San Andreas fault resulted in impounded drainage. This area has extensive wetlands and provides important wildlife habitat.

Lake Palmdale was a natural sag pond that was impounded in 1924 to create the Harold Reservoir. This reservoir provides water for local agriculture.

Jackson Lake, located in the Angeles National Forest near the town of Wrightwood, is also a natural sag pond in the San Andreas rift zone.

Crystal Lake is an alpine lake found high in the San Gabriel Mountains. This natural lake formed from one of the largest landslides known in southern California. The Crystal Lake area was once a major recreational complex of the Angeles National Forest. The water is now off limits for swimming because of biological contamination. A major fire in 2001 destroyed much of the forests around the lake. It remains a popular fishing destination.

FLOOD PROTECTION AND WATER STORAGE

Flood protection and water conservation planning began in the early part of the 20th century following a disastrous flood event in 1914. A total of 14 dams were built to control waters from the San Gabriel Mountains. A brief history of Los Angeles County flood protection and water conservation system is described under *Cultural Resources*.

Extensive flood protection and water conservation systems were constructed by Los Angeles County and the Army Corps of Engineers throughout the first half of the 20th century. These structures are a dominant feature of the Los Angeles Basin landscape. Within the study area there are 29 dams and debris basins (See Map: Flood Protection Facilities).

The San Gabriel River has five major dams, all of which have the dual purpose of both flood protection and water supply and storage. Other major dams on the southern slopes of the San Gabriel Mountains include Tujunga, Big Santa Anita, Santa Anita, Sawpit, Big Dalton, San Dimas, Live Oak, and Puddingstone Dams. Little Rock Dam and Harold Reservoir (Lake Palmdale) are the only major dams on the north slope of the San Gabriel Mountains. Harold Reservoir, created from a natural sag pond on the San Andreas fault, is the study area's oldest dam (1891).

In addition to dams, many of the rivers and creeks throughout the basin were straightened (channelized) and hardened to confine the flow of channels during heavy rains.

WATER CONSERVATION AND SUPPLY

The importance of the San Gabriel Mountains as a water source was apparent to early settlers who relied on the mountains to feed water from the canyons to farmlands (Robinson1991). The City of Pasadena petitioned the California Board of Forestry in 1888 to protect the San Gabriel Mountains for its watershed values. During this time, excessive timbering was impacting water quality and destroying mountain springs and watercourses used to irrigate the San Gabriel Valley. The State of California established the San Gabriel Forest Reserve in 1891. Watershed protection was the primary impetus for establishing the reserve.

Groundwater

Groundwater basins, or aquifers, are natural underground formations filled with sediment, including sand and gravel. Beneath the study area are portions of seven major groundwater basins. Wells drilled into the basins provide water for municipal use. Local groundwater basins provide 30% of the region's water supply on average. These basins will supply up to 60% during drought years (LADPW 2006a and 2006b). For most of these basins, only a portion is located in the study area. Table 2 provides a description of the groundwater basins within the study area. Also, see Map: Groundwater Basins and Water Supply Facilities.

Spreading grounds artificially recharge groundwater to aquifers by spreading imported water, local runoff (including the water impounded by the upstream dams during storms), and recycled water. Los Angeles County Department of Public Works manages 27 spreading facilities throughout Los Angeles County.

San Gabriel River Water Conservation System

The largest water conservation facilities in Los Angeles County are located on the San Gabriel River, just south of San Gabriel Canyon and in the San Gabriel Valley near Whittier Narrows. The San Gabriel River water conservation system begins in the San Gabriel Mountains with the capture of storm runoff and snow melt in the reservoirs of Cogswell, San Gabriel, and Morris Dams. Water released through valves or passing over spillways when the reservoirs are full can be diverted at the mouth of the canyon to the San Gabriel Canyon Spreading Grounds or can continue downstream in the unlined San Gabriel River toward the Santa Fe Dam. In the upper portion of the Santa Fe Reservoir is the Santa Fe Reservoir Spreading Grounds. Releases from Santa Fe Dam can be spread in the


Flood Protection Facilities
San Gabriel Watershed and Mountains Special Resource Study
National Park Service
U.S. Department of the Interior
Palmdale
Harold Reservior
Little Rock Dam
Acton
Santa Clara River
Santa Clarita
Little Rock Creek
Big Rock Creek
Mescal Creek
San Gabriel Mountains
Devil Canyon Second Afterbay
Big Tujunga Creek
Big Tujunga Dam
Cogswell Dam
San Gabriel Dam
Big Santa Anita Dam
Sawpit Dam
Morris Dam
Big Dalton Dam
San Antonio Dam
Sierra Madre Dam
San Dimas Dam
Thompson Creek Storage Facility
Azusa
Pasadena
Puddingstone and Live Oak Res
Live Oak Dam
Santa Fe Dam
Weymouth Reservior
Santa Monica Mountains
Los Angeles River
San Gabriel River
Puddingstone Dam
San Gabriel
Pomona
Los Angeles
Whittier Narrows Dam
Whittier Reservior
Chino Ranch Reservior
Santa Monica
Orange County Reservior
Santa Fe Springs
Santa Monica Bay
Coyote Ck
Anaheim
Long Beach
Pacific Ocean
Study Area Dams
Other Regional Dams and Reserviors
Cities
Water
Improved Flood Waterways and Structures
Parks and Open Space
Study Area
0 1.5 3 6 Miles
National Park Service, Pacific West Region
Updated 9/2007
Source: US Army Corps of Engineers, National Inventory of Dams
SCAG Land Use Data (2001), Improved Flood Waterways and Structures
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unlined San Gabriel River downstream with large flows continuing to Whittier Narrows Dam. Water can also be diverted just below Santa Fe Dam and routed via Sawpit Wash to Peck Road Spreading Basin and the beginning of the Rio Hondo water conservation system.

The Whittier Narrows Dam is at the northern boundary of the Montebello Forebay. San Gabriel River flows arriving in the reservoir can be directed either to the San Gabriel Coastal Basin Spreading Grounds and the downstream unlined San Gabriel River, or to the Rio Hondo Coastal Basin Spreading Grounds. Any water released from Whittier Narrows Dam that is not captured in the Coastal Plain spreading facilities flows on to the ocean (LADPW 2004)

Imported Water

Municipal water for the greater Los Angeles metropolitan region is supplemented by water imported from northern California through the State Water Project and from the Colorado River.

The Metropolitan Water District of Southern California, a consortium of 26 cities and water districts, receives water from the State Water Project.

Recycled Water

Recycled water is used for municipal use such as irrigation, industrial applications, environmental uses, groundwater replenishment, or maintenance of seawater barriers to groundwater basins along the coast. The remainder is discharged into creeks and rivers, supporting riparian habitat in some locations.

The Sanitation Districts of Los Angeles County manage three Water Reclamation Plants (WRP) within the study area. These locations include the San Jose WRP, the Whittier Narrows WRP, and the Pomona WRP.

WATER RIGHTS AND SUPPLY MANAGEMENT

Water rights determine who can draw upon water from rivers and groundwater basins and how much can be allocated to each user per year. Most water supply resources within the study area are fully appropriated, meaning the State Water Resource Control has determined that all of the water is

Table 2: Groundwater Basins

Groundwater Basin	Surface Area	Storage Capacity	Recharge Areas
Coastal Plain of Los Angeles, Central Subbasin	177,000 acres	13,000,000 acre feet	Precipitation, surface inflow at Whittier Narrows, , imported water, recycled water from Whittier and San Jose Treatment Plants, underflow from San Gabriel Valley.
San Gabriel Valley	154,000 acres	10,740,000 acre feet	Precipitation, runoff from surrounding mountains, imported water from San Gabriel River, treated sewage effluent, subsurface flow from Chino subbasin and fracture systems along San Gabriel Mountain front.
Raymond	26,200 acres	1,450,000 acre feet	Precipitation, streamflow from Arroyo Seco, Eaton Creek, and Santa Anita Creek, spreading grounds, San Gabriel Mountain front fracture systems.
Upper Santa Ana Valley, Chino Subbasin	154,000 acres	18,300,000 Acre feet	Precipitation, underflow from adjacent basins, recharges facilities at Deer Creek, Day Creek, East Etiwanda, San Sevaine, and Victoria.
San Fernando Valley	145,000 acres	3,670,000 acre feet	Spreading from imported water at the Pacoima, Tujunga, and Hanson spreading grounds. Runoff and streamflow from mountains, precipitation, reclaimed wastewater, and industrial discharges.
Acton Valley Groundwater Basin	8,270 acres	40,000 acre feet	Precipitation in the valley, runoff from Santa Clara River and its tributaries, and subsurface inflow.
Antelope Valley	1,100,00 acres	68,000,000 acre feet	Primarily perennial runoff from surrounding mountains and hills, percolation through alluvial fan systems. Big Rock and Little Rock Creeks contribute 80% of runoff into the basin.
California Department of Water Resources, 2003			


Groundwater Basins and Water Supply Facilities
San Gabriel Watershed and Mountains Special Resource Study
National Park Service
U.S. Department of the Interior
Palmdale
ANTELOPE VALLEY
ACTON VALLEY
Acton
California Aqueduct
Los Angeles Aqueduct
Santa Clara River
Little Rock Creek
Big Rock Creek
Mescal Creek
Santa Clarita
SANTA CLARA RIVER VALLEY
Big Tujunga Creek
SAN FERNANDO VALLEY
Pasadena
San Gabriel
Azusa
Los Angeles River
San Gabriel River
SAN GABRIEL VALLEY
Pomona
UPPER SANTA ANA VALLEY
Los Angeles
Santa Monica
Santa Monica Bay
Santa Fe Springs
COASTAL PLAIN OF LOS ANGELES
Coyote Ck
Anaheim
Long Beach
COASTAL PLAIN OF ORANGE COUNTY
Pacific Ocean
Cities
Rivers and Creeks
Spreading Grounds
Water Storage Facilities
Water Transfer Facilities
Water
Groundwater Basins
ACTON VALLEY
ANTELOPE VALLEY
COASTAL PLAIN OF LOS ANGELES
COASTAL PLAIN OF ORANGE COUNTY
EL MIRAGE VALLEY
SAN FERNANDO VALLEY
SAN GABRIEL VALLEY
SANTA CLARA RIVER VALLEY
UPPER SANTA ANA VALLEY
Study Area
National Park Service, Pacific West Region
Updated 8/2011
Source: Water Storage Facilities and Water Transfer Facilities - SCAG Land Use Data (2001)
Spreading Grounds - Los Angeles County Department of Public Works (2005)
Groundwater Basins - State Water Resources Control Board (2000)
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0 2 4 8 Miles

owned by water rights holders. The Antelope Valley Groundwater Basin has not been adjudicated. At the state level, water rights are managed by the State Water Resources Control Board. At the local level local, agencies and organizations that are involved in administering water rights within the study area include:

- San Gabriel River Water Committee
- Main San Gabriel Basin Watermaster
- San Gabriel Valley Protective Association
- San Gabriel River Watermaster
- Central Basin Watermaster
- West Coast Basin Watermaster
- Six Basins Watermaster
- Upper Los Angeles River Area Watermaster

Numerous agencies, water districts, and water companies are also involved in water supply management such as buying, selling, pumping, delivery, and clean-up (LADPW 2006b).

Vegetation

INTRODUCTION

The diverse landscape of the study area contains examples from most of the vegetation types and wildlife that are found in Southern California today. From the high peaks of the San Gabriel Mountains to the low coastal plain south of the Puente-Chino Hills, differences in climate, soils, and geology set the stage for a wide array of plant communities. Alpine, coastal, and desert communities can all be found within relatively short distances. These plant communities provide habitat to an abundance of wildlife.

The study area includes habitat within two distinct ecoregions as defined by Jepson, the coastal Southwestern ecoregion and the Mojave Desert ecoregion (see Map: Vegetation). The Southwestern ecoregion includes the transverse and peninsular ranges and is bordered by the Mojave and Colorado deserts to the east and the Mexican border to the south. Common plant communities include coastal strands and bluff, lagoons, coastal sage scrub, chaparral, foothill woodlands, and coniferous forests in the mountains. Chaparral is the dominant native plant community in the study area and throughout southern California's national forest

White fir, Islip Saddle, San Gabriel Mountains. Photo courtesy of Ryan Gilmore.

Alluvial fan scrub, Big Tujunga Canyon. Photo courtesy of JC Dittes.

system. These chaparral systems are important for watershed conservation in southern California (Halsey 2008).

The Mojave ecoregion lies north and east of the study area and includes one-fifth of the state. Plant communities include desert scrub, Joshua trees, and pinyon/juniper woodlands.

Many of the region's native plant communities have been displaced due to grazing, agriculture, and ultimately, urban development. Almost all of the native plant communities that remain contain sensitive, rare or endangered flora and fauna.

This section describes the native and wildlife vegetation that existed in the study area when European settlers arrived and provides an overview of existing vegetation and wildlife found within the study area today.

NATIVE VEGETATION

Although no comprehensive inventories and studies of the region's native vegetation were conducted by early Spanish explorers, diaries kept during expeditions help paint a picture of the pre-European landscape.

Accounts from Early Explorers

The first detailed accounts of study area vegetation were from the overland expedition led by Captain Gaspar de Portola in 1769-1770. Diaries kept by Juan Crespi, a padre in the expedition, provide some of the most detailed early descriptions of the study area's native vegetation. Crespi describes the San Gabriel Valley as lush with dense woodlands of willow and oak trees and other species such as rose bushes, sage, thistles, grapevines, cumin, and holy thistles. He also describes a great swamp, watered by a spring-fed river, with many plants and "good grasses." Crespi writes that this area would make a "*grand, excellent spot for a very large plenteous mission"* (Crespi 2001).

As the Portola expedition continued north and west, they crossed the western San Gabriel Mountains and descended into the Soledad Basin. Crespi describes the Santa Clara River valley as an area having good grass-grown soil and areas with large cottonwoods, sycamores, white oaks, willows, and vineyards (Crespi 2001).

Early Surveys

In the 1940s, the U.S. Forest Service created a detailed map of California's native vegetation. The California State Board of Forestry, in its publication, *An Historico-Ecological Study of the Range Resource of California*, amended this map after consulting historical records by pioneers, travelers, and early residents that observed vegetation. According to this document, native plant communities of the study area would have included: California prairie in the valleys and coastal plain; sagebrush in the Puente-Chino Hills; sagebrush, chaparral, coniferous woodland, and forest in the San Gabriel Mountains; and desert scrub in the Antelope Valley (Burcham 1957).

The vegetation that has changed most dramatically since European contact is the *California prairie*. California prairie was found along alluvial areas in Southern California in elevations 50 to 500 feet above sea level. Soils in these areas are similar to soils which underlie Midwestern prairies. In the study area, California prairie habitat would have dominated in the San Gabriel Valley and coastal plain areas south of the Puente-Chino Hills. Dominant species were perennial bunchgrasses such as purple needlegrass and nodding needlegrass. Herbaceous plants such as such as wildflowers, sedges, and bulbs were also common. Today there is virtually no remnant of this community apparent in the Los Angeles region. Native grasses are typically found intermixed with nonnative species introduced from Europe. This is a result of the California prairie being well suited for grazing and irrigated agriculture (Burcham 1957).

John Muir, in his famous book, *The Mountains of California*, describes the vegetation of the San Gabriel Valley as flourishing with white sage in the valleys and low hills, black sage on the mountains and streamsides with melilotus, columbine, collinsia, verbena, zauschneria, wild rose, honeysuckle, philadelphus, and lilies. Wild buckwheat was also in great abundance (Muir 1894). Steep hillsides in the Puente-Chino, San Jose Hills, and southern San Gabriel Mountains foothills would have been covered in chaparral and coastal sage scrub. Coastal sage scrub, in particular, has been severely reduced from its former range as this habitat was very suitable for agriculture and ranching.

The other dominant community that has been dramatically altered since European settlement is the foothill woodland which would have intermingled with California prairie and chaparral communities. The foothill woodlands were profuse in the deep alluvial soils of lower flats and hills in the Santa Clara River Valley (Soledad basin) and the Los Angeles basin. This would include woodlands of walnut and oak found in canyons and hillsides, and broad corridors of willow, alder, sycamore, and mulefat along rivers and creeks (Schiffman 2005).

EXISTING VEGETATION AND HABITAT

The vegetation and habitat of the study area are primarily described according to the California Wildlife Habitat Relationships System (CWHR) habitat classification scheme which has been developed to support the CWHR System, a wildlife information system and predictive model for California's regularly-occurring birds, mammals, reptiles, and amphibians.

Grassland

Annual grassland habitat primarily occupies what was once California prairie. Introduced annual grasses are the dominant plant species in this habitat including wild oats, soft chess, red brome, wild barley, true clovers, and many others. Remnants of native plants and grasses are also found in this habitat including California poppy and purple needlegrass, and Idaho fescue.

Characteristic wildlife associated with annual grassland include the western fence lizard, common garter snake, and western rattlesnake, California ground squirrel, California vole, badger, coyote, burrowing owl, short-eared owl, and western meadowlark. This habitat also provides important foraging habitat for raptors such as the northern harrier and the prairie falcon (CDFG 2008a).

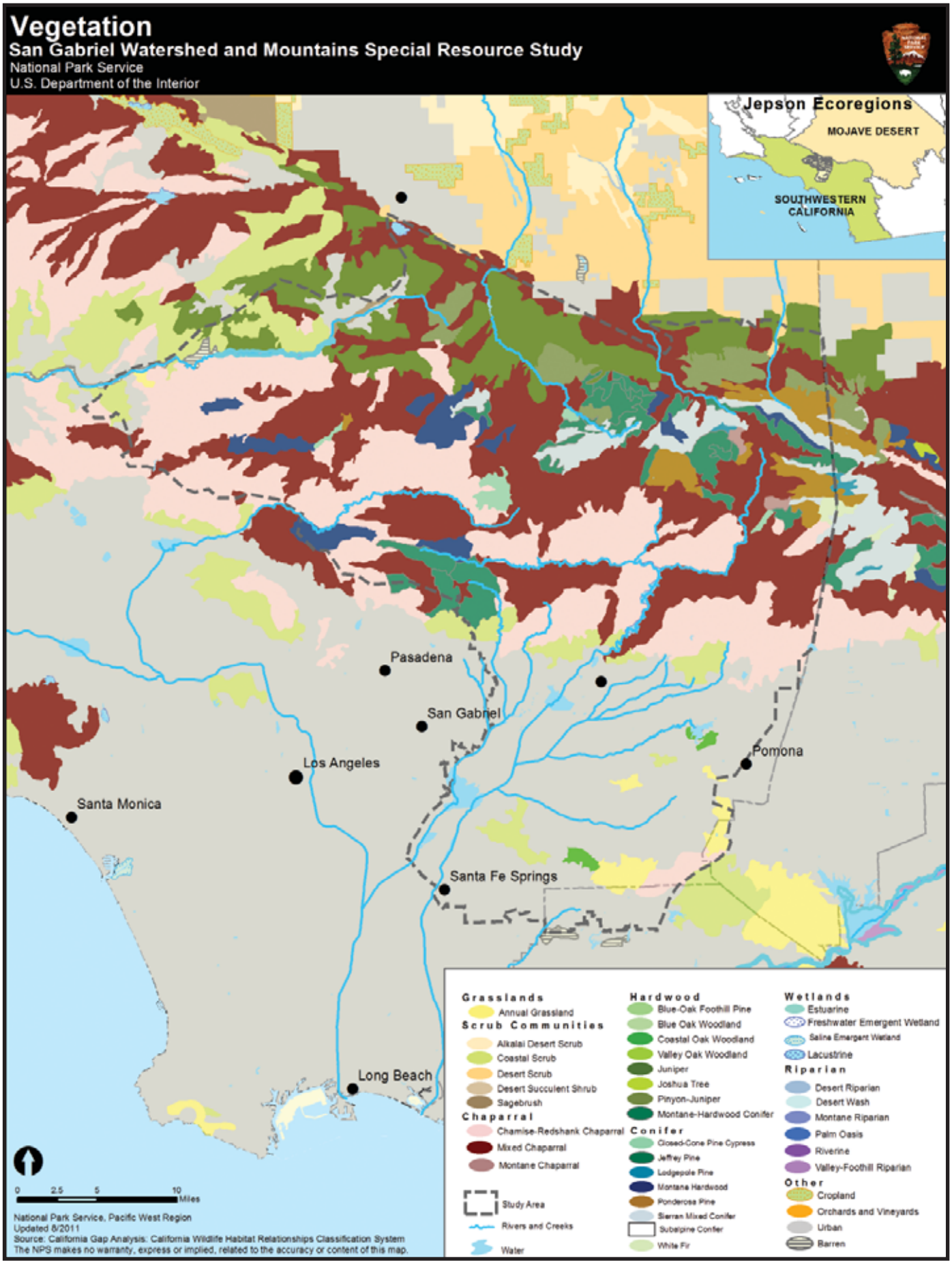
Within the study area, fragmentary representatives of native grasslands exist in the Antelope Valley, along the Santa Clara River, eastern San Gabriel Valley, San Jose Hills, Puente Hills, and the San Gabriel Canyon. The native grasslands in these areas are typically occurring in scattered patches.

Vernal pools, small depressions with a hardpan soil layer, are also found in grassland habitat. Vernal pool systems are extremely rare in Los Angeles County. There are only two verified vernal pools currently recognized in the region – Cruzan Mesa and Plum Canyon. However, there is at least one small seasonal pond with typical vernal pool characteristics within the study area. Located in the upper Placerita-Sand Canyon watershed in the Angeles National Forest, this pool supports Riverside fairy shrimp and western spadefoot toad (PCR Services Corporation 2000a).

Scrub and Chaparral Communities

Coastal Sage Scrub is found at elevations below 2,500 feet in climates with mild temperatures and maritime influence. Shrubs are knee high with soft flexible leaves that are often drought-deciduous (they lose their leaves during the summer dry season). Common species include California sagebrush, brittle-bush, California buckwheat, and

Photos (top to bottom): 1. Walnut grove, Puente Hills. NPS photo. 2. Rabbitbrush and sub-alpine vegetation on Pine Mountain, Angeles National Forest. Tom Chester photo at: http://tchester.org/sgm/plants/pix/rabbitbrush.html. 3. Chaparral, Angeles National Forest. NPS photo.


Vegetation
San Gabriel Watershed and Mountains Special Resource Study
National Park Service
U.S. Department of the Interior
Jepson Ecoregions
MOJAVE DESERT
SOUTHWESTERN CALIFORNIA
Pasadena
San Gabriel
Los Angeles
Santa Monica
Pomona
Santa Fe Springs
Long Beach
Grasslands
Annual Grassland
Scrub Communities
Alkalai Desert Scrub
Coastal Scrub
Desert Scrub
Desert Succulent Shrub
Sagebrush
Chaparral
Chamise-Redshank Chaparral
Mixed Chaparral
Montane Chaparral
Hardwood
Blue-Oak Foothill Pine
Blue Oak Woodland
Coastal Oak Woodland
Valley Oak Woodland
Juniper
Joshua Tree
Pinyon-Juniper
Montane-Hardwood Conifer
Conifer
Closed-Cone Pine Cypress
Jeffrey Pine
Lodgepole Pine
Montane Hardwood
Ponderosa Pine
Sierran Mixed Conifer
Subalpine Conifer
White Fir
Wetlands
Estuarine
Freshwater Emergent Wetland
Saline Emergent Wetland
Lacustrine
Riparian
Desert Riparian
Desert Wash
Montane Riparian
Palm Oasis
Riverine
Valley-Foothill Riparian
Other
Cropland
Orchards and Vineyards
Urban
Barren
Study Area
Rivers and Creeks
Water
0 2.5 5 10
Miles
National Park Service, Pacific West Region
Updated 8/2011
Source: California Gap Analysis: California Wildlife Habitat Relationships Classification System
The NPS makes no warranty, express or implied, related to the accuracy or content of this map.

various types of sage. Coastal sage scrub is one of the most threatened communities in California. At least 13 rare, threatened and endangered species are associated with this habitat (Schoenherr 1992).

The study area contains a wide range of coastal sage scrub communities. Three classifications of coastal sage scrub are typical of the Southwestern ecoregion as classified by Axelrod: Venturan, Riversidian, and Diegan. A fourth representation, coastal sage scrub-chaparral, typically found in transitional areas near mountain foothills, has been defined by Holland. All four variations are represented in the study area. Riversidian coastal sage scrub is primarily located in the upper Santa Clara River watershed. Venturan is found in the San Jose Hills, Puente Hills, and San Gabriel Mountains foothills. Diegan coastal sage scrub is found in the eastern Puente Hills. The Puente Hills represent a transition between Venturan and Diegan coastal sage scrub. Many of these areas are designated habitat for the federally threatened coastal California gnatcatcher (Puente Hills Landfill Native Habitat Preservation Authority 2007; Davis, et al. 1994, Axelrod 1978).

Desert scrub includes a number of widely spaced formations of shrubs and subshrubs which occur on open, sandy soils where groundwater is inaccessible to all but a few deep-rooted species. Dominant species include sagebrush, antelope bush, creosote bush, saltbush, rabbitbrush, cheesebush, sages, winterfat, and burrobrush. This community often inter-grades with juniper and Joshua tree woodlands. Primary resident species include Couch's spadefoot toad, desert tortoise, a variety of lizards and snakes including desert iguana, kingsnake, black-throated sparrow, kangaroo rats, and pocket mice (CDFG 2008). Within the study area, desert scrub is found on lower slopes within the San Andreas rift zone on north facing slopes that transition onto the Antelope Valley floor, interspersed with grasslands (PCR Services 2000a).

Alkali desert scrub communities tolerate alkaline soils by absorbing salt and water. Common plants include saltbushes, desert holly, sagebrush, and alkali golden bush. In the study area, it is found in the Antelope Valley and the northern foothills of the San Gabriel Mountains. Wildlife associated with desert scrub includes the pallid kangaroo mouse, chisel-toothed kangaroo rat, zebra-tailed lizard, and the San Emigdio blue butterfly (CDFG 2008a, Schoenherr 1992, Mayer and Laudenslayer 1988, Davis et al 1998, PCR Services Corporation 2000a).

Alluvial wash and alluvial fan sage scrub generally consists of a mixture of shrubs which colonize and persist within infrequently scoured and flooded terrain such as floodplains, alluvial plains, or along seasonal streams. The dominant shrub in most washes is scalebroom. Alluvial fan sage scrub type is found in alluvial plains and washes in the Antelope Valley, in canyons adjacent to the San Gabriel Valley and throughout the alluvial plains and washes of the Santa Clara River. It is extremely reduced from its historic range as a result of alterations to river channels for flood protection.

Alpine dwarf scrub is restricted to elevations about 10,000 feet in southern California. In the San Gabriel Mountains, common species include draba, Parish's alumroot, creambush, rock-cress, and species of buckwheat. At its lower extent it interfaces with subalpine conifer, closed cone pine/cypress, Sierran mixed subalpine forest, and southern California subalpine forest. Resident wildlife associated with alpine dwarf scrub includes blue grouse, pika, rufous hummingbird, and mountain sheep (Mayer and Laudenslayer 1988, USFS 2005).

Sagebrush typically occurs at a wide range of middle to high elevations. This habitat is dominated by sagebrush, rabbitbrush, horsebrush, mahogany, gooseberry, and western chockeberry. Wildlife associated with sagebrush include: migrating mule deer, pronghorn, sage grouse, jackrabbit, and ground squirrels. Within the study area it is found in the Soledad basin and Antelope Valley areas (CDFG 2008a, Davis et.al. 1994).

Chaparral is the most prolific plant community in the study area. This community consists of sclerophyllous (hard-leafed), medium to tall shrubs that form a dense cover on steep slopes, usually below 5,000 feet in southern California. Dominant species found within this community include scrub oaks, chamise, manzanita, wild lilac, toyon, and western mountain-mahogany. The study area contains chamise-redshank chaparral, mixed chaparral, and montane chaparral.

Chamise-redshank chaparral consists of nearly pure stands of chamise or redshank. Wildlife species associated with this chaparral are similar to those associated with sagebrush and coastal sage scrub. Within the study area it is abundant in the San Gabriel Mountains and southern foothills, the upper Santa Clara River watershed, and a few stands in canyons of the Puente-Chino Hills (CDFG 2008a, Davis et.al. 1994).

Mixed chaparral is floristically diverse and contains approximately 240 species. This is the dominant type of habitat in the study area and comprises over

170,000 acres or 25% of the study area landcover. Typically associated shrubs include chamise, silk-tassel, toyon, yerba-santa, California fremontia, scrub oak, chaparral oak, and species of ceanothus and manzanita. Species found here are those that are found in other chaparral habitat, coastal sage scrub, and sagebrush. Within the study area, mixed chaparral is mostly restricted to the San Gabriel Mountains and higher elevations of the Antelope Valley (CDFG 2008a, Davis et.al. 1994).

Montane chaparral is typically associated with coniferous habitats such as ponderosa pine, mixed conifer forests, Jeffrey pine, red fir, and lodgepole pine. In the San Gabriel Mountains, it is typically found at elevations over 7,000 feet. Common species include ceanothus, manzanita, huckleberry oak, mountain mahogany, toyon, and California buckthorn. Montane chaparral provides habitat for a wide variety of wildlife including rabbits and hares, many types of bird species, and important foraging habitat for deer. This habitat is found in upper watershed of the San Gabriel River (CFDG 2008a, Davis et.al. 1994).

Woodlands and Forests

Coastal oak woodlands are common to coastal foothills and valleys. Dominant species in southern oak woodlands and forests include coast live oak, interior live oak, Engelmann oak, and southern California walnut woodlands and forests. Coastal oak woodlands provide habitat to a wide variety of wildlife including at least 60 mammal and 110 bird species in some areas (CDFG 2008a).

In the Puente-Chino Hills area, the dominant oak species is the coast live oak. It is found scattered throughout many hillsides, drainages, and broad valleys. It is most prevalent on north facing slopes and in drainage bottoms. Large complexes of oak woodland are found in Powder Canyon, Brea Canyon, and Tonner Canyon. Throughout the San Gabriel Valley and southern San Gabriel Mountains foothills, oak woodland is found scattered on north facing slopes and in drainage bottoms. The upper Santa Clara River watershed contains coast live oak woodlands, usually along the margins of canyon bottoms and on lower slopes in chaparral and coastal sage scrub understory habitats.

Often intergrading with oak woodlands are *walnut woodlands*. Dominated by the southern California black walnut, which grows 10 to 30 feet high, walnut woodlands are common on the hillsides of Brea and Tonner canyons where they form some of the best developed examples of their type south of Ventura County in southern California and represent the state's last remaining extensive stand of southern California black walnut. Walnut woodlands are also found throughout the eastern San Gabriel Valley in the San Jose and South Hills (PCR Services Corporation 2006, Schoenherr 1992, PCR Services Corporation 2000 and 2000d, Quinn 1990).

Closed-cone cypress is found scattered among chaparral and hardwood forests. Typically, dominated by single species of closed-cone pines or cypress, this habitat grows in areas with rocky and infertile soils. Dominant species include Piute cypress, cuyamaca, and species common to chaparral habitat. Great-horned owls and red-tailed hawk roost in this habitat (CDFG 2008a).

Joshua tree woodland is dominated by Joshua trees with numerous smaller shrub species such as creosote bush and sagebrush interspersed. Joshua trees provide nesting and perching sites for birds associated with desert scrub habitat. Within the study area, Joshua trees are located on the lower slopes in the San Andreas rift zone at the northern base of the San Gabriel Mountains (PCR Services Corporation 2000a, CDFG 2008).

Juniper woodlands are dominated by California juniper, often with an understory of desert scrub species including foothill yucca and buckwheat. Within the study area, juniper woodlands are typically found on northern slopes of the San Gabriel Mountains, lower slopes within the eastern portion of the upper Santa Clara River watershed, and on lower slopes in the San Andreas rift zone where it is mixed with Joshua tree woodland and chaparral. Juniper berries are an important food source to bird species and the foliage is consumed by some mammal species (CDFG 2008a, PCR Services Corporation 2006, Davis et.al. 1994).

Pinyon-juniper woodland consists of a mixture of single needle leaf pinyon pine and California juniper, with mountain mahogany, buckwheat, squawbush, foothill yucca, penstemons, and native grasses. This habitat is found in the upper Santa Clara River watershed and along the northern slopes of the San Gabriel Mountains at middle elevations (PCR Services Corporation 2006).

Montane hardwood occurs at middle to high elevations in the transverse and peninsular ranges. Within the study area, it is found in the San Gabriel Mountains. At higher elevations, formations typically have an overstory of conifers such as pines, bicone Douglas fir, incense-cedar, and California black oak. At lower elevations, overstory species typically include oaks, white alder, bigleaf

maple, bigcone Douglas-fir, and California-laurel. Understory vegetation usually is dominated by chaparral species such as coffeeberry, manzanita, and ceanothus. A wide variety of wildlife relies on this habitat including jays, woodpeckers, squirrel, black bear, mule deer, and various reptiles and amphibians (CDFG 2008a, Davis et.al. 1994).

Montane hardwood-conifer includes both hardwood and coniferous trees with very little understory. Dominant species include canyon live oak, Pacific madrone, ponderosa pine, sugar pine, and incense-cedar. A transitional habitat between mixed chaparral, dense coniferous woodlands, montane hardwood, and open woodlands, montane hardwood-conifer provides important forage for birds and mammals. Amphibians are found in more mesic areas of this habitat. Within the study area, this habitat is found throughout the San Gabriel Mountains (CDFG 2008a, Davis et.al. 1994).

Jeffrey Pine forest occurs in the San Gabriel Mountains between subalpine conifer and pinyon-juniper habitat. The dominant species is Jeffrey pine. However, it is also associated with other pines, firs, incense-cedar, and black cottonwood. Its understory primarily includes scrub oak, ceanothus, Sierra chinquapin, and manzanita. The species richness of Jeffrey pine exceeds that of surrounding habitat. Jeffrey pine seeds, bark, and foliage are important to wildlife *(CDFG 2008, Davis et.al. 1994)*.

Lodgepole pine forests occur at high elevations in the San Gabriel Mountains. Lodgepole pine forests are dominated by this species but occasionally will include aspen and mountain hemlock. Understories are sparse, consisting of scattered scrubs and herbs. Wildlife includes reptiles, amphibians, birds, and mammals. Species richness is highest adjacent to mountain meadows *(CDFG 2008a, Davis et.al. 1994)*.

Ponderosa pine includes forests with 50% or more of this species. Shrub layer species include mountain-misery, manzanita, ceanothus, and Pacific dogwood. This habitat is important for migratory deer and California condors. It occurs at higher elevations in the eastern San Gabriel Mountains *(CDFG 2008a, Davis et.al. 1994)*.

Sierran mixed conifer forests are typically found in the Sierra Nevada range. Stands in the San Gabriel Mountains and other areas in southern California are disjunct populations. Dominant species include Douglas-fir, white fir, ponderosa pine, sugar pine, incense-cedar, and California black oak. Understory includes a mixture of deerbrush, manzanita, chinquapin, gooseberry, rose, and mountain-misery. This habitat has a high degree of species richness, providing habitat for 355 species of animals (CDFG 2008a).

White fir stands are forests which typically include 80% or more of this species. Located at high elevations in the upper San Gabriel River watershed, white fir provides habitat for insect-gleaning birds such as grosbeaks, chickadees*, western tanagers, and warblers (CDFG 2008, Davis et.al. 1994).*

Subalpine coniferous forest occurs at the highest elevations of the San Gabriel Mountains and is dominated by lodgepole pine, limber pine, and white fir. A few alpine plants in southern California are narrow endemics (native to and restricted to a relatively limited area) while others are widely distributed with disjunct populations on peaks in the Sierra Nevada Mountains, Great Basin, and even in the Rocky Mountains (USFS 2005, Major and Taylor 1988, Stephenson and Calcarone 1999).

On high peaks such as Mount San Antonio (10,500 feet), lodgepole pine forms krummholz, a term used for woodlands made up of deformed trees growing in widely spaced, low-growing, multi-stemmed prostrate mats. Krummholz is an environmental response to the harsh alpine growing conditions (Major and Taylor 1988; Thorne 1988).

Riparian Communities

The study area contains a wide range of riparian habitats including Mojave riparian forest, southern coast live oak riparian forest, southern cottonwood willow riparian forest, southern mixed riparian forest, southern riparian scrub, and southern sycamore alder riparian woodland (Davis et. al. 1998).

Much of the remaining intact riparian habitat in the study area is in the San Gabriel Mountains and foothills and the upper Santa Clara watershed.

In the San Gabriel Valley and Los Angeles coastal plain, riparian areas exist along river corridors and creeks in the Puente-Chino Hills. It is estimated that approximately 75% of the historical riverine areas associated with the lower San Gabriel River have been lost to urbanization and alterations for flood protection. The greatest losses have occurred in the Whittier Narrows area (Stein et al 2007). Remaining riparian areas support a high diversity of wildlife including threatened and endangered species.

Wetlands

Lacustrine wetlands or freshwater marsh develop in areas of still or slow-moving permanent freshwater and is dominated by the perennial, emergent cattail. Small areas of freshwater marsh are found

in Puente Hills valleys, along major drainages, in scattered locations along the shorelines of reservoirs and natural lakes in the San Gabriel Mountains, along slow-flow portions of the river and tributaries within the upper Santa Clara River, adjacent to artificially created impoundments used to water livestock, and in scattered ponds and irrigation ditches throughout the Antelope Valley.

Wet Meadows. The San Gabriel Mountains support small, widely scattered, montane meadows. Montane meadows are grass- and herb-dominated plant communities within lower and upper montane conifer and mixed hardwood-conifer forests. Montane meadows are restricted to sites where there is a combination of gentle slope gradient, relatively impervious bedrock, high soil moisture retention, shallow depth to groundwater, and fine-textured soils. Many meadows form along fault zones or other geologic contact points that impound groundwater. Some San Gabriel Mountains meadows serve as popular recreation areas (Stephenson and Calcarone 1999).

Other Types of Vegetation

Agricultural lands in the study area include orchards, irrigated croplands, and ranchlands. Most agricultural areas are located in the Antelope Valley, although a few areas of the Puente and San Jose Hills still have cattle-grazing. Most of the lands in the San Gabriel Valley and Los Angeles Coastal Plain are developed. *Urban woodlands* that consist primarily of ornamental trees such as eucalyptus, Canary Island pine, and jacaranda dominate these areas (Schiffman 2005).

Disturbed or barren areas either completely lack vegetation or are dominated by ruderal species. Ruderal vegetation includes grasses and "weedy" herbaceous species, including doveweed, mustards, wire lettuce, sow thistle, telegraph weed, Russian thistle, dock, yellow star thistle, Australian saltbush, and cocklebur. Disturbed areas primarily occur throughout the Soledad basin and in the Antelope Valley.

SPECIAL STATUS PLANTS

The diverse range of plant communities in the study area contains suitable habitat for 77 plant species considered sensitive, rare, threatened or endangered. Of these 77 species, 53 are endemic (See Tables B1 and B2 in Appendix B). The study area provides habitat for 5 federally-listed threatened (FT) or endangered (FE) plant species described below. See maps: Federally-Listed Threatened and Endangered Species and Designated Critical Habitat.

Braunton's milk vetch (FE)

Braunton's milk vetch (*Astragalus brauntonii)* is associated with fire dependent chaparral habitats. Populations are found only on limestone or wash sites following a fire event. Known only to Ventura, Los Angeles, and Orange Counties, the remaining populations contain no more than approximately 20 to 30 individuals and the current total number of individuals is estimated to be fewer than 100. Within the study area, specimens have been found in Monrovia (Clamshell Canyon) and in the Puente-Chino Hills. The Clamshell Canyon area is designated critical habitat for this species. Threats to this species include direct loss from urban development, fragmentation of habitat and reduced capabilities for sustained ecologic processes, fragmented ownership of single populations resulting in different landscape treatments, alteration in fire cycles, and extinction from naturally occurring events due to small population size and low numbers of individuals (USFWS 2006b).

California Orcutt Grass (FE)

California Orcutt grass (*Orcuttia California*) is an annual grass associated with vernal pool systems in Los Angeles, Riverside, and San Diego Counties. Listed as endangered by both federal and state governments, this species is in decline. Several specimens have been located in the upper Santa Clara watershed (CDFG 2000). Threats include habitat loss and degradation due to urban and agricultural development, livestock grazing, off-road vehicle use, trampling, invasions from weedy nonnative plants, and other factors (USFWS 1998).

Nevin's barberry (FE)

Nevin's barberry (*Berberis nevinii*) is an evergreen shrub in the barberry family that is endemic to southern California. Naturally, this species occurs in scattered locations in association with alluvial scrub, chaparral, coastal sage scrub, oak woodland, and/or riparian scrub or woodland. Specimens in the study area are located in the foothills of the San Gabriel Mountains. Threats to the long-term survival of Nevin's barberry include the introduction of invasive, nonnative plants that compete with native species and contribute to combustible fuel loads, and fire management strategies that alter natural fire processes. Designated critical habitat is located on U.S. Forest Service and Bureau of Land Management lands in Riverside County (USFWS 2008).

Slender-horned Spineflower (FE)

Slender-horned spineflower (*Dodecahema leptoceras*) is an annual in the buckwheat family. Its habitat is older alluvial scrub habitat in southern California. Within the study area, populations occur in the Santa Clara, Tujunga, and Santa Ana River watersheds. Remaining populations are primarily threatened by development projects, flood control activities, sand and gravel mining, and recreational uses (CDFG 2000).

Thread-leaved brodiaea (FT)

Thread-leaved brodiaea *(Brodiaea filifolia)* is a perennial herb typically found on gentle hillsides, valleys, and floodplains in mesic, southern needlegrass, grassland plant communities. It is threatened by urban development, off-road vehicle use, grading, alteration of existing hydrologic conditions resulting from flood control structures, over-grazing, and competition from non-native plant species. Designated critical habitat areas are located in the southern foothills of the San Gabriel Mountains near Glendora and San Dimas where they are associated with grassland, coastal sage scrub, and mixed chaparral (USFWS 2005c).

Wildlife

Early explorers described the Los Angeles region as being rich in wildlife. Father Crespi and Pedro Fages of the Portola Expedition described vast numbers of antelope, hares, and tracks of other very large animals that were present in the San Gabriel Valley. Large mammals included coyote, wolf, fox, and mantugar (described as a sucking pig). There were also many reptiles and amphibians (Crespi 2001, Fages 1919). Fages described numerous varieties of birds including various kinds of thrushes, and a few birds of prey quail, sparrows, mocking birds, woodpeckers, vultures, pelicans, herons, ducks, divers, mud hens, and others (Fages 1919).

California prairie was also home to both grizzly and black bears, ground squirrels, and many other small mammals. William H. Brewer, a botanist and member of the Whitney geological survey expedition, described the San Gabriel Mission as being the "adobe for myriads of ground squirrels." Additional prairie animals would have included the badger, long-tailed weasel, western meadowlark, horned lark, and ferruginous hawk. Small native mammals and bears created the soil disturbances that constituted an important ecological component of the prairie ecosystem (Schiffman 2005).

Today, native wildlife still constitutes the majority of the faunal species in the Los Angeles basin. These species are recent immigrants from the natural chaparral and woodlands on the hillsides and in the canyons adjacent to the urbanized plains and valleys. Some of these native animal species are probably more widespread today than they were at the time of European contact (Schiffman 2005).

WILDLIFE CORRIDORS

The San Gabriel Mountains are the largest contiguous protected open space area in Los Angeles County. Because of the diversity of habitat in the mountains, they are a refuge for native wildlife. Species include large predators such as black bears, mountain lions and numerous coyote. Other large mammals include the state-protected bighorn sheep and mule deer. Insects include ants, grasshoppers, and butterflies. Riparian areas feature rare and endangered fish and amphibian species. The only known location for mountain yellow-legged frog is in the San Gabriel Mountains. Other reptiles and amphibians that reside here include the San Gabriel Mountains slender salamander (endemic), western spadefoot toad, coast range newt, and the coast horned lizard. Wildlife connections to the adjacent Castaic and San Bernardino Mountains are important for wildlife diversity and migration.

Another important regional wildlife corridor is the connection between the San Gabriel Mountains and the Sierra Pelona Range. The Agua Dulce Canyon in Soledad basin provides an important wildlife corridor between these two large protected areas. As the only major river in southern California without any dams on its main channel, the Santa Clara River functions as an important corridor between the mountains and the ocean. Protecting this corridor is a high priority for local and state agencies as well as conservation groups.

The Puente-Chino Hills are part of an important regional wildlife corridor. Together, the Puente-Chino Hills and Santa Ana Mountains encompass about 511,000 acres of wildlands which contain biological resources of statewide and worldwide significance (Noss, Beier and Shaw, n.d.). This wildlife corridor contains many of the rare and endangered ecosystems of the southern California region including coastal sage scrub, alluvial fan sage scrub, grasslands, Southern California walnut woodlands, big-cone Douglas fir forest, and Engelmann oak woodlands (Noss, Beier and Shaw n.d.).

Encroachment by roads and development threatens habitat connections. Fragmentation of the wildlife corridor from encroaching development impacts wildlife diversity. Mammals, which are top predators

(mountain lions, coyotes and bobcats), are the most threatened by fragmentation.

"The Puente-Chino Hills/Santa Ana Mountains complex provides an archipelago of natural open space thrust into one of the world's largest metropolitan areas. As such, their value for biodiversity conservation, environmental education, outdoor recreation, and scenic beauty are immense (Noss, Beier and Shaw n.d.)."

Protecting this wildlife corridor is a high priority for local and state agencies. In 2006, a 20-foot wide, 160-foot long concrete tunnel in the Puente Hills was installed beneath Harbor Boulevard to provide a safe crossing for wildlife moving between Whittier Narrows and the Santa Ana Mountains.

SPECIAL STATUS WILDLIFE

A high concentration of sensitive wildlife is present in the study area, which provides habitat for approximately 116 species considered sensitive, rare, threatened or endangered (See Tables B1 and B3 in Appendix B). Eleven of these species are federally listed threatened (FT) or endangered (FE) animals (See maps: Federally Listed Threatened and Endangered Species and Designated Critical Habitat).

Arroyo Toad (FE)

Arroyo toads (*Bufo microscaphus californicus*) are found in seasonal pools and streams where natural disturbance is common. A highly sensitive species, arroyo toads are known to have one of the most specialized habitat requirements of any amphibian found in California. Shallow breeding pools with a minimum of silt, and free of predatory fish, are necessary for successful juvenile development (CDFG 2000).The arroyo toad is threatened by urban development, agriculture, and water diversions and was listed as endangered in 1994. Critical habitat has been designated for streams in the San Gabriel Mountains (Big Tujunga Creek and Little Rock Creek). The only known population in Antelope Valley is on Little Rock Creek above the Little Rock Reservoir (PCR Services 2000a, USFWS 2005a).

California Condor (FT)

Suitable habitat for condors *(Gymnogyps californicus)* includes foothill rangeland and forest in remote areas where the birds can roost and nest in tall trees and on cliffs. Rock outcrops in the San Gabriel Mountains provide suitable habitat for condors. Condors once considered extinct from this region have been sighted in the San Gabriel Mountains (CDFG 2008a and USFS 2005).

Coastal California Gnatcatcher (FT)

The coastal California gnatcatcher *(Polioptila californica californica)* is an insect-eating bird that typically occurs in or near coastal sage scrub, alluvial fan sage scrub, southern coastal bluff scrub, and coastal-sage chaparral. This subspecies is restricted to coastal southern California and northwestern Baja California, Mexico. Considered locally common in the mid-1940s, by the 1960s, the gnatcatcher experienced a significant population decline in the United States that has been attributed to widespread destruction of its habitat. Critical habitat for the coastal California gnatcatcher includes areas of the western San Gabriel Mountains, the San Jose Hills, the southern San Gabriel Mountain foothills east of Azusa, the Montebello Hills, Whittier Narrows, and the Puente-Chino Hills (USFWS 2007).

Desert Tortoise (FT)

Desert tortoise occupy desert scrub habitat in California, Nevada, Arizona, and southwestern Utah. Small numbers of desert tortoise occur along the northern edge of the San Gabriel Mountains. The U.S. Fish and Wildlife Service determined that the Mojave population of desert tortoise was threatened in 1990. The desert tortoise was listed in response to the loss and degradation of habitat caused by urbanization, agricultural development, recreational use, military training, mining, and livestock grazing. Individual species are also threatened by collision with automobiles and collection by humans for pets (USFS 2005).

Mountain Yellow-legged Frog (FT)

Mountain yellow-legged frogs (*Rana mucosa*) are diurnal frogs that occupy shaded streams with cool water from springs or snowmelt. Historically, the mountain yellow-legged frog was found throughout southern California on both the coastal and desert slopes of the San Gabriel, San Bernardino, San Jacinto, and Palomar mountains. Current surveys show that the frog has disappeared from most of its historical range in southern California. Most of the remaining populations are located in isolated headwater streams in the San Gabriel Mountains (USFWS 2005b). Designated critical habitat for the mountain yellow-legged frogs includes the East and North Forks of the San Gabriel River, the South Fork of Big Rock Creek, Little Rock Creek, Devil's Canyon, Day Canyon, and Bear Creek (USFWS 2006a).

Least Bell's Vireo (FE)

The Least Bell's vireo (*Vireo beliipusillus*) inhabits riparian woodlands with tall trees and shorter

thick shrubs. Loss of riparian habitat, urbanization, non-native species invasion and predation, and long-term camping threaten the Least Bell's vireo. Riparian areas within the study area contain suitable habitat for the Least Bell's vireo (USFWS 1994).

Red-legged Frog (FT)

California red-legged frogs (*Rana aurora draytonii*) inhabit shrubby riparian areas and deep, slow moving water. Threats to the California red-legged frog include habitat degradation, off-road vehicles, reservoir construction, grazing, non-native aquatic predators, and water quality. Critical habitat for the red-legged frog was designated in 2006. A population of California red-legged frogs was recently discovered in the Angeles National Forest after the 2009 Station Fire (USFWS 2010, USFS 2010).

Southwestern Willow Flycatcher (FE)

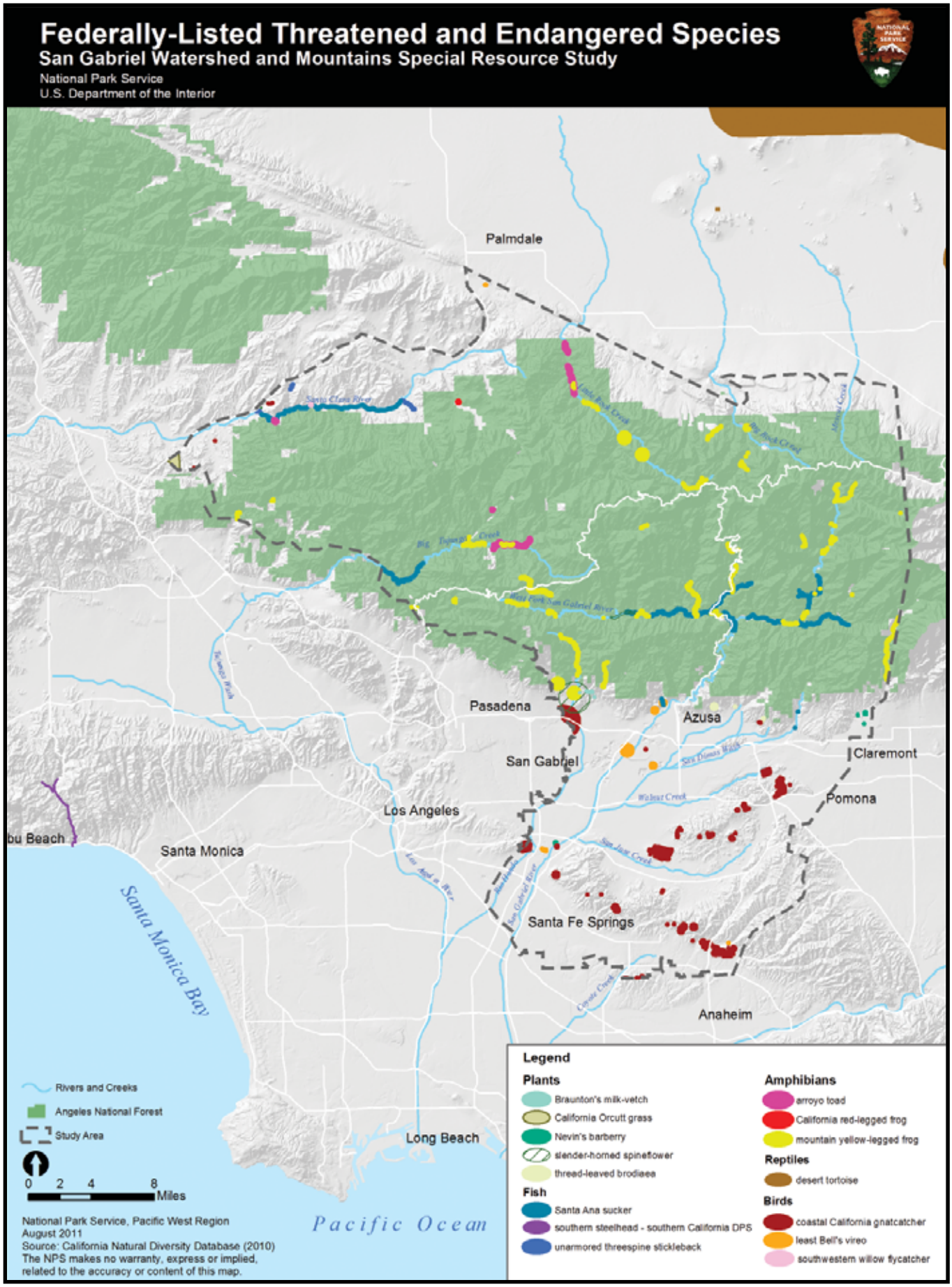
The southwestern willow flycatcher (*Empidonax trailii extimus*) is a small insectivorous bird that makes its home in dense riparian areas in the study area. Nesting takes place primarily in thick riparian stands of willows or coast live oaks. Threats such as cowbird parasitism and habitat destruction from urban, recreational, and agricultural development have reduced the species so that, on the California coast, they can only be found in small isolated populations. Major threats to this species include loss of habitat and nest parasitism by the brown-headed cowbird (USFWS 1995).

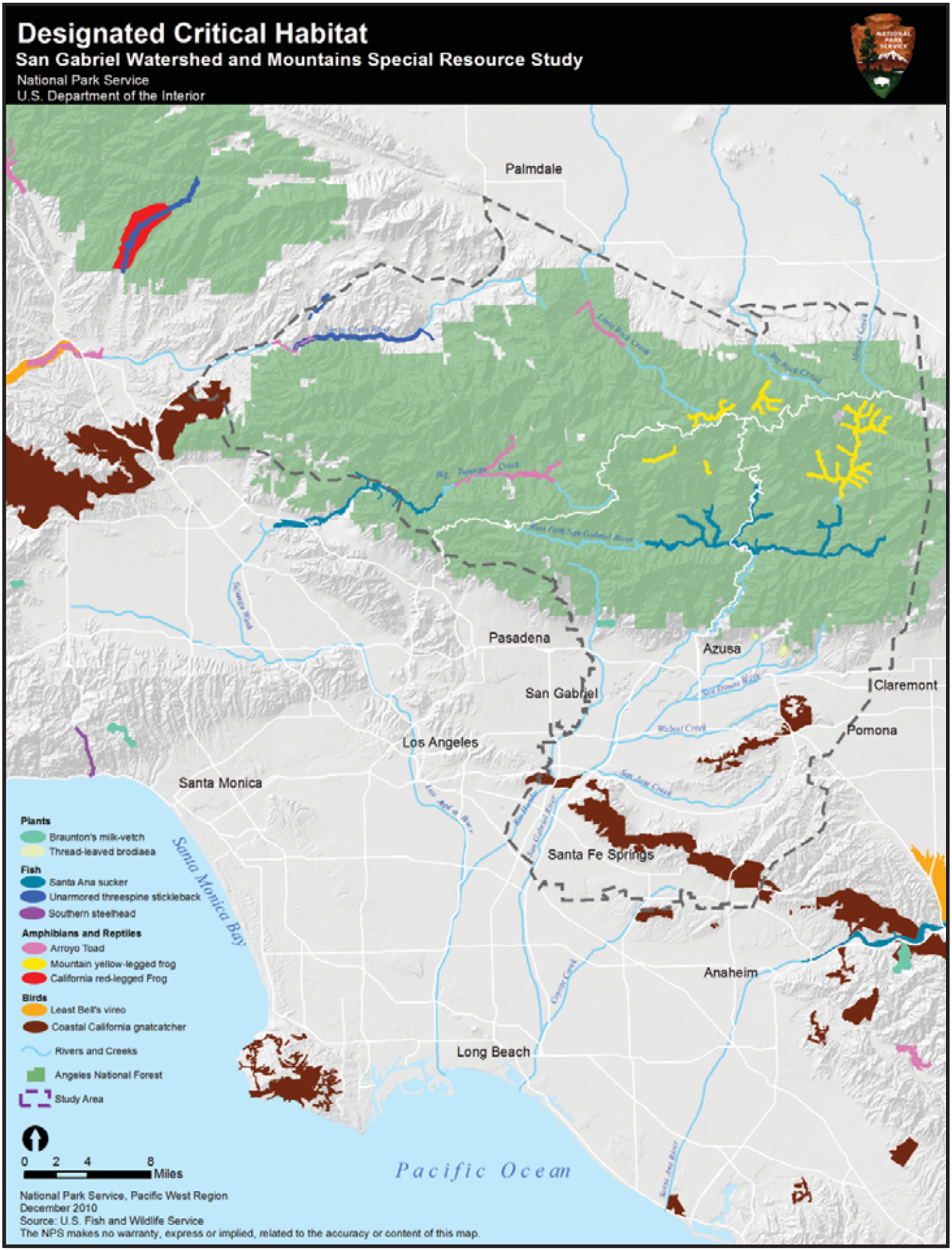
FISHERIES

The Los Angeles basin was home to at least seven native species of freshwater fishes that have been declining or have been extirpated since the 1930s. Steelhead (*Oncorhynchus mykiss*), the Pacific lamprey (*Lampetra tridentata*), the Pacific brook lamprey (*Lampetra* cf. *pacifica*), and the unarmored threespined stickleback (*Gasterosteus aculeatus williamsoni*) have been extirpated from the Los Angeles basin since the 1950s. Two others, the Santa Ana speckled dace (*Rhinichthys osculus*), and the arroyo chub (*Gila orcutti*), have become rare in the Los Angeles basin (Swift. et al. 1993; USFWS 2004).

Historically, the San Gabriel River was the most abundant trout stream in southern California (Robinson 1946). The West, North, and East forks of the San Gabriel River and their tributaries contain highly significant aquatic habitats. Low-elevation portions of these streams provide refugia for a number of sensitive native fish species, including the Santa Ana sucker, Santa Ana speckled dace, and arroyo chub.

Photos (top to bottom): 1. California gnatcatcher. Photo courtesy of BonTerra Consulting. 2. Pacific gopher snake, Angeles National Forest. Eric Lowenback photo. 3. Mountain yellow-legged frog. Photo courtesy of BonTerra Consulting.


Federally-Listed Threatened and Endangered Species
San Gabriel Watershed and Mountains Special Resource Study
National Park Service
U.S. Department of the Interior
Palmdale
Pasadena
Azusa
Claremont
San Gabriel
Pomona
Los Angeles
Santa Monica
Santa Fe Springs
Anaheim
Long Beach
Santa Monica Bay
Pacific Ocean
Rivers and Creeks
Angeles National Forest
Study Area
0 2 4 8 Miles
National Park Service, Pacific West Region
August 2011
Source: California Natural Diversity Database (2010)
The NPS makes no warranty, express or implied, related to the accuracy or content of this map.
Legend
Plants
Braunton's milk-vetch
California Orcutt grass
Nevin's barberry
slender-horned spineflower
thread-leaved brodiaea
Fish
Santa Ana sucker
southern steelhead - southern California DPS
unarmored threespine stickleback
Amphibians
arroyo toad
California red-legged frog
mountain yellow-legged frog
Reptiles
desert tortoise
Birds
coastal California gnatcatcher
least Bell's vireo
southwestern willow flycatcher


Designated Critical Habitat
San Gabriel Watershed and Mountains Special Resource Study
National Park Service
U.S. Department of the Interior
Palmdale
Pasadena
Azusa
Claremont
San Gabriel
Pomona
Los Angeles
Santa Monica
Santa Fe Springs
Anaheim
Long Beach
Pacific Ocean
Santa Monica Bay
Plants
Braunton's milk-vetch
Thread-leaved brodiaea
Fish
Santa Ana sucker
Unarmored threespine stickleback
Southern steelhead
Amphibians and Reptiles
Arroyo Toad
Mountain yellow-legged frog
California red-legged Frog
Birds
Least Bell's vireo
Coastal California gnatcatcher
Rivers and Creeks
Angeles National Forest
Study Area
0 2 4 8
Miles
National Park Service, Pacific West Region
December 2010
Source: U.S. Fish and Wildlife Service
The NPS makes no warranty, express or implied, related to the accuracy or content of this map.

The largest remaining population of arroyo chub is reported from the West Fork of the San Gabriel River and the largest remaining population of Santa Ana speckled dace are on the lower reaches of the East, North, and West forks (Swift et. al. 1993, Stephenson and Calcarone 1999).

Because of stocking, rainbow trout (*Oncorhynchus mykiss*) are the most abundant species of fish found in the San Gabriel River drainage system. Populations occur on the West, North, and East forks of the San Gabriel River, and in both San Gabriel and Cogswell Reservoirs. Average densities of over 3,500 fish per mile were recorded on the West Fork (Deinstadt et. al. 1990). The upper San Gabriel River drainage is the most heavily stocked river system in the Los Angeles Basin, with more than 60,000 rainbow trout introduced annually into these waters from October through June.

The Santa Clara River also supports important habitat for native fish including southern steelhead, unarmored three-spine stickleback, tidewater goby, Santa Ana sucker, and arroyo chub (LADPW 2005). The Tujunga River Watershed supports both the Santa Ana sucker and arroyo chub (The River Project 2006).

SPECIAL STATUS FISH SPECIES

Santa Ana Sucker (FE)

The Santa Ana sucker (*Catostomuss antaanae*) is endemic to the Los

Angeles River, the San Gabriel River, and the Santa Ana River. Habitat requirements include clean, clear, and relatively cool streams of varying width and depth with a mix of substrates including sand, gravel, cobble, and boulders.

This species is now restricted to three noncontiguous populations in: Big Tujunga Creek; the East, West, and North Forks of the San Gabriel River; the lower and middle Santa Ana River; and the Santa Clara River Watershed. The Santa Clara River population of Santa Ana sucker is presumed to be an introduced population. The East, North, and West forks of the San Gabriel River are all designated as southern California arroyo chub/ Santa Ana sucker streams in the California Natural Diversity Database (CDFG 2006).

The population in the San Gabriel River drainage system is considered to be the only viable population within the species' native range. Threats to the Santa Ana sucker include urbanization, water diversions, dams, introduced competitors and/or predators, and other human-caused disturbances likely are playing a role in the decline of the species (USFWS 2004).

Southern Steelhead (FE)

Southern steelhead (*Oncorhynchus mykiss irideus*) are winter-run steelhead whose native habitat occurs in basins along the southern California coast. Steelhead require quality freshwater, marine, and estuarine ecosystems to support a healthy population, and therefore serve as an important indicator of watershed health. The coastal watersheds of the study area provide essential habitat for steelhead.

Native southern steelhead were historically reported from the San Gabriel River, but are now extinct as a result of major habitat modification or blockage of stream ways associated with flood control, urban development, and other factors. While the West Fork currently supports a productive, self sustaining "wild" trout population, this condition is a result of past stocking programs.

All tidally influenced waters within the study area are designated in the 1996 amendments to the Magnuson-Stevens Fishery Management and Conservation Act as "Essential Fish Habitat."Additionally, the study area is part of the Southern California Evolutionarily Significant Unit (ESU). An Evolutionarily Significant Unit is a distinctive group of Pacific salmon, steelhead, or sea-run cutthroat trout (NOAA 2002).

Unarmored Threespine Stickleback (FE)

The unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*) is a small, scaleless, native fish that resides in slow water creeks along the California coast. It is endangered in its native habitat, the western and northeastern seaboards of the United States. Within the study area the stickleback is found in the Soledad basin in several tributaries of the upper Santa Clara River (CDFG 2000).Threats include habitat loss through stream channelization, increased water turbidity, introduction of nonnative competitors, water pollution, aquifer draw downs, and beaver activity. Critical habitat for the stickleback has been proposed for portions of the upper Santa Clara River and several of its tributaries (USFWS 1980).

Significant Ecological Areas

Through the Significant Ecological Areas program, Los Angeles County has designated and proposed areas of high priority for regional conservation. County significant ecological areas include those areas that contain:

- Rare, endangered, or threatened plant or animal species
- Biotic communities, vegetative associations, or habitat that are either one-of-a-kind, or restricted in distribution on a regional basis
- Habitat that serves as a concentrated breeding, feeding, resting, or migrating grounds, and is limited in availability
- Biotic resources that are of scientific interest because they are either an extreme in physical/geographical limitations, or they represent an unusual variation in a population or community
- Areas important as game species habitat or as fisheries
- Areas that would preserve relatively undisturbed examples of the natural biotic communities in Los Angeles County

Existing significant ecological areas in the study area include Tonner Canyon/Chino Hills, Power Canyon/Puente Hills, Whittier Narrows Dam County Recreation Area, Sycamore and Turnbull Canyons, Buzzard Peak/San Jose Hills, Santa Clara River, Santa Fe Dam Floodplain, Dudleya Densiflora and Gallium Grande populations (San Gabriel Canyon), San Dimas Canyon, San Antonio Canyon Mouth, Big Rock Wash, Little Rock Wash, Desert Montane Transect, and the Rio Hondo Wildlife Sanctuary. Los Angeles County has proposed new additions and expansions to many of these areas in its draft General Plan (2008).

Effects of Fire

Fire is part of the natural ecology in southern California. Many of the plant communities have adapted to natural fire regimes, averaging anywhere from 30 to 200 year intervals in southern California. Over the last two decades, human activities have caused fire to occur much more frequently. Frequently occurring anthropogenic fire as a result of urbanization is currently the most important disturbance factor responsible for displacing native scrub lands. Although many believe that communities such as chaparral and coastal sage scrub are fire-dependent, they are highly threatened by these frequent fires (Keeley 2005, Halsey 2008).

In fall of 2009, the San Gabriel Mountains experienced the largest wildfire on record to affect the Los Angeles region. Determined to be caused by arson, the fire burned approximately 161,000 acres, all within the study area. Approximately 154,000 acres of the burned lands were part of the Angeles National Forest and 6,700 acres were private lands.

The Burned Area Emergency Response (BAER) Assessment team evaluated Soil Burn Severity for national forest and private lands. The initial assessment was made in 2009 and a follow-up assessment was made after initial recovery efforts in 2010. Approximately 73 percent of the burn area was mapped as having a moderate or high soil burn severity (62% moderate and 11% high). The remaining 27% was either low soil burn severity or unburned.

Thirty seven plant communities were burned or impacted by suppression activities during the fire. In addition, the burned area includes occupied and potential habitat for one federal endangered plant species and eleven Forest Service sensitive plant species. Some of these habitats and species are at risk to further losses due to habitat loss.

Recent BAER team evaluations indicate the native vegetation within the burn area is recovering well due to a combination of factors. These include the native vegetation's adaptation to fire, the fire return interval being over 30 years in many of the burned areas, and the average rainfall year. Burn areas that seem to be experiencing a slower recovery are those locations where the factors listed above have not occurred simultaneously. These areas primarily occur on the drier, northern slopes composed of desert transition chaparral and California juniper/pinyon pine scrub, which are adapted to longer fire return intervals (50-200 years) and typically recover more slowly post-fire.

The most significant negative influence upon the vegetation recovery throughout the burn area is the abundance of nonnative plant species. Illegal off-highway vehicle activity can exacerbate the spread of nonnative species further hampering vegetation community recovery.

The BAER Report predicted that post-fire events would lead to the potential injury or mortality of threatened and endangered species. The modification of streams by post-fire sediment loads is a major threat to species such as arroyo toad, California red-legged frog, mountain yellow-legged frog, western pond turtle, Santa Ana sucker, arroyo chub, and Santa Ana speckled dace. Many historic pools that functioned as habitat are now filled with sediment. In some areas, the stream channels have

become braided or the active channel has shifted to a new location. Rescue teams were able to salvage and relocate some threatened and endangered species to other suitable habitat sites in the region (USFS 2010).

The following treatments were recommended for the Station Fire burned area by BAER team:

- Installing gates and signs for the forest closure areas
- Stabilizing hazardous material sites
- Salvaging threatened and endangered species
- Forest closure patrol and enforcement, and stabilization of cultural resource sites
- Restoring burned wildlife habitat
- Treating pre-existing noxious weed infestations and installing interpretive signs

The Puente-Chino Hills also experienced a significant fire in November 2008, the Freeway Complex Fire. Approximately 30,300 acres were burned, including 90% of Chino Hills State Park. Although many of the important habitats in Chino Hills State Park were impacted by this fire, in Spring of 2009, many habitats were beginning to recover. One of the largest threats to this recovery is the potential of another fire before the plant communities have a chance to reestablish.

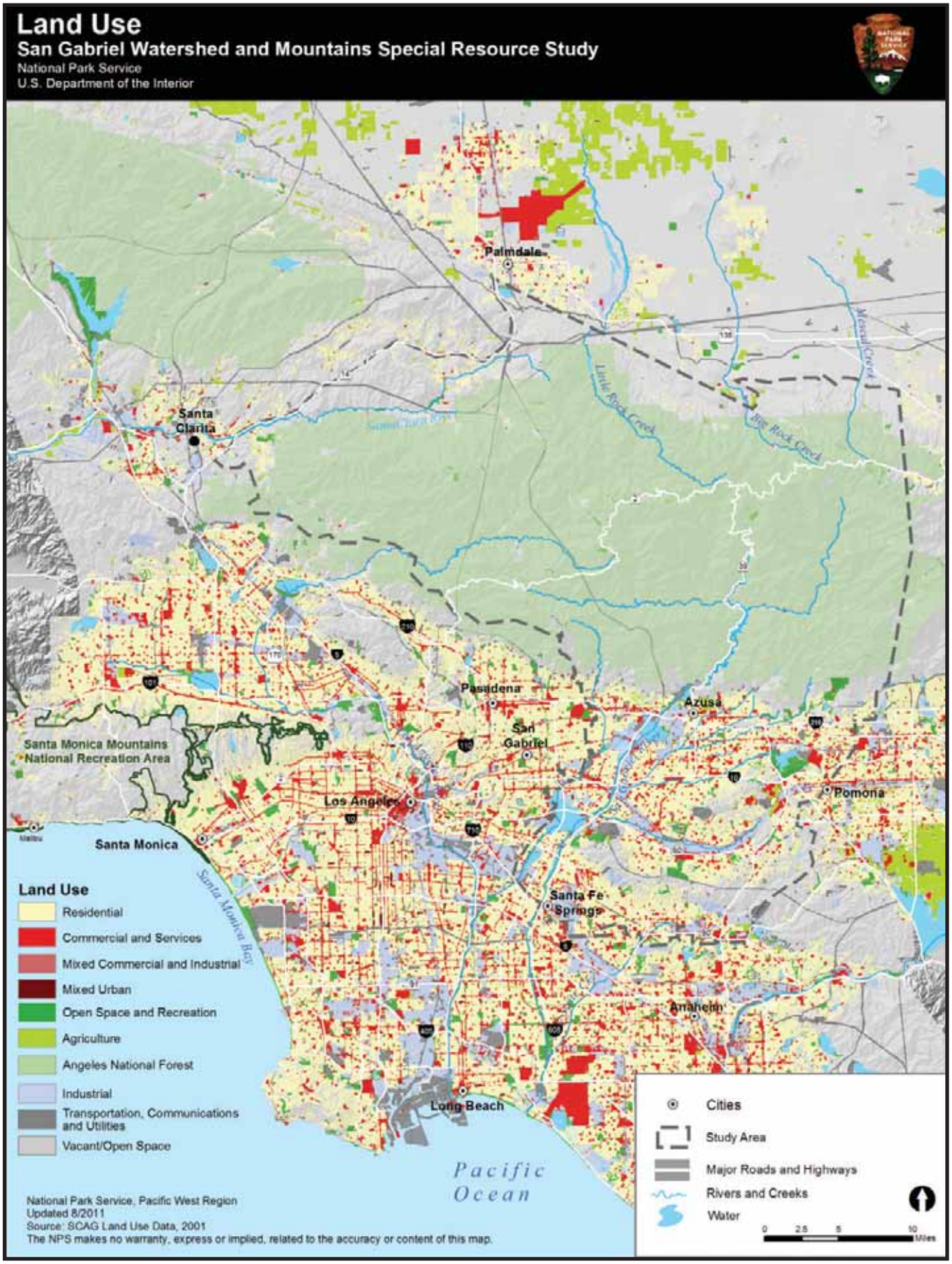
Land Use Condition and Change

Portions of the study area landscape have changed dramatically since European contact in the 18th century. Early explorers encountered braided rivers, natural springs (cienegas), prairie grasslands, thick woodlands, coastal scrub, and dense chaparral forests. Today, many of the native plant communities have been replaced by nonnative species from other locations. This is especially true of the Los Angeles basin where most of the native vegetation has been altered by grazing, cultivated agriculture and ultimately, conversion to urban land uses. Rivers and creeks that once roamed freely from the mountains and crossed over the plains have been altered by dams and engineered channels to prevent flooding of homes and businesses and to provide water for irrigation, domestic, and industrial uses.

While the canyons and foothills of the San Gabriel Mountains were used for timber, irrigation, and grazing during dry periods, higher elevations were less impacted given the difficulty associated with gaining access to the steep slopes, rough terrain, and thick chaparral forests.

With the completion and continued implementation of the flood control plans, and the importation of water to the region, more areas of the Los Angeles Basin became available for urbanization. The chart

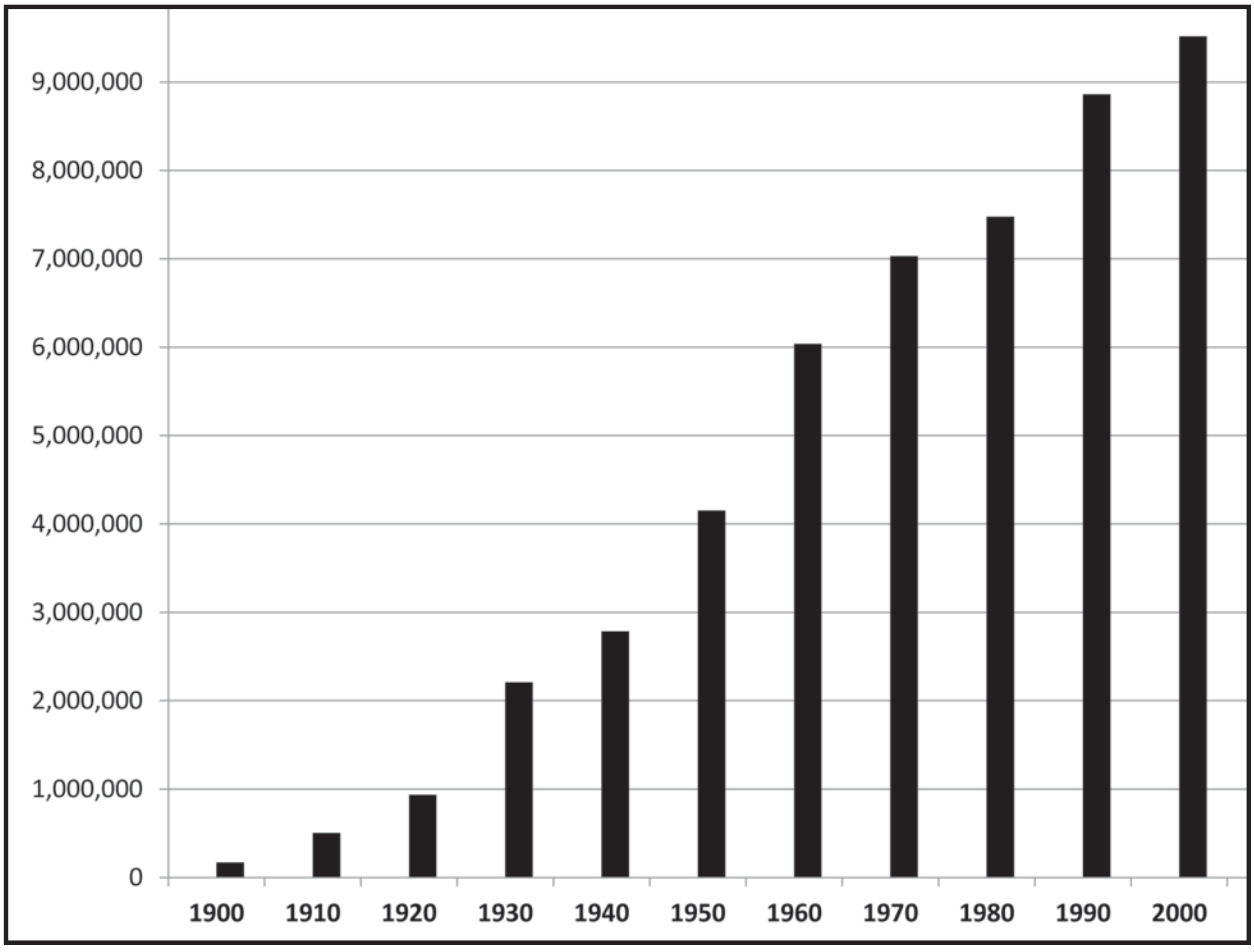
Station Fire in the San Gabriel Mountains, 2009. NPS Photo.


Land Use
San Gabriel Watershed and Mountains Special Resource Study
National Park Service
U.S. Department of the Interior
Palmdale
Santa Clarita
Pasadena
Azusa
San Gabriel
Santa Monica Mountains National Recreation Area
Los Angeles
Pomona
Santa Monica
Santa Fe Springs
Anaheim
Long Beach
Pacific Ocean
Santa Monica Bay
Little Rock Creek
Big Rock Creek
Land Use
Residential
Commercial and Services
Mixed Commercial and Industrial
Mixed Urban
Open Space and Recreation
Agriculture
Angeles National Forest
Industrial
Transportation, Communications and Utilities
Vacant/Open Space
Cities
Study Area
Major Roads and Highways
Rivers and Creeks
Water
0 2.5 5 10 Miles
National Park Service, Pacific West Region
Updated 8/2011
Source: SCAG Land Use Data, 2001
The NPS makes no warranty, express or implied, related to the accuracy or content of this map.

below depicts the rapid urbanization that took place since 1920 and that continued following World War II. Since 1940, Los Angeles County population increased by 240%.

Remaining open spaces are primarily found in the mountains and hills of the region which were more costly areas to build in. These lands remain important wildlife corridors and destinations for recreation. See Map, *Land Use* for area land use as of 2001. Current land use trends are described in Chapter 7, *Environmental Consequences*.

Los Angeles County Population Growth Chart 1900 - 2000

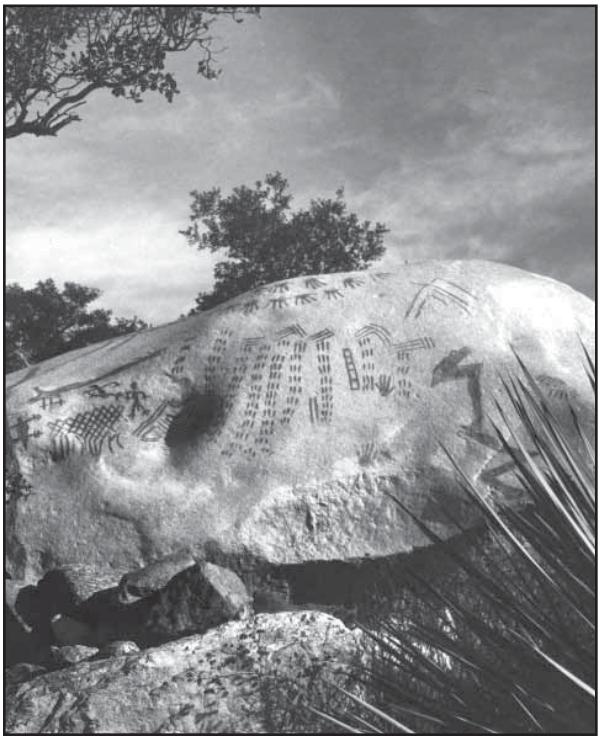


Cultural Resources

Introduction

The San Gabriel Watershed and Mountains area includes rich and diverse cultural resources that represent many layers of history in the region. This history includes the settlement of Native Americans, Spanish missionaries and colonialists, Mexican rancheros, and Euro-American settlers. Many cultural resources within the study area represent the settlement and growth of southern California. The distinctive regional environment, such as mountain passes and riverways, played a role in determining migration routes and settlement patterns. Native American trails, exploration routes, as well as trade and emigration routes from the east, traverse the study area. Later, railroads and highways such as Route 66 would also provide migration routes through the study area.

Cultural resources in the region include prehistoric archeological sites, historic sites, and historic landscape elements related to ranching, agriculture, mining, settlement, and transportation.



Pictographs in the San Gabriel Canyon. 1937. Photo courtesy of the Los Angeles Public Libarary.

Overview of Cultural Resources:

Resources with national designations:

- Portions of the Juan Bautista National Historic Trail, the Old Spanish National Historic Trail, Route 66 Corridor, and the Pacific Crest Trail.
- Upton Sinclair House National Historic Landmark (NHL)
- Other sites that have been nominated or have potential for listing as NHLs include the Mount Wilson Observatory and the San Dimas Experimental Forest both in the Angeles National Forest.
- A theme study on large federal dams found that the Los Angeles County Flood Control System may be nationally significant for its impact on the history and development of the region.

Resources with state and local designations (National Register of Historic Places, California Register, or other local listings):

- There are eight properties listed on the National Register of Historic Places at the state level of significance. An additional 2 sites are listed on the California Register.
- There are 17 State Historic Landmarks and 21 State Points of Historical Interest
- There are 31 properties listed on the National Register of Historic Places at the local level of significance.
- There are 90 additional properties recognized as historically significant by local governments.
- There are 135 historical sites within the study area that appear eligible for listing on the National Register of Historic Places, California Register, or other local listing as individual sites and contributors to a district. Most of these sites need survey evaluation to determine eligibility.
- In addition, there are 106 sites that need to be reevaluated to determine whether they have potential for listing on the National Register of Historic Places, California Register, or local listing/designation.

Prehistory

EARLY HUMAN OCCUPATION

Prior to historic contact in 1769, Native Americans occupied the region for at least 12,000 years. Some Native American groups moved from the inland deserts to coastal areas which had a more suitable environment.

Archeological evidence shows that human occupation of the Los Angeles basin appears to have been continuous since its beginning, though not necessarily by the same peoples. Sites identified on the Channel Islands and near the Los Angeles coast indicate that portions of the study area were occupied or in use during the Paleo-Indian Period. To the east of the study area, the earliest component of the Sayles Site at Cajon Pass, which links the Los Angeles basin with the Mojave Desert, has been dated to approximately 6,000 years. Archeological evidence within the Angeles National Forest date to at least 6,000 years ago (USFS 1986).

NATIVE AMERICAN SETTLEMENTS

Many Native American villages (both primary and seasonal settlements) were located in the Los Angeles basin and in mountain canyons (Raab 2005; Robinson1991). Settlements were adjacent to, or near, freshwater sources, including the San Gabriel River's banks. Interior groups are presumed to have had access to coastal resources either directly or through trade, though historic references refer to inter-village conflicts in which "inland Gabrielino were effectively prevented by coastal Gabrielino from reaching the sea for fishing and trading purposes" (Bean and Smith 1978).

NATIVE AMERICAN GROUPS

Tongva

The Tongva were the predominant native group in the Los Angeles basin from the time of their settlement to their incorporation into the Spanish missions. The Tongva arrived around 2,500 B.P. (before present day), slowly displacing the indigenous Hokan speakers. The Tongva, with the exception of the Chumash, became "the wealthiest, most populous, and most powerful ethnic nationality in aboriginal southern California" (Bean and Smith 1978, Robinson 1991). The Tongva were also known as Gabrielinos because of their incorporation into Mission San Gabriel.

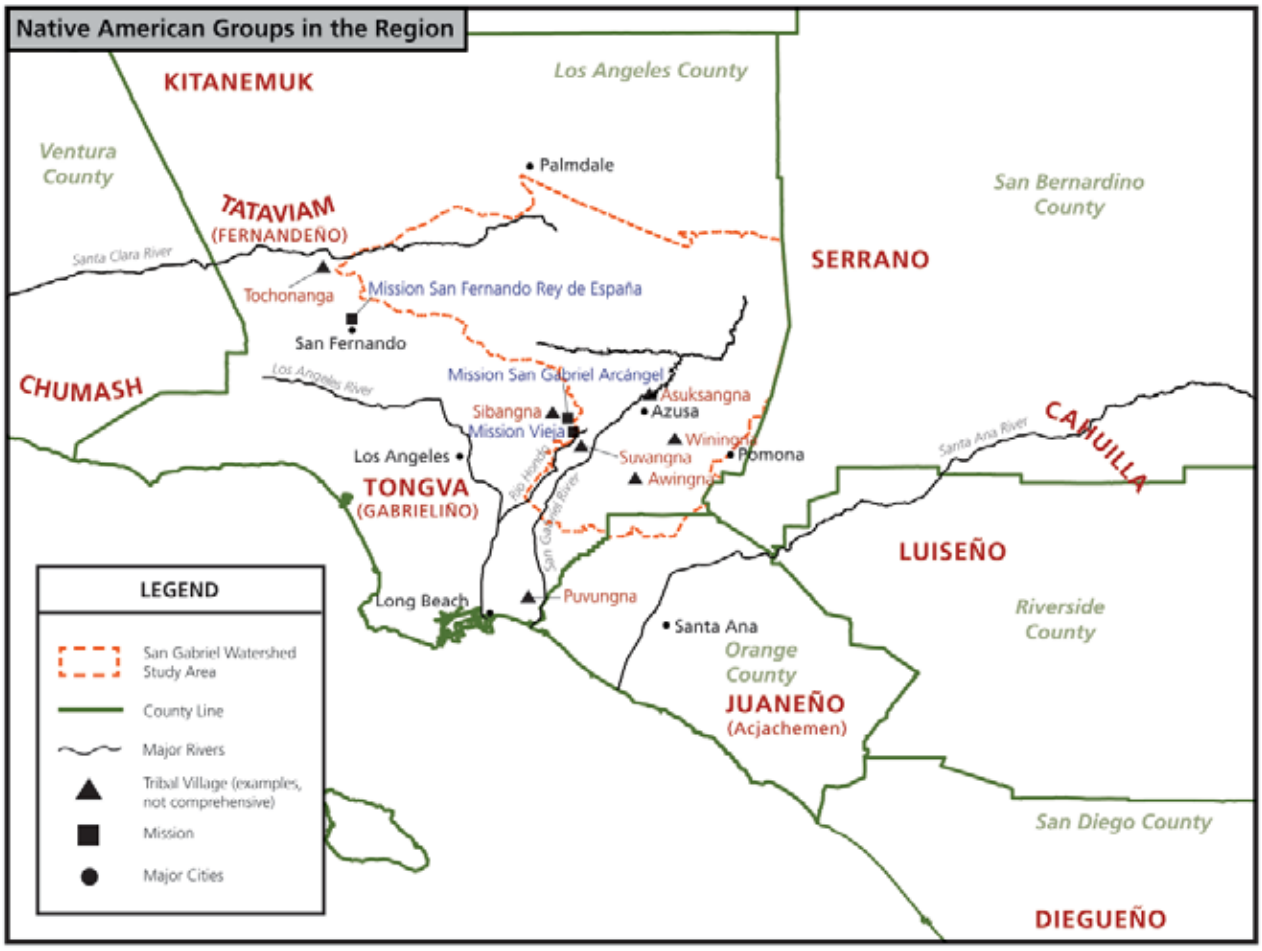
The Tongva were active hunters, artisans, traders, and fishermen. They made trails throughout the mountain areas and traveled seasonally to take advantage of the region's resources (Johnston 1962). The Tongva used the San Gabriel Mountains for hunting deer, mountain sheep, and smaller mammals, and for gathering acorns, pinyon nuts, yucca, sage, and other plants and seeds. The San Gabriel River provided a means for transportation, sustenance, and farming.

The Tongva territory and other areas where they had activities included Los Angeles County south of the crest of the San Gabriel and Santa Monica Mountains, half of Orange County and the islands of San Clemente, San Nicolas, and Santa Catalina (Bean and Smith 1978; Kroeber 1976).

It is difficult to estimate the Tongva population. According to some estimates, their population exceeded 5,000 at the time of contact. It is possible that there were 50 to 100 mainland villages. Houses were large, domed, circular structures thatched with tule, fern, or carrizo. Archeologists have identified approximately 155 aboriginal sites in the mountains; most were seasonal camps for hunting and gathering. Permanent villages were usually along streams or close to springs and marshes. Asuksangna was a large Gabrielino village located on a knoll just outside the mouth of San Gabriel Canyon and north of the city of Azusa (Johnston 1962; Bean and Smith 1978; Robinson 1991). Evidence of permanent Tongva settlement has been found at several places in the North, East, and West forks of the San Gabriel (Robinson, 1946). The Awingna site, located on the banks of San Jose Creek, continued to exist after Rancho La Puente was established. Winingna occupied the city of Covina (Johnston 1962). See graphic, "Native American Villages."

Tataviam

The Tataviam territory was located to the north of the Tongva and was centered in the San Fernando Valley (Kroeber 1976). Their territory included the upper Santa Clara River drainage east of Piru Creek, extending over the Sawmill Mountains to the north to include at least the southwestern fringes of the Antelope Valley. Mount Gleason in the San Gabriel Mountains, at 6,500 feet, was the highest point in their territory (Bean and Smith 1978; Robinson 1991). Tataviam villages varied in size from large centers to small settlements. At the time of contact, the Tataviam population was most likely fewer than 1,000 people. The Tataviam were also referred to as the Fernandeños because of their incorporation into the San Fernando Mission. The Tataviam differed slightly in speech from the Tongva, but were usually grouped with the Tongva due to the similarity of their culture and practices (Bean and Smith 1978).



In recent archeological studies, the Tataviam have been considered a part of the Tongva culture (Robinson 1991).

Other Native American Groups

Other Native American groups in the region did not have settlements within the study area, but traded with the Tongva and Tataviam, traveled through their territories, or became incorporated with them in the missions. These groups include the Chumash, whose expansive territory was to the west; the Serrano (Indian mountaineers), who occupied the eastern end of the San Gabriel Range and the San Bernardino Mountains; the Kitanemuk, who were principally in the Tehachapi Mountains and occupied the major portion of the Antelope Valley; and the Kawaiisu, who occupied the land to the east of the Kitanemuk in the higher Sierra Nevada (Robinson 1946 and 1991; Bean and Smith 1978; Kroeber 1976).

NATIVE AMERICAN LANDSCAPE MANAGEMENT

There are several views on the impact the Native Americans had on the landscape based on different archeological research and historical accounts. These views range from passive hunter/gatherer with little impact on the landscape to societies where active landscape management through burning practices and quasi-agricultural production was common (Raab 2005).

According to one theory now gaining broad acceptance, Native Americans used fire to manage the landscape, playing a very active role in maintaining the diversity of native plant communities. Fire was used to clear forests for growth of certain plants needed for food and fiber and to improve forage for game animals. There are numerous accounts of the intentional burning by the Native Americans in descriptions by the 18th century explorers (Blackburn and Anderson 1993).

PREHISTORIC ARCHEOLOGICAL RESOURCES

The study area contains hundreds of prehistoric archeological sites, with more being recorded each year, many of which represent the Tongva.

Prehistoric sites include permanent and seasonal habitation sites of various sizes with midden soils. Some habitation sites may be associated with rock shelters. Smaller food processing or tool manufacturing sites such as bedrock mortars and lithic scatters may constitute separate sites or be located in association with larger habitation sites. Rock art sites (pictographs and petroglyphs) are also known and are sometimes associated with habitation sites. Cultural features typically associated with habitation sites include housepit depressions and living surfaces (floors) representing semi-subterranean residential and ceremonial structures, earth ovens, stone hearths, rock alignments, and accumulations of fire altered rock. Graves consisting of buried human skeletal remains with or without associated artifacts are also typical of habitation sites.

Much of native southern California material culture, such as basketry, was fiber-based and therefore perishable. Artifacts made of stone, bone, and shell, are often preserved in archaeological sites. They include such objects as: milling stones (ovoid to round grinding slabs) and hand stones (manos); portable stone mortars and pestles; percussion and pressure flaked lithic artifacts such as projectile points, cutting blades, drills and scrapers; steatite pipes, vessels and ornaments; a variety of shell beads, ornaments and implements; bone basketry making implements, seed harvesters and other tools; and bird bone whistles, sometimes decorated with incised patterns or small split-shell beads held fast with asphaltum. Even basketry fragments can be preserved if they have been charred or only partially carbonized by fire.

Most of the recorded archeological sites within the study area are within the Angeles National Forest. Approximately 225 prehistoric sites are located within the Forest, not including isolated finds of individual artifacts. The 7,800-acre Aliso-Arrastre Middle and North Special Interest Area, located within the Aliso, Arrastre, and Kentucky Springs Watersheds on the Santa Clara-Mojave Rivers Ranger District, includes numerous prehistoric archaeological sites ranging from long-term occupation sites to seasonal encampments and special-use resource procurement, processing, and storage sites. There are stone circle features, many of which are interpreted as house rings, storage caches, or religious sites. This concentration of stone circles may be unique in southern California. There are several sites containing cupule rock art features. One of these sites is currently being nominated to the National Register of Historic Places (USFS 2005). A National Register nomination has been prepared for rock art sites within the forest dating from approximately 4,000-200 B.P. Resources include the only remaining Tongva rock art site in eastern Tongva territory.

To the west of the Angeles National Forest, a substantial number of sites have been recorded in the vicinity of Agua Dulce between the cities of Santa Clarita and Acton along Highway 14.

Fewer sites have been recorded in the urbanized communities south of the Angeles National Forest as a consequence of rapid growth and development in the 20th century. Nevertheless, considering the area's relatively dense prehistoric population and the presence of freshwater sources such as the San Gabriel River and its tributaries, there is reasonable potential for finding buried or otherwise obscured prehistoric sites in the area. Archeological sites located within the urban communities include the Patricia Ontiveros Adobe Old Fort and the village of Sejat. Several sites have also been determined eligible for listing on the National Register of Historic Places.

Of the 1,200 archeological sites within the study area that have been recorded, approximately 160 have either been listed, or determined eligible for listing, in the National Register of Historic Places either individually or as sites contributing to larger archeological districts.

Hispanic Period

European exploration into the region during this period (1542-1846) had significant impacts on the lives of Native Americans. Spanish missionaries and explorers forced native cultures to assimilate into the European cultural system. This section describes the Spanish explorations into this area, the missions, ranchos, and associated cultural resources.

Spanish Exploration and the Mission System

Explorations and early settlements during the late 1700s brought about significant changes to the study area landscape, most of which took place in the valleys and plains. The Portola and Anza expeditions brought livestock and new settlements of Europeans and Mexicans through the establishment of missions, pueblos (small towns), and presidios (military posts).

THE PORTOLA EXPEDITION AND EL CAMINO REAL

Many Spanish explorers traveled through the study area and established settlements. In 1769, the expeditions of Don Gaspar de Portola and Padre Junipero Serra led to the founding of five missions and two presidios. The expedition route, known as El Camino Real, crossed through the San Gabriel Valley on its way to Monterey. A historical marker commemorates the Portola Expedition in Brea Canyon, just north of the city of Brea.

THE JUAN BAUTISTA DE ANZA EXPEDITIONS

Captain Juan Bautista de Anza led two expeditions to establish an overland route to connect Sonora, Mexico to Alta California. The route was used to provide the California settlements with supplies. In 1774, Anza left Tubac, Arizona, with soldiers, servants, and a herd of cattle and reached Mission San Gabriel Arcángel. At this time, the mission (Mission Vieja) was in its original location on the banks of the Rio Hondo.

In 1775, Anza made a second expedition bringing more colonists and livestock. Mission Nueva was established at its present location in the city of San Gabriel. On January 4, 1776, the expedition reached the mission during a fierce winter storm. The colonists remained at the mission for about six weeks to rest while Anza, Pedro Font, and soldiers traveled to San Diego to help quell a Native American rebellion (National Park Service 1996).

The colonists that arrived on the expedition more than doubled the Hispanic population of Alta California. With mixed European, Indian, or African parentage, the colonists represented diverse cultural backgrounds. These influences changed the lives of the Native Americans. Pio Pico, the last Mexican governor of California, was a descendent of the expedition colonists (National Park Service 1996). Additionally, this expedition also more than doubled the livestock numbers by bringing over 1000 domestic animals (Burcham 1957).

The Juan Bautista de Anza National Historic Trail was designated in 1990 to commemorate the expedition. The study area includes 19 miles of the 1,200 mile long national historic trail from Pomona in the east to El Monte in the west.

OTHER EXPLORATIONS

Other portions of the region were also explored during the late 1700s – early 1800s. Captain Pedro Fages traveled through Cajon Pass and along the northern foothills of the San Gabriel Mountains looking for army deserters, and Father Francisco Garces traveled southwesterly and intersected the Anza expedition. He camped on the San Gabriel River, near present El Monte (Hafen 1954 and McIntyre 1986). Father Jose Maria Zalvidea explored the Antelope Valley and the Mojave Desert, almost circling what is now the Angeles National Forest (USFS 1986; Robinson 1946; Leadabrand 1966).

THE MISSIONS

The Spanish established a chain of 21 missions and several presidios along the California Pacific Coast. Mission San Gabriel Arcángel was founded in 1771 and Mission San Fernando Rey de España, just beyond the study area, was founded in 1797. Spanish towns, or pueblos, including El Pueblo de Nuestra Señora (Los Angeles), were also established (Beck and Haase 1974).

Mission San Gabriel Arcángel

Mission San Gabriel Arcángel was the fourth Spanish mission. The original site of the mission was located along the Rio Hondo. It is believed that the timber for the Mission came from the San Gabriel Mountains. The first Mission buildings were only used for a few years. The mission was relocated to higher ground 5 miles northeast (presently the city of San Gabriel) in 1776 because of excessive dampness and flooding (King 1975 and 1990).

The missions owned extensive lands within the study area. The San Gabriel Mission lands extended 35 miles south to San Pedro and 62 miles inland to the Muscupaibe Range, totaling approximately 1.5 million acres (King 1990).

The Mission was the center of community life and economic development. Religious and festive gatherings including wedding fiestas occurred at the Mission (Rowland 1948). The Mission was also a place of education, including religious study, agricultural practices, art, and music.

Land Use during the Mission Period. Mission San Gabriel Arcángel became the agricultural leader of the California missions. Spanish settlers established an irrigation system for the mission and the pueblo of Los Angeles. Irrigation water was brought from the foothill canyons of the San Gabriel Mountains. Water from the San Gabriel River was diverted by a brush "toma," or weir, upstream into a system of "zanjas" (ditches) (Robinson 1991; Nelson 1983). Native Americans dug and installed clay-tile pipes.

The native vegetation was well suited to grazing and the missions had several ranches for producing livestock. For example, Mission San Gabriel owned seventeen ranchos for raising cattle and horses,

and fifteen ranchos for raising sheep, goats, and pigs (Burcham 1957). By 1832, the San Gabriel Mission livestock numbers had grown to 16,500 cattle, 11,000 sheep, 830 horses, 117 mules, 280 hogs, and 130 goats. Crops grown on mission lands included wheat, other grains, and many vegetables. In 1834, the Mission was recorded as having four vineyards with over 150,000 vines and over 2,000 fruit trees. Orange trees planted at the Mission were the first citrus grown in Los Angeles County (Sugranes 1909; Farnsworth 1883).

Mission San Fernando

Mission San Fernando, founded in 1797, helped to relieve the long journey between missions San Gabriel and San Buenaventura (in Ventura). It is located west of the study area and south of the Angeles National Forest. Like Mission San Gabriel, Mission San Fernando supplied the Los Angeles pueblo with hides, tallow, cloth, livestock, and other goods. It also became a popular stopping place for travelers. The 240-foot long convento building, built in 1822, is the largest building to survive from mission days and the largest adobe building in California. The church, damaged severely in the 1971 Sylmar earthquake, was demolished, and an exact replica was built (Engelhardt 1908).

Mission Period Impacts on Native Americans

The Tongva culture rapidly declined following the establishment of the missions. Between 1770 and 1830, Native American populations declined from an estimated 310,000 to approximately 245,000. The greatest factor was the introduction of diseases. Other factors included social and cultural dislocation, and outright violence (Cook 1978).

Many Native Americans were incorporated in the missions (San Gabriel Arcángel, San Fernando, and San Juan Capistrano). The Tongva residing in the mission lived under a strict church system of governance, and were provided a minimal education in agriculture, carpentry, cattle-raising, reading, and music (Weber 1979). However, there were also attempts at resistance. The 1785 Toypurina Revolt at Mission San Gabriel and others at San Diego and the Colorado River were organized by leaders who were threatened by Spanish colonial activities (Thomas 1989). In the end, despite the destruction of native villages and cultures, the Tongva peoples survived (Weber 1979).

Mission Period Resources

Construction of the Mission San Gabriel Arcángel began during the latter part of the 18th century, and was completed in 1800. It remains in the city of San Gabriel. Other remaining structures include mills. The 1816 Old Mill, "El Molino Viejo," located in San Marino, was designed of fired bricks and adobe. These sites are state historic landmarks. Although nothing is left of the original structures, the site of the original mission, Mission Vieja, is also a state landmark. Other remaining mission resources are located outside of the study area.

MEXICAN INDEPENDENCE AND THE RISE OF THE RANCHOS

Mexico gained independence from Spain in 1821 and California fell under Mexican rule. Under the new government, missions became secularized, and land grants were given to individuals along with incentives to raise livestock. Many ranchos were established in the region. During this period, population growth in the region began to increase as overland routes to the West Coast were explored and established for trade and commerce.

Photos (top to bottom): 1. Artist representation of the Juan De Anza Expedition - *On the Trail* by Bill Singleton, courtesy of NPS. 2. San Gabriel Mission. 2006. NPS photo.

Trade and Overland Routes (Westward Migration)

The Santa Fe Trail was the first overland route to linking Missouri to Santa Fe, New Mexico. Later, trade routes linking Santa Fe further west to the Pacific were established.

The Old Spanish Trail was the longest and most difficult pack mule route in America. The trail linked Mexican settlements in southern California with those in northern New Mexico. In 1829, Mexican trader Antonio Armijo succeeded in establishing a route from Abiquiu, New Mexico, to Los Angeles. The trail was used for trading woolen blankets from New Mexico for California horses and mules (Hafen 1954).

Trade along the Old Spanish Trail tied into and contributed to a broader economic system, including the Santa Fe Trail/Chihuahua Trail trade, the Camino Real, and the ranching and maritime trade economy of California. Each area contributed its own resources to the trade. New Mexico supplied woolen goods to California and other markets. Within the study area, the ranchos were a significant source for horses and mules. Mission San Gabriel was a supply point for early travelers and the destination for the first trade caravan.

The Old Spanish National Historic Trail (NHT) was designated in 2002. A portion (21 miles) of the 2,700 mile Old Spanish NHT passes through the study area from Claremont and going west to El Monte and into Los Angeles. Several areas within the study area represent settlements from the Old Spanish Trail. El Monte was an encampment. The state historic landmark plaque at the city's Santa Fe Historical Park states that in the 1850s, some began to call El Monte "The End of the Santa Fe Trail." The Bureau of Land Management and the National Park Service are producing a comprehensive management plan for the trail.

Ranchos and Land Grants

In 1833, the Mexican government decreed the missions to be secularized, with their lands and properties dispersed (Thomas 1989). Many settlers and some Native Americans received land grants in the form of ranchos from the secularized lands. Ranchos occupied the valleys and foothills below the San Gabriel Mountains. The ranchos were primarily used for cattle grazing and agriculture. Southern California was heavily dependent on a pastoral economy. Cattle production became profitable since it required little labor and the lands were well suited for raising cattle. The demand for beef intensified as the state's population increased, mainly in the north, following the discovery of gold in 1848.

As cattle, sheep, horses and other livestock increasingly occupied the landscape many native plants lacked the adaptations to withstand the impacts of grazing and were soon replaced by invasive exotic plant species from the Mediterranean region. By 1860s, much of the native grasslands or California prairie had been displaced (Burcham 1957; Schiffman 2005).

Ranchos continued into the early part of the American period until a series of winter storms and droughts beginning in the mid-1800s led to their collapse. According to the census, in 1860, there were 70,000 cattle in Los Angeles County; by 1870 there were 20,000 cattle (Cleland 1941). During this period, sheep replaced the cattle. Raising sheep for wool production was an important industry in the valley from the 1860s through the 1870s. The collapse of ranching affected the economy in the region, greatly reducing the amount of funding from taxes to the state and county (Cleland 1941).

Ranchos within the Study Area

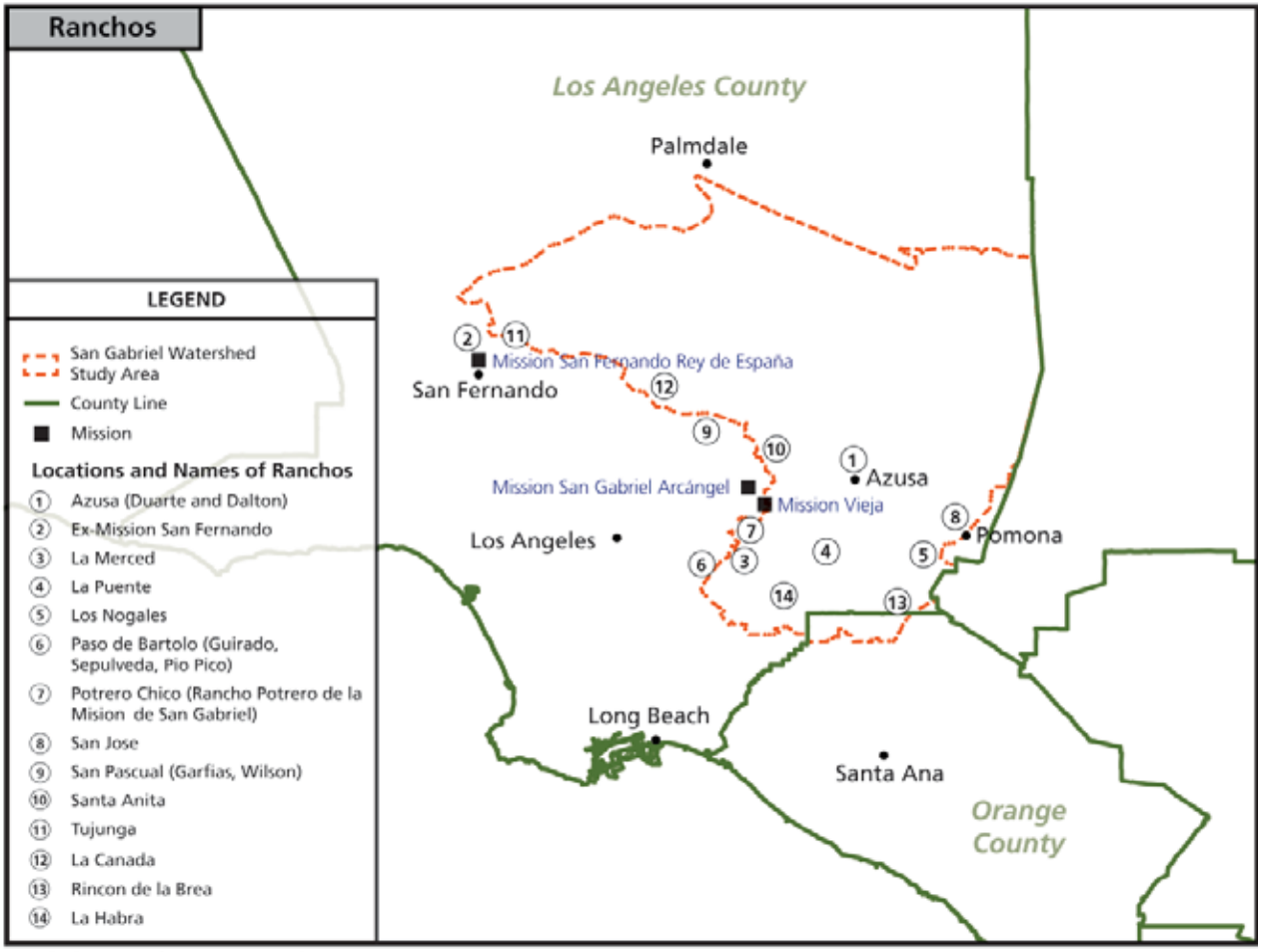
In 1837, the 22,000-acre Rancho San Jose became the first former mission land to be granted. La Casa Primera de Rancho San Jose, built by the Palomares family in 1837, still stands in Pomona; it is now a museum and headquarters of the Pomona Valley Historical Society. The Casa de Madera, now known as the Palomares Adobe, also remains in Pomona and is open to the public.

William Workman, John Rowland, and Juan Matias Sanchez, who arrived in California along the Old Spanish Trail, were granted Rancho La Puente and Rancho La Merced. In 1842, the 48,000-acre Rancho La Puente went to Rowland and Workman (Cleland and Dumke 1966; King 1990 and 1975).

In 1850, Workman purchased Rancho La Merced. The 2,300-acre, triangular-shaped land grant was situated near the site of Mission Vieja. Workman later sold his half of Rancho La Merced to his ranch manager, Juan Matias Sanchez. The Sanchez Adobe still remains and is a historic site in the city of Montebello.

Other ranchos with portions within or near the study area included:

- Rancho Santa Anita, owned by Hugo Reid, consisted of 8,000 acres. Reid was married to a Tongva woman, one of the few Indians who received land after secularization. Reid's account of the Tongva is one of the few sources of information on Tongva life during this period.



National Park Service, Pacific West Region, Internal Map, 03/2011
Sources: Beck, Warren A. and Ynez D. Haase *Historical Atlas of California*

- Rancho Potrero Chico, owned by Juan Matias Sanchez, was one of the San Gabriel Mission's original ranchos.
- Rancho Noghales (Los Nogales) included 4,000 acres south of San Jose Creek.
- Rancho Azusa, named for the Indian Rancheria of Asuksangna, was granted to Andreas Duarte and Luis Arenas in 1841.
- Rancho Paso de Bartolo Viejo was owned by Don Pio Pico, the last Mexican governor of California, who later became a rancher and businessman after American acquisition of California. Pio Pico State Historic Park in Whittier includes Don Pio Pico's adobe mansion, and six acres of the former rancho.
- Other ranchos include Ex-Mission San Fernando, Rancho Tujunga, Rancho La Canada, and Rancho San Pascual (Hafen 1954; Robinson 1991; King 1990).

Rancho Period Resources

There are many resources from the Mexican Land Grant and Ranchos period that still remain within the study area. Many are listed on the National Register of Historic Places, the California Register, or are locally recognized historic sites. They include the Adobe De Palomares, La Casa Primero de Rancho San Jose, the Workman Adobe, the Workman Family Cemetery (El Campo Santo), the Rowland Adobe, John Rowland House, a mill on the San Gabriel River built by Rowland, and the Juan Matias Sanchez Adobe. Several sites associated with Rancho La Puente are listed on the National Register of Historic Places.

Mexican Period Impacts on Native Americans

Following secularization, most Native Americans left the missions to work on ranchos or to return to their native lands. Further spread of disease along with Spanish, Mexican, and American settlement in the state reduced the Native American population to approximately 125,000-150,000 (Cook 1978).

American / Contemporary Period

Prior to the U.S.-Mexican War of 1846-1848, the United States, inspired by the doctrine of "Manifest Destiny," continued to expand to the west while Mexico struggled to control the lands acquired from Spain. During the war, Governor Pio Pico and General Castro concentrated their forces in the Los Angeles area. William Workman and John Rowland were some of the leaders of the American contingent (Hafen 1954). In January 1847, Mexican forces surrendered to the Americans in California, and in September, Mexico City fell, thus ending the war. In 1848, the Treaty of Guadalupe Hidalgo gave California to the United States (King 1990). The Rio San Gabriel Battlefield in Montebello is a state historic landmark commemorating the 1847 battle between American forces and Mexican Californians.

During the mid-1800s, southern California remained primarily Hispanic-dominated with a small population relative to northern California. As previously described, there was a brief explosion of wealth during the first decade of the American period, as the Mexican rancheros provided beef for the gold miners in the mountain regions to the north. Significant growth did not occur in southern California until the 1880s, with the arrival of the railroad and the first real estate booms. These events brought profound changes to the social and cultural make-up of the region, with Anglo-Americans replacing Hispanic Californians as the dominant group (National Park Service 2010).

EARLY AMERICAN PERIOD IMPACTS ON NATIVE AMERICANS

By the time the first Americans settled in the Los Angeles area, Tongva survivors were scattered and working at a subsistence level on Mexican land grants. The discovery of gold in California brought numerous immigrants into regions, including the remote valleys of the Sierra Nevada, that had not previously been occupied by Euro-Americans. During 1845-1855, the Native American population was reduced from 150,000 to just 50,000. Between 1770 (first encounter with Europeans) and 1900, Native American populations severely declined from an estimated 310,000 to approximately 20,000 (a decline of over 90 percent) (Cook 1978). Today, it is estimated that a few hundred to a few thousand Tongva still live in California.

American Period Themes

During the early American period (1846-1950) the Los Angeles region experienced growth and advancements in commerce and industry, transportation, technology and engineering, arts, social history, recreation, and government. These themes and related resources in the study area are described below.

Commerce and Industry

The region's resources provided opportunities for immigrants that moved to the region. Many settlers who came during the gold rush became involved in agriculture. Later, other industries and technologies such as road and water systems provided additional opportunities for the region to develop.

GOLD MINING

Throughout the late 1800s and early 1900s, mining contributed to the growth of the state. Although most of the new immigrants came to northern California, gold mining also contributed to the economy of southern California as the region provided food and supplies to the northern mines (Robinson 1973).

Some prospectors, however, did settle in the southern region with the hopes of discovering gold. Placer gold was mined in the San Gabriel Mountains as early as 1834. (See the Natural Resources "Mineral Resources" section). Gold had been discovered as early as 1842 in Placerita Canyon by Francisco López. This discovery may have contributed indirectly to the more famous, and consequential, American discovery in 1948 by drawing attention to the potential for valuable mineral resources in the new state. This location lies just west of the study area.

Mining was extensive, but few made any profit in the region (Robinson 2007, pers. com.). The areas that were mined within the study area include the San Gabriel Canyon, Tujunga Canyon, the east slope of Mount San Antonio (Mount Baldy), and Mount Gleason (Clark 1998). The most productive gold mines were in the Acton District. The Governor and the Red Rover mines accounted for more than three-fourths of the total gold production in Los Angeles County since 1880 (Robinson 1973). Governor Mine was the most productive gold mine in Los Angeles County. The Bureau of Mines listed the total gold output of the Governor Mine as more than $1,500,000 – almost three times the yield of any other gold mine in the county. Red Rover had a total yield of $550,000 (Robinson 1973).

The mining town of Eldoradoville, located at the main fork of the San Gabriel River, had a population of about 1,500 by 1861. Eldoradoville had general stores, dance halls, and several saloons. Miners had also set up camps along the East Fork of the river building wooden shacks and stone cabins (Smith 1936).

Floods during 1859 and 1861 were difficult for mining operations on the San Gabriel. In 1868, nearly all of the mining equipment was swept out of the canyon. Eldoradoville was completely washed away in the winter of 1861-62, the same event which signaled the demise of southern California's Hispanic cattle industry (Thrall 1935).

The enduring influence of gold mining can be seen today as gold-panning enthusiasts continue to take their pans out to the creeks, rivers, and streams of the San Gabriel Mountains.

Mining-related resources

Former gold mining boomtowns, such as Eldoradoville, and other mining sites are located within the Angeles National Forest. The U.S. Forest Service is evaluating the Eldoradoville site for potential listing on the National Register of Historic Places. Gillibrand Claim #10 (Iron Blossom Mine), Vincent's Blue Cat Claim, and Mining Site have been determined eligible for listing on the National Register of Historic Places. Other mining sites, including North Chilao Placer, Baldora Mining Complex, Noverto Placer Mine, Gold Bar/ Eldoradoville/Hooverville area, Steamshovel Placer, East Fork Old Miners' Trail, and Bighorn Mine, are also being evaluated.

The Baldora Mine Complex appears eligible for the National Register. The preserved ball mill (Baldora Ball Mill No. 2) represents the most intact, complete mine of its type in California. The mines, mills, and their support buildings represent early 1900s mining technology in the San Gabriel Mountains and an important period of early exploration, settlement, and economic development of the region (Conkling and Sturm 1997).

Significant sites related to the discovery of gold are also located just beyond the study area. Oak of the Golden Dream in Newhall is a state historic landmark commemorating California's first authenticated gold discovery by Francisco López.

PETROLEUM

Oil has long been an important resource in the region throughout history. Before the arrival of the Spanish, Native Americans used naturally occurring asphaltum for tools and craft works. Spanish and Mexican settlers learned to use pitch and coal tar from Native Americans. In the 1920s, oil was discovered near Newhall, in northern Los Angeles County (not far from Francisco López's original gold discovery). Soon, more oil was found throughout the Los Angeles basin and in other parts of California. It soon became the most profitable industry in southern California. Oil production in California is ten times greater than its gold production and ranks 2nd in the nation among oil-producing states.

California's petroleum industry began in the Santa Clarita Valley. The Pico Well No. 4, Pico Canyon Oil Field, west of Newhall (just outside the study area), was the first commercially successful well in California and led to other oil production operations within the study area. Well No. 4 made Pico Canyon oil field the most commercially successful oil field in the entire west coast (Stein 1960; Western Oil and Gas Association 1965). It was also the longest continually operating oil well in the world. Oil production continued for 114 years before it was finally capped in 1990. The Pico Well No. 4, Pico Canyon Oil Field, is a National Historic Landmark District.

Within the study area, the Puente Hills and the cities of Whittier and Brea were also rich with oil. Oil was discovered in the Puente Hills in 1884 when William Rowland discovered oil on his father's former ranch, Rancho La Puente. Rowland founded the Puente Oil Company, which produced over a million and a half barrels of oil in its first 15 years (Keating 2006).

Petroleum-related resources

Olinda, located in Brea, was a boomtown in the late 1800s which supplied oil to the Santa Fe Railroad. The 2,300-acre Brea-Olinda field produced more than 300 million barrels of oil in its lifetime (Keating 2006). The area stretched southeast from the Puente Hills through Brea and Tonner canyons to the site of old Olinda. Olinda Oil Well #1, drilled in 1897, is still pumping. Many structures tied to the oil industry have been removed, but features such as access roads, well pads, and several towers and pumps remain. The Brea Cañon Oil Company Building also remains. Olinda is a State Historic Landmark and is known as the Olinda Museum and Trail.

AGRICULTURE

Agriculture played a significant role in the development of the San Gabriel Valley. During the Spanish and Mexican periods, the missions and ranchos cultivated the land for crops and vineyards

and grazed cattle and raised sheep. Agriculturalists first had to overcome high costs for developing irrigation systems, a lack of local markets, limited transportation facilities, and financial dependence upon bankers (Cleland 1941).

The completion of a transcontinental railroad to southern California in 1883 provided a means to distribute produce. With new advances in irrigation systems and the formation of water districts throughout the region, the fertile valleys and foothills were quickly converted to orchards and farms (Burcham 1957).

Citrus

The San Gabriel Valley and other parts of southern California were once dominated by citrus orchards. Citrus was first planted by the Spanish missionaries in the early 1800s. Rancho landowners also planted commercial citrus orchards on their lands. By the late 1800s, citrus became very profitable in the region.

In 1880, there were over 1.25 million citrus trees in southern California (Atchison, Topeka, and Santa Fe Railway 1938; Dumke 1944). In the 1880s and 1890s, sheep herders of the San Gabriel Valley began to trade their stock to grow oranges. The California Foothill Orange and Lemon District stretched along the foothills from Pasadena to Claremont and into San Bernardino County. The southern region of the valley, including towns such as El Monte and Downy, grew citrus and row crops (McBane and Hartig 1998). The Pomona Valley area produced over $2 billion in revenues from the citrus industry between 1890 and 1940.

In the mid-1930s, there were approximately 18,000 growers and the citrus industry employed about 200,000 people (Atchison, Topeka, and Santa Fe Railway 1938). The rapid growth of this industry had significant impacts on workers in the region. Labor for the citrus industry was dominated by Mexican immigrants. This was aided by the removal of immigration restrictions for Mexicans in the early 1900s. "By 1926, 10,000 Mexican pickers worked in Southern California citrus groves, and by 1940 approximately 22,000 Mexican men labored in the orchards, constituting nearly 100 percent of the picking force. Approximately 11,000 Mexican women packed citrus fruit" (Garcia 2001).

Citrus-related resources. Resources from the citrus industry include structures such as packing houses as well as orchards. The College Heights Lemon Packing House/Claremont Packing House and the Teague Grove in San Dimas are examples of resources within the study area. The Teague Grove was one of the largest groves in the world. At one time it had nearly 250,000 trees. Today, there are about a dozen remaining trees.

Walnut

The walnut industry, like the citrus industry, thrived in the region. In the early 1900s, state production was almost entirely from southern California. The walnut crop was handled by brokers, speculators, and commission men. It suffered from poor marketing just as the citrus industry had. There were several local cooperatives, but at first they did not take collective action. A central organization called the Executive Committee of Southern California Walnut Associations was formed in 1905. Later, the California Walnut Growers Association established grading standards. The Diamond Brand was known for having the best walnuts (Teague 1944).

The Paradox Hybrid Walnut Tree in Whittier represents the once flourishing walnut industry in Southern California. The Paradox Hybrid was planted by the University of California Experiment Station in 1907. The university planted a dozen experimental walnut varieties. The Paradox Hybrid was the only one spared when the university gave up their lease in 1925 (Pomeroy 2000).

Other crops

In addition to citrus and walnuts, other crops were also planted in the valley. Olives, flax, wheat, barley, oats, tobacco, alfalfa, silk, and cotton were examples of other crops grown. Many new crops were also grown for experimentation (Cleland 1941, Dumke 1944).

Agriculture in the Antelope Valley

Agriculture first peaked in the Antelope Valley area in the 1880s. With the arrival of the railroad, the formerly isolated Antelope Valley on the north side of the San Gabriel Mountains began to see its first settlers. The first homesteads in Antelope Valley were established where water was available. In 1886, Palmenthal was founded by Swiss German families. Its name was later changed to Palmdale. During the 1880s and early 1890s, heavy rainfall allowed homesteaders to successfully cultivate alfalfa, barley, wheat, and a variety of fruits and nuts. However, a serious drought between 1894 and 1904 devastated many farms, forcing some settlers to abandon their land. A second agricultural boom began in 1905 with the introduction of new irrigation techniques which provided the means for the large-scale cultivation of alfalfa. By 1920, alfalfa was the Antelope Valley's major crop (Los Angeles County Libraries 2006).

Photos (top to bottom): 1. Glendora orchards, San Gabriel Valley, 1931. Photo courtesy of Fairchild Aerial Surveys, Inc. and the Los Angeles County Library. 2. Pio Pico Adobe, 1919. Los Angeles County Library photo. 3. Workman House. 2007. NPS photo.

Early American Settlements in the Study Area

During the early part of the American period, many Mexican land grant holders held on to their grants until the 1870s or later. The California Land Act of 1851 addressed questions regarding pre-existing property rights in California prior to United States acquisition of California. The act required all persons claiming lands in California to give legal proof of their claim in order to receive property rights under United States statutes (Raab 2005). After the collapse of the Hispanic ranching industry after the mid-1860s, landowners became interested in subdividing and developing their lands for other purposes.

The population of Los Angeles grew steadily from about 1,600 to 11,000 during the first three decades of the American period. Settlements throughout the region were established following the arrival of the Southern Pacific Railroad in 1876, success from industries, such as mining and commercial agriculture, and the land boom of the 1880s. During the land boom's peak period in 1887, $100,000,000 worth of real estate in southern California was sold, more than 130,000 persons remained as permanent settlers, and Los Angeles increased in size 500 percent (Dumke 1944). Many people who came were only interested in realty speculation, but others were interested in settling and developing the area's resources. This resulted in the development of many small towns while other town sites remained undeveloped with only staked-out lots (Dumke 1944).

Recreation

CONSERVATION, WILDERNESS AND MOUNTAIN RECREATION

In southern California, the arrival of the railway in 1876, followed by the boom of the agricultural industry started to place significant pressures on the regional landscape. Furthermore, increased timber, hunting and fishing, and devastating fires in the region all took a noticeable toll on mountain areas and wildlife. As the landscape changed at a rapid rate in the late 1800s, many residents recognized the need to protect areas for recreation.

An interest in the wilderness and outdoors was furthered by the writings of naturalist John Muir. Muir first hiked the San Gabriel Mountains in 1875 where he reveled in the wildlife views, trails, and canyons that the mountains provided. In his book, "The Mountains of California," Muir describes the waterfalls of the San Gabriel's Eaton Canyon as a "charming little thing, with a low sweet voice, singing like a bird (Muir 1894)."

The alarming depletion of wilderness on both a national and local scale began to concern the American public. This eventually led to one of the nation's most influential acts regarding land policy, the Forest Reserve Act of 1891. The Act provided Congress authority to set aside public lands for present and future use. Local residents mobilized to seek designation of both the San Bernardino and San Gabriel Mountain ranges as forest reserves.

In 1891, the Los Angeles Chamber of Commerce appealed to Congress to have "all public domain included in the watersheds of Los Angeles, San Gabriel and other rivers in the Sierra Range" withdrawal from sale such that the mountains "may in future time serve the general public as a great park" (Robinson 1991). The San Gabriel Timberland Reserve, which is now in part the Angeles National Forest, was proclaimed by President Harrison on December 20, 1892, and was the first forest reserve to be created in California and only the second in the United States. In 1905, legislation turned over reserve lands to the Department of Agriculture – later coming under management by the newly formed U.S. Forest Service.

GREAT HIKING ERA

Hiking became a popular recreation activity in the late 1800s. The San Gabriel Mountains provided numerous trails through scenic mountain passages and became a prime destination for many outdoor enthusiasts. Many trails connected foothill communities to the mountains. For example, the Mount Wilson Trail, constructed by rancho owner Benjamin Wilson, begins in Sierra Madre. Later, the Pacific Electric Railway expanded rail lines within easy walking distances of mountain trailheads. With improved access, the San Gabriel Mountains became a weekend destination for many southern California residents.

For nearly four decades (1890s-1938), hiking was tremendously popular among area residents. On a single holiday weekend, as many as five thousand hikers passed through Joe Clark's Half Way House, a check point on the Sturtevant hiking trail (Robinson 1946). Many accommodations for weekend travelers emerged near train depots and trailheads, including cafes, stores, and tourist camps. The Angeles National Forest was so popular that visitation between 1932 and 1933 alone was greater than visitation to all of the national parks at that time combined (Thrall 1934). During World War II, hiking popularity declined only to reemerge again during the post war boom. Today, the Angeles National Forest remains one of the most visited national forests in the United States.

MOUNTAIN CAMPS, RESORTS, AND OTHER FACILITIES

Camps

As the San Gabriel Mountains became an increasingly popular recreation destination, tourist camps were developed to accommodate hikers. The first of these camps, Switzer Camp, was established in the heart of San Gabriel's Arroyo Seco in 1884. Rustic in nature, the camp consisted of tents, a communal log cabin, and a series of campfire pits.

Throughout the 1880s and 1890s, Switzer Camp accommodated hundreds of guests from Southern California and inspired a wave of camp resorts throughout the San Gabriels, including Steil's Camp, Dell's Camp, Sturtevant Camp, Strain's Camp, and Martin's Camp. The popularity of these camps was so great that, in the summer of 1890, it was estimated that 1,000 people visited Steil's camp in one summer alone (Robinson 1991).

Of these camps, the famed Sturtevant Camp, founded by Wilbur M. Sturtevant in 1893, was the most frequented and adored. Located in a wooded grove near a stream of the Big Santa Anita Canyon, Sturtevant camp's picturesque location quickly became a favorite among hikers and campers (Robinson 1991).

Resorts

Professor and inventor Thaddeus Lowe and engineer David Macpherson were successful

entrepreneurs of the area. To further the concept of the San Gabriel Mountains as a tourist destination, they developed a plan for a rail line that would ascend Rubio Canyon to the summit of Echo Mountain, where tourists would find an elaborate series of resorts. (The Mount Lowe Railway is further described in the "Transportation" section).

From 1892 to 1894, three mountain resorts were constructed along the railway: The Rubio Pavilion within Rubio Canyon, The Chalet near the top of Echo Mountain's ridge, and the impressive summit resort of The Echo Mountain House. Popularly known as the "White City," the incline railway and Echo Mountain Resort Complex soon became a sensation throughout the country.

During the 41 years of operation, the "White City" under the ownership of Lowe and later Huntington, were reported to have accommodated more than three million people. But the White City and Mount Lowe railway could not survive a series of unfortunate, natural events including windstorms, fires, and a flood, which not only obliterated the elaborate railway system, but virtually every structure as well (Robinson 1991).

CCC-built facilities

As the Great Depression years began to set in, investment in parks and recreation began to diminish. During this time, President Franklin D. Roosevelt established the Civilian Conservation Corps (CCC), in addition to numerous other social work programs, to help improve the economy. The CCC played a significant role in constructing many recreational facilities around the country.

The California Region of the Forest Service had prepared new designs for Forest Service buildings during the establishment of the CCC. With these designs they were able to receive awards for several CCC camps to work on the construction of recreational facilities. The first CCC camp in the country was reportedly built at Piru Canyon in the Castaic Range of the Angeles National Forest (Jones and Stokes 2004). Between 1933 and 1942, more than twenty CCC camps were established in the Angeles National Forest. With the assistance of other relief agencies such as the Work Projects Administration (WPA), the CCC were responsible for constructing many of the roads, campground facilities, and trails in the Angeles National Forest.

Other Recreation Facilities

The rise of the automobile had already brought a renewed interest to mountain resorts in the 1920s. During this time, the Los Angeles County Board of Supervisors decided to construct a series of mountain recreational facilities in the San Gabriel Mountain's Swarthout Valley. In 1923, construction began, with recreation buildings, trails, campgrounds, and picnic areas. At the center of these facilities was the Big Pines County Park – a first-rate recreation facility envisioned by the Board. From roughly 1923-1933, the Los Angeles County Department of Parks and Recreation spent approximately four million dollars in developing the park. The park had a swimming pool, ice skating rink, tennis courts, children's playground, numerous campgrounds, and ski and sled facilities (Robinson 1991).

In the 1920s the Forest Service also began to develop campground facilities. Many of the facilities received supplemental funding from organizations including the Los Angeles Chamber of Commerce, the San Gabriel River Water Committee, and the State.

In the San Gabriel Mountains, the desire to drive to scenic destinations and recreation areas within the upper reaches of the mountains eventually outweighed the desire for hiking. Soon hiking camps began to close and were replaced with roadside amenities for tourists, including automobile convenience cabins.

WINTER SPORTS

By the 1930s, winter sports were becoming a favorite pastime for southern California residents. Skiing, in particular, gained popularity. The mountainous locale of Big Pines Park proved to be an ideal location for the region's first ski resort. Big Pines soon became a popular skiing destination, hosting winter sports competitions in the mid-1930s, attracting both local and world-class skiers. Though skiing and winter sports in general slumped in popularity during the depression and WWII years, ski resorts bounced back after the war (Robinson 1991).

SPORTS CLUBS

Organized sports in the country and within southern California began to take hold at the turn of the 18th Century. In 1904, the town of San Gabriel founded the San Gabriel Country Club. Offering the first 9-hole golf courses in the region, by 1912, the Country Club had significant membership. The Country Club, still in existence, is considered the oldest golf club in both Los Angeles and Orange Counties.

Nationwide organizations such as the YMCA and the Boy Scouts of America, which possessed strong

recreational components, began to form local chapters in the San Gabriel Valley. The Boy Scouts of America opened its San Gabriel Chapter in 1910, and the West San Gabriel Valley YMCA chapter was established in 1912.

HISTORIC RECREATION RESOURCES

There are numerous historic resources within the study area related to recreation, including park areas, trails, and visitor facilities. Angeles National Forest resources under consideration for local and state recognition include: Crystal Lake, Charlton-Chilao, and Big Pines. Big Pines Park is in the process of being nominated for the National Register as a historic district. Within the study area, there are also five Recreation Residence Tracts of cabins (Big Santa Anita, McClellan, Manker Flat, San Antonio Falls, and Upper San Antonio) all considered eligible for the National Register.

Resources that represent "The Great Hiking Era" include the Mount Wilson Trail and Lizzie's Trail Inn / Museum, which served hikers and packers as they headed up the Mt. Wilson trail starting in the early 1900s. The Mount Lowe Railway is a designated National Register District listed at the state level of significance.

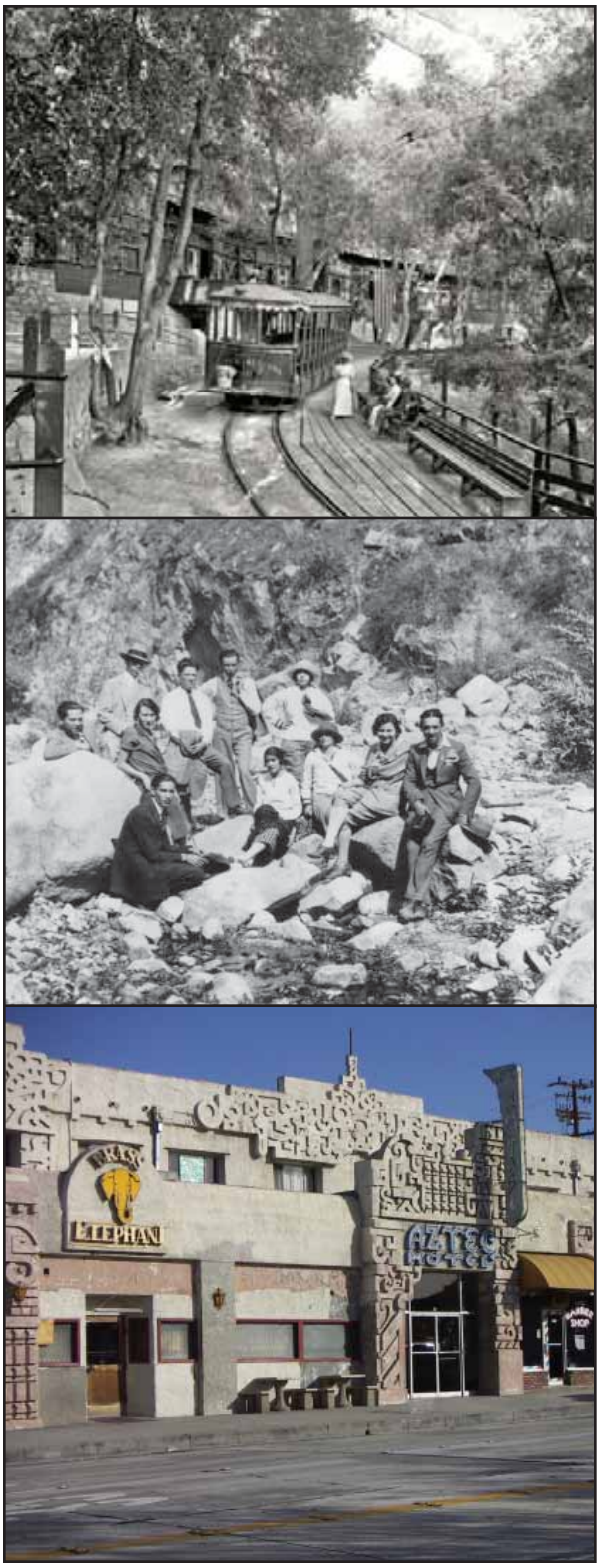
Transportation

As described earlier, the study area and the broader southern California region has a rich history of travel routes and transportation. Many migration and travel routes were determined by the regional environment, such as mountain passes and river corridors. Prior sections have already described Native American, Hispanic, and early American trade routes. This section describes the technology related to transportation, including railroads and the modern highway system.

RAILROADS

Railroads extended into the study area to meet the needs of the region's growth during the mid-1800s. The Southern Pacific Railroad and the Santa Fe Railroad were extended through the study area east from Los Angeles. When the Santa Fe offered competition in the mid-1880s, the rates were reduced, and the resulting rate war helped to increase migration to California. Along the San Gabriel Valley, the Santa Fe Railroad had stops at towns such as Sierra Madre, Arcadia, Monrovia, Duarte, Azusa, San Dimas, and Claremont (Dumke 1944).

Several railroad stations/depots remain within the study area, including the Atchison, Topeka, and Santa Fe Railroad Station in Claremont, the



Photos (top to bottom): 1. Electric car at Ye Alpine Tavern, Mount Lowe Railway, 1913. Shorpy.com photo. 2. Mexican Americans at San Gabriel River, 1920. Photo courtesy of Shades of L.A. Collection and Los Angeles County Library. 3. Aztec Hotel, Route 66 (now Foothill Boulevard). 2006. NPS photo.

Southern Pacific Railroad Station in Whittier, and the Pomona Southern Pacific Railroad Depot.

Pacific Electric Railway

As towns in the region developed, they needed a connection to Los Angeles and to the main trunk railroad lines. The Pacific Electric Railway would provide that connection. Henry Huntington had envisioned building an interurban system that would cover Southern California (Crump 1962). The system began in 1873 when cars were pulled by horses and mules along iron railroad tracks. In 1889, the Los Angeles Cable Railway Company began constructing a double track wire-cable railway. Pacific Electric was formed in 1911 by a merger of eight companies (Hilton and Due 1960).

The Pacific Electric Railway was labeled by several transit historians as "The World's Greatest Interurban Railway" (Fischler 1979). The railway was an exceptional example of an interurban system of its period. The Pacific Electric Railway spanned over 1,000 miles of track and provided pollution-free transit in the Los Angeles region from hydroelectric power in the Sierra Nevada.

The railway had a significant impact on the development of the Los Angeles region. It encouraged new communities in the San Gabriel Valley by providing a link to Los Angeles. The railway also hauled freight and helped to improve transportation of citrus which was a primary source of income for the valley.

Historian William D. Middleton wrote "in a time before Southern California became the world's most automobile-oriented society, almost everyone rode Pacific Electric's 'big red cars' to the beaches, mountains, race tracks, and other pleasure spots of the Southland, as well as to and from their daily work" (Fischler 1979). The Pacific Electric Railway offered scenic vistas on lines which included the Mount Lowe Railway section, which climbed 3,130 feet above Altadena in about 6 miles. Its last journey was in December, 1937. It is listed on the National Register of Historic Places.

"Although some of the integrity of the Mount Lowe Railway has been affected over the years through fire, floods, etc, much of the right-of-way and structures are still intact, and have become interpretive hiking trails" (Darrell Vance, personal communication, 2007).

In the 1920s, buses and cars started to compete with the Pacific Electric Railway. Highways and cars crossed rail lines and trolleys were slowed. The system did not keep up with technology. There were plans to build an underground network, but it was never implemented. Ridership greatly declined in the 1950s and the last trains ran in 1961.

The railway has been noted as a civil engineering landmark of California. It was the first mountain railroad in the world to be operated by electricity. Andrew Hallidae, who designed San Francisco's cable car system, designed the cable winding machinery. The Circular Bridge was the first bridge in the world designed for both a curve and an ascending grade.

A comprehensive survey of remaining resources of the railway system has not been completed. Although much of the railway system no longer exists, there are a few remaining resources within the study area, including the Mount Lowe Railway National Register District, the Puente Largo Bridge, and railway depots and substations. The Great Bridge (Puente Largo) took trains over the San Gabriel River. The Great Bridge was an impressive structure constructed with reinforced concrete. The Pacific Electric Railway Bridge, also known as the Irving Gill Bridge, in Torrance, is listed on the National Register. The La Habra depot is now a performing arts theater. The Whittier freight depot which was shared with the Southern Pacific Railroad is now a transit center and the Whittier depot storefront ticket agency is now the Moose Hall. The Pacific Electric Railway Substation #8 nearby in Altadena is listed on the National Register of Historic Places.

Parts of the system, including trolley cars, can be seen in several museums including the Orange Empire Railway Museum in Perris, California. Existing rights-of-ways remain in portions of the study area. Many of the system's rights-of-way were purchased by railroads and are preserved as rail transportation corridors. In 1990, the Blue Line portion of the Los Angeles County Metrorail System (outside the study area) opened. The line, for the most part, uses the Pacific Electric 4 track right-of-way. The Southern California Regional Rail Authority now operates Metrolink commuter trains on the former Covina-Claremont branch line.

HIGHWAYS

The popularity of automobiles changed transportation in the region and led to a departure from mass transit. Soon many roads through the study area were paved, including Route 66. Los Angeles County became the second largest auto manufacturing region in the nation in the mid-1900s. Streets and highways were quickly built or modernized. Covina was one of the first cities in the nation to pave all of its streets (King 1975).

Route 66

U.S. Highway 66, popularly known as "Route 66," is the nation's first all-weather highway linking Chicago and Los Angeles. Route 66 was popular among thousands of motorists who drove west. The road, which opened in 1926, is 2,400 miles long, although it is estimated that all of the various alignments total about 5,000 miles of roadway (National Park Service 1995). The study area includes 18 miles of Route 66 which crosses through the foothill communities and parallels, or in some areas is replaced by, Interstate 210.

Route 66 helped enable "the most comprehensive movement of people in the history of the United States" and linked the rural west to metropolitan areas. It provided an economic boom to the towns it passed through. Many businesses developed to serve the traveling public. The Route 66 corridor includes bridges motels, gas stations, diners, and other roadside businesses. Fanciful buildings, signs, and colossal sculptures were a colorful feature of highway culture and commerce during the 1920s and 30s. These "roadside attractions," combined with natural features, create the distinctive character of the road (Cassity 2004).

The congestion, safety issues, and need for an efficient rapid transport system for defense purposes in post-war America during the 1950s and 1960s, figured prominently in the passage of the Federal Aid Highway Act of 1956. This Act, which created the current Interstate system, led to the decline of Route 66 as a federal highway. The road was decommissioned in 1985.

Route 66 Corridor Resources within the Study Area. The portion of Route 66 within the study area is part of a high-growth urban metropolis. As a result, the area reflects considerable change through time. In the early days of its history, the Route 66 corridor was dominated by citrus and other agriculture. Over time, the corridor has been extensively developed. Many buildings and signs remain that reflect evolving periods of development (Kaisa Barthuli, personal communication, 2007).

A National Park Service comprehensive survey of historic California Route 66 properties is underway. There are several resources identified within the study area that are associated with Route 66 during its historic period:

- The Aztec Hotel (Monrovia)
- The Azusa drive-in theater marquee (Azusa)
- La Paloma Mexican Restaurant sign (La Verne)
- Golden Spur Restaurant sign (Glendora)
- Palm Tropics Motel (Glendora)
- Colonial Motel (Azusa)
- Stardust Motel (Azusa)

Other historic road features associated with Route 66 will be identified in the forthcoming survey (Kaisa Barthuli, personal communication, 2007).

Technology and Engineering

Engineering and technology played important roles in the history of the study area, including advancements in water systems, transportation, agriculture, and scientific discovery in space exploration and astronomy. This section describes the development of water supply and flood control systems in the region and the advances in scientific discovery in space exploration and astronomy.

Water supply

The Los Angeles region is prone to periods of drought and massive floods. In the 1880s a legal battle over water in the region known as the "Battle of San Gabriel River" took place (King 1975). The Wright Act was passed in 1887 and allowed cities to create water districts and develop irrigation. In 1889, a Compromise Agreement was made regarding what each town or region should receive from the river, and a permanent body, the Committee of Nine, was formed to settle any future disputes.

After years of drought, the city of Los Angeles pursued other means of bringing in other water sources. Ex-mayor Fred Eaton and city engineer William Mulholland (at the time in charge of the city Department of Water) traveled to the Owens Valley in 1904. Mulholland was convinced that an aqueduct could be built to carry water by gravity flow across the Mojave Desert and through the San Gabriel Mountains into the San Fernando Valley. A bond issue to purchase land and survey the route was passed in September 1905, and funding for the aqueduct was approved by voters in 1907. Construction of the Owens River aqueduct was completed in 1913 (Nelson 1983).

The construction of the aqueduct was highly controversial. The project took the water in the Owens River for the City of Los Angeles, leaving the former Owens Lake a dry alkali flat. This generated much enmity among the agricultural community of the Owens Valley.

In the 1920s, Congress authorized construction of a dam at Boulder Canyon on the Colorado River. Construction of Hoover Dam began in 1931. The city of Los Angeles filed an application with the

State Bureau of Water Rights to obtain water from the Colorado River after the completion of the dam. The 242-mile Colorado Aqueduct was a challenging engineering enterprise in its own right. Water had to be pumped out of Lake Havasu, the reservoir created behind Hoover Dam, and then over or through six mountain ranges (Nelson 1983).

A California Water Plan was approved in 1960 to address flooding issues, conflicts with northern and southern California, and to deal with the Supreme Court decision to reduce California's share of Colorado River water by half. Later, the California Aqueduct was constructed, extending 444 miles along the west side of the San Joaquin Valley (Nelson 1983). A small portion of the aqueduct traverses the northernmost portion of the study area.

Flood control

As urban development increased in the early 1900s, the unpredictable nature of the meandering rivers of the Los Angeles basin was viewed as incompatible with the needs of the growing metropolitan region. Before the region was urbanized, flooding was considered an inconvenience, but it also benefited agriculture and ranching after periods of drought. With continued urban growth, however, natural flood events needed to be controlled. In addition, land use changes, including the construction of impermeable surfaces, altered the river systems and exacerbated the flooding.

The flood of 1914, which caused $10,000,000 in damaged property, was the catalyst for the first comprehensive effort to solve the flooding problem in Los Angeles (Bigger 1959). Before the 1914 flood, flood control efforts were handled locally in a piecemeal manner. At the time there was no state or federal law that provided for comprehensive regional flood control. The Los Angeles County Board of Supervisors appointed a team of engineers to produce a comprehensive flood control plan for the county. The Los Angeles County Flood Control District was established as the central authority (Orsi 2004).

The first plan consisted of dams in the mountains, check dams in the canyons, and the channelization of rivers in the Los Angeles Basin. Implementation of the 1915 Comprehensive Plan took several turns and ultimately resulted in mismanagement and a failed attempt at a large dam in San Gabriel Canyon. These events undermined public confidence in the flood control authority. In 1931, under new leadership, the Flood Control District presented a new plan. This plan was similar to the 1915 approach; however, it added the inclusion of

Aerial view of flooding at Hall's Canyon wash in La Canada, located in the Cresenta Valley between the San Gabriel Mountains and the Angeles National Forest. Spence Air Photo. Courtesy of the Los Angeles County Library.

spreading grounds to allow water to percolate into groundwater basins beneath the Los Angeles Basin (Orsi 2004).

The 1936 Flood Control Act provided federal funding for comprehensive flood control projects. Because Los Angeles County already had a plan in place, the county was able to take advantage of this opportunity. This was the first and largest program to receive funding under the new law. The 1936 act and a subsequent flood control act passed in 1938 called for the Army Corps of Engineers to work with the Los Angeles County Flood Control District on future flood control efforts. This resulted in the Los Angeles County Flood Control System, a comprehensive, coordinated river-based flood-control system constructed by the Los Angeles County Flood Control District and the U.S. Army Corps of Engineers.

Flood control structures were built by the Department of Public Works and the Army Corps of Engineers. Large dams were built, including the Devils Gate Dam on the Arroyo Seco in 1920. Early dams were built in mountain canyons, then further downstream on the rivers. Debris basins were constructed near the mouths of the canyons to collect erosion (Nelson 1983).

Five large dams were constructed on the San Gabriel River. The first was Cogswell Dam in 1934. The other dams are Morris, San Gabriel, Santa Fe, and later Whittier Narrows in 1957. President Herbert Hoover attended the dedication of Morris Dam which played a part in the World War II effort. Morris Dam has been determined eligible for listing on the National Register of Historic Places. In total, 14 dams were constructed.

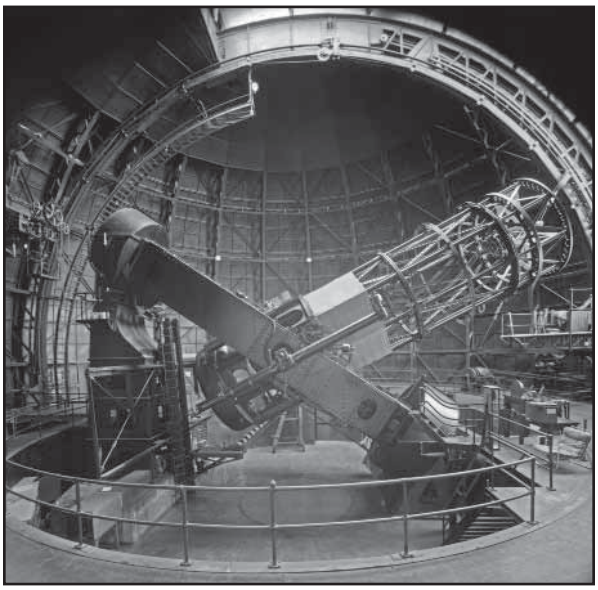
In a theme study on large federal dams, the U.S. Bureau of Reclamation found that the Los Angeles County Flood Control System may be nationally significant. Many of the system's flood control resources are located within the study area. The theme study identified potential contributing resources: dams, debris basins, spreading ground facilities, diversion tunnels, outlets, inlets, stilling basins, guide walls, gates, spillways, trash racks, penstocks, transformer yards, pumping stations, powerhouses, turbines, fish ladders, and temperature control devices (Billington, Jackson, and Melosi 2005).

Science. Scientific experiments and research have yielded valuable knowledge within the study area. For example, nationally significant research has been conducted at the Mount Wilson Observatory and the San Dimas Experimental Forest for many years.

Astronomy and astrophysics. Before the Mt. Wilson Observatory was constructed, the Mount Lowe Observatory on Echo Mountain was the principal astronomical institution in southern California. Constructed in 1894 by Thaddeus Lowe, builder of the Mount Lowe Railway, its director was Dr. Lewis Swift. There Swift discovered numerous nebulae and comets (National Park Service 1991).

The Mount Wilson Observatory was constructed in the Angeles National Forest, at the summit of

High flood water raging down the Puente Creek wrecks a Union Pacific train. 1927. Photo courtesy of the Los Angeles County Library.



100-inch telescope at the Mt. Wilson Observatory. June 1949. Photo reproduced by permission of The Huntington Library, San Marino, California.

Mount Wilson in 1904. Mount Wilson was chosen as the site for the observatory because of its location on a high mountain with clear skies (W.W. Robinson 1946). Later that year, the Mount Wilson Toll Road Company was formed to build a road to the site (Thrall 1937).

The Mount Wilson Observatory was a model modern facility that forever changed the history of the science of astronomy. The observatory contains five significant research telescopes that are still in operation: the Snow horizontal telescope, the 60-foot solar telescope, the 150-foot solar telescope, the 60-inch reflector, and the 100-inch Hooker reflector (National Park Service 1989).

At Mount Wilson, many well-known scientists, including Edwin P. Hubble and Albert Michelson, were able to make significant astronomical discoveries and conducted many important experiments. For example, Nobel Prize-winning physicist Albert Michelson conducted an experiment to accurately measure the speed of light; he was also the first to measure diameters of various stars.

Since 1986, the Mount Wilson Observatory has been operated by the Mount Wilson Institute (MWI), a non-profit organization that focuses on scientific research, historic preservation, astronomical education, and public outreach. Several guest institutions operate facilities on the observatory.

A National Historical Landmark theme study for Astronomy and Astrophysics (1989) included a National Historic Landmark nomination for the Mount Wilson Observatory.

San Dimas Experimental Forest. The San Dimas Experimental Forest was established in 1933 and is the only U.S. Forest Service experimental forest in southern California. The experimental forest maintains some of the earliest and most comprehensive records from continuously monitored experimental watersheds.

The experimental forest includes a range of facilities that were constructed through umemployment relief programs during the 1930s. The Lysimeter facility (tunnel and instrument room) is the largest of its kind in the world. It is a significant engineering structure and is the most elaborate research facility on the experimental forest. The facility contains 26 large lysimeters (each measuring 10.5 x 21 ft and 6 ft deep) and numerous small ones (Jones & Stokes 2004).

An inventory and evaluation report for the experimental forest concluded that it appears eligible for listing on the National Register of Historic Places as a historic district. (Also see "Architecture" section in this chapter and the discussion in Chapter 3, *Resource Significance.*

Other Cultural Themes Represented in the Study Area

Arts

ARCHITECTURE, LANDSCAPE ARCHITECTURE, URBAN DESIGN

There are numerous resources throughout the study area that represent diverse architectural styles, ranging from Mission/Spanish revival to Queen Anne. Types of structures and historic uses include adobes, hotels, and schools. Several structures are listed on the National Register of Historic Places for architecture – the Ygnacio Palomares Adobe (1854), located in Pamona, was the home of Don Ygnacio Palomares, one of the owners of Rancho San Jose; the Phillips Mansion (1875), also located in Pomona, is the only "Second Empire" style home in Southern California; the Temple Mansion, located in the City of Industry (original adobe home in 1842 and remodeled in 1872 to resemble an English manor house); the Clarke Estate (1921) in the Santa Fe Springs is one of the best remaining examples of architect Irving Gill's work.

Within the Angeles National Forest, the San Dimas Experimental Forest (SDEF) contains a significant collection of Forest Service buildings and other structures constructed under Depression-Era relief programs. The SDEF field headquarters located in Tanbark Flats is an excellent example of U.S. Forest Service architecture. Facilities at Tanbark Flat include a laboratory/office, residences, a mess hall/ conference room, and several storage/utility buildings. Research/monitoring equipment includes rain gauges, stream gauges, debris dams, water quality samplers, a weather station, and a lysimeter complex. Other important CCC structures include stone landscape features that contribute to the cultural landscape (Jones & Stokes 2004).

The Glendora Bougainvillea, the largest growth of bougainvillea in the United States at 70 feet tall, represents landscape architecture. The two city blocks on which 24 individual bougainvillea plants grow, were once occupied by orange groves. The Glendora Bougainvillea, listed on the National Register of Historic Places, are some of the best remaining examples of the early twentieth century image of California as a paradise (Pomeroy 2000).

VISUAL AND PERFORMING ARTS

Several resources within the study area represent the performing arts, including the Pomona Fox Theater and the Padua Hills Theater in Claremont. In the early 1900s, Pomona and Claremont became prosperous from the citrus industry. The Pomona Fox Theater included state-of-the-art projection and sound systems and refrigeration air conditioning. The Padua Hills Theatre and the theatrical group, the Mexican Players, attracted thousands of visitors and provided education on the rich and diverse culture of Mexico (National Park Service 1998).

LITERATURE

The Upton Sinclair House, located in Monrovia, is a National Historic Landmark (NHL). The house represents Sinclair, who was one of the most influential American novelists focused on social justice in the early twentieth century.

Social History

CLUBS AND ORGANIZATIONS / REFORM MOVEMENTS

The La Puente Valley Woman's Club, Montebello Woman's Club, and Pomona YMCA Building are examples of clubs that represent social history within the study area. The Montebello Woman's Club made substantial contributions to the city. They founded and staffed the first library in Montebello, sold World War I bonds and stamps, and assisted the Red Cross in both World Wars (Pomeroy 2002).

RELIGIOUS INSTITUTIONS

Several churches, temples, and other structures represent the religious diversity of the region. The Episcopal Church of the Ascension in Sierra Madre, founded in 1885, is constructed of stone modeled after churches of Sussex, England. The Hsi Lai Temple in Hacienda Heights is the largest Buddhist temple complex and monastery in the Western Hemisphere.

Government, Military and Aerospace

Several resources within the study area represent government – both local government and federal government, including the U.S. Forest Service – and the United States military.

GOVERNMENT

There are many historic U.S. Forest Service buildings and facilities within the Angeles National Forest that are important in telling the history of the national forest. The West Fork Ranger Station, also known as "Old Shortcut," was the first ranger station built in California. The San Dimas Experimental Forest, as described earlier, includes buildings that are excellent examples of U.S. Forest Service architecture. Additional historic resources include recreation camps (Buckhorn, Messenger, Switzer), the Rincon administration site, trails, and fire lookouts.

Within the San Gabriel Valley, Pio Pico Casa in Whittier, now part of Pio Pica State Park, represents Pio Pico, the last Mexican governor of California. Other structures are related to local government institutions.

MILITARY AND AEROSPACE

During World War II, California played a major role in the war effort. There are several resources related to World War II and the Cold War that remain within the study area. The Morris Dam Test Facility in Azusa was used for military experiments to build an effective torpedo during World War II. The Navy conducted tests in the lake during 1942-44 (John Robinson, personal communication, 2007). The Temporary Detention Camp for Japanese Americans at the Pomona Assembly Center and the Santa Anita Assembly Center (just beyond the study area) are two sites that are related to the internment of people of Japanese ancestry during World War II. These two assembly centers make up the Temporary Detention Camps for Japanese Americans State Historical Landmark. The Santa Anita Assembly Center was the largest assembly center. The Los Piñetos and the Mount Gleason Nike Installation sites in the Angeles National Forest

Morris Dam. 2006. NPS photo.

and two dismantled sites in the Puente Hills are from the Cold War era. Several post-World War II military plane crash sites (F-6 Hellcats and Lockhead T-33A) have been recorded in the Angeles National Forest.

During the 1950s, significant technological advances were made with aviation. Within the study area and the region, numerous air-training bases were established, where many aircraft manufacturers, including Douglas Aircraft and Hughes Aircraft, expanded or established factories. Antelope Valley was transformed from an agricultural area to a significant place for the aerospace industry. The shift from agriculture to the aerospace and defense industry occurred in Palmdale during this period. Edwards Air Force Base (formerly Muroc Army Air Base) in Palmdale is the second largest base in the Air Force. In 1952, the U.S. government bought Palmdale Airport, renaming it Air Force Plant 42. Rockwell, Northrop, Lockheed, and McDonnell Douglas maintain production facilities at Plant 42.

The Space Flight Operations Facility (SFOF) in nearby Pasadena is a National Historic Landmark. The SFOF is significant because it is the hub of the vast communications network through which NASA controls its unmanned spacecraft flying in deep space. The Mariner, Viking, Pioneer, and Voyager projects that have explored the solar system have all been controlled for at least part of their missions in this facility. The Jet Propulsion Laboratory has been the primary NASA center for the unmanned exploration of the planets.

Post World War II Period

World War II had a significant impact on California and the study area region. Because of the war in the Pacific, the aircraft industry developed, as described earlier. The Los Angeles – Antelope Valley area were major production areas. "World War II gave California, along with the rest of the nation, an economic stimulus that swept the state to new pinnacles of prosperity, encouraged unbelievable population growth and a continuation and intensification of the industrialization process which had started in the 1920s" (Cleland and Dumke1966). The *Los Angeles Times* noted in 1955 that "The impact of the migration [into the Los Angeles area] averaging nearly 500 new residents a day for ten years, makes even seasoned statisticians sit up and take notice…Only five American cities – New York, Chicago, Detroit, Philadelphia, and Los Angeles – exceeded the 1955 population of the San Gabriel Valley" (Cleland and Dumke1966).

The period following the war was also one of substantial economic growth in the Los Angeles region. More than $1.6 billion was invested in industrial expansion during the postwar decade. By the mid-1950s Los Angeles was the third largest industrial and marketing center of the United States (Cleland and Dumke1966). Southern California diversified its economic activities, expanding on the aircraft and oil industries, including automotive construction, metal products, food, and building materials. The downside to this growth was the impact on the environment, including smog. Despite extensive development of water resourced at the beginning of the century, as described above, water was still an issue for the region during the post-war era.

Cultural Landscapes

A cultural landscape is a geographic area including both cultural and natural resources, and wildlife or domestic animals therein associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values. The study area includes several examples of cultural landscapes.

Prehistoric Landscapes

Native American villages and seasonal camps were located throughout the study area. Many sites in the urban areas have been disturbed while other sites in the forest have been relatively well-preserved. As described in the archeological resources section, the Aliso – Arrastre Middle and North Special Interest Area is known to have numerous prehistoric archaeological sites. Sites range among long-term occupation sites, seasonal encampments and special-use resource procurement, processing, and storage sites. One site containing cupule rock art features is currently being nominated to the National Register of Historic Places (USFS 2005). A National Register nomination has been prepared for rock art sites within the forest dating from approximately 4000 to 200 B.P. (Whitley 2002). Because these archeological sites have not been disturbed by modern development, they retain exceptional potential for studying the cultures of native people and their relationship to the natural environment.

Historic Landscapes

There are many cultural landscapes within the study area that represent themes such as transportation, recreation, agriculture, science, and architecture. Some cultural landscapes retain both historic and natural features while others do not. This section describes some examples of historic landscapes within the study area.

Beginning with the Hispanic Period, the Mission San Gabriel Arcangel retains some key structures. The church building began during the latter part of the 18th century and was completed in 1800; it remains in San Gabriel. Other extant structures include mills such as El Molino Viejo and another grist mill near the mission. Nothing remains of the original site of the mission, however. Other structures and natural features related to the mission landscape have been altered or removed, including elements related to ranching and agriculture.

Within the study area there are numerous historic resources that represent the ranchos, such as original homes; however, cultural landscape elements such as the spatial relationships between the remaining built environment and natural features are not readily evident. Landscape features usually associated with ranching operations and agriculture that would have surrounded these structures are no longer apparent since most of these areas have been developed or heavily urbanized.

Even though many features of the Mount Lowe Railway within the Angeles Forest no longer remain, elements such as the natural setting, the path of the railway, and stone foundations and retaining walls of structures remain. Interpretive signs provide context for the railway, including spatial relationships among key features.

The San Dimas Experimental Forest contains cultural landscape elements that represent Forest Service administration and science. Structures that contribute to the cultural landscape were previously described under "Architecture, Landscape Architecture, Urban Design." The natural landscape features of the experimental forest are intact. Many features have been preserved as the experimental forest continues to operate today.

Photos (top to bottom): 1. Mt. Lowe Railway, circle bridge view. 2007. NPS photo. 2. Mt. Lowe Railway track remains. 2007. NPS photo. 3. San Dimas Experimental Forest. Photo by the United States Forest Service.

Table 3: Inventory of Cultural and Archeological Resources within the San Gabriel Watershed and Mountains Special Resource Study Area – Representation of National Park Service Themes

Resource Name	Location	Listing Status
SPANISH, MEXICAN, AND AMERICAN SETTLEMENT		
Juan Bautista de Anza National Historic Trail	Extends through study area	NHT
Old Spanish National Historic Trail	Extends through study area	NHT
Workman Adobe	Industry	NR-state
Hawkins--Nimocks Estate-Patricio Ontiveros Adobe	Santa Fe Springs	NR-state, SPHI
La Casa Alvarado	Pomona	NR-local
Jonathan Bailey House	Whittier	NR-local
Pitzer House	Claremont	NR-local
John Rowland House	Industry	NR-local
El Monte – 1st Southern Californian Settlement by Immigrants from United States	El Monte	CR, SHL
Grave of George Caralambo	Whittier	SHL
Site of Mission Vieja	Montebello	SHL
J. D. Palomares Ranch	La Verne	SPHI
W. R. Rowland Adobe Redwood Ranch House	Walnut	SPHI
Juan Matias Sanchez Adobe	Montebello	SPHI, NRST3
NATIVE AMERICANS (Resources representing Tongva/Gabrielino, Tataviam, Fernandeno, and Serrano peoples)		
Angeles National Forest Native American prehistoric resources determined eligible: Alimony Earth Oven #2 Burial Site at Chilao Flats (also 51-33), Chilao Creek Midden, House Pits at Lower Chilao Lower Alder Creek Terrace Site Old Shortcut Road Prehistoric Site #1	Angeles National Forest	Determined eligible for NR
Additional resources in the study area: Many archeological sites have been identified but most have not yet been evaluated. Most numerous in Agua Dulce Quadrangle (33 sites)	Throughout study area	2 sites = NRST2
CLUBS AND ORGANIZATIONS		
La Puente Valley Woman's Club	La Puente	NR-local
Montebello Woman's Club	Montebello	NR-local
Pomona YMCA Building	Pomona	NR-local
East Whittier Women's Improvement Club	Whittier	SPHI
Women's Club of Claremont	Claremont	SPHI, NRST3
Montebello Senior Citizens Center	Montebello	NRST2
Masonic Temple	Pomona	NRST3
RELIGIOUS INSTITUTIONS		
Whittier First Christian Church	Whittier	NRST2
Rivera First Baptist Church	Pico Rivera	SPHI, NRST3
Claremont Missionary Home, Pilgrim Place	Claremont	NRST3
First Baptist Church	Monrovia	NRST3
First Methodist Episcopal Church, Seventh Day Adventist Church	Pomona	NRST3

Resource Name	Location	Listing Status
German Baptist Church, Bible Missionary Church	Santa Fe Springs	NRST3
Holy Trinity Episcopal	Covina	NRST3
Methodist Episcopal Church, United Methodist Church	Monrovia	NRST3
RECREATION		
Old Short Cut, Chilao Visitor's Center [West Fork Ranger Station]	Angeles NF	SHL, NRST2
Lizzies Trail End Museum/Lizzies Trail End Inn	Sierra Madre	SPHI, NRST3
Five Recreation Residence Tracts of cabins (Big Santa Anita, McClellan, Manker Flat, San Antonio Falls, and Upper San Antonio)	Angeles NF	eligible for NR
EDUCATION		
Barbara Greenwood Kindergarten	Pomona	NR-local
First Home of Pomona College (Ayre Cottage)	Pomona	SHL, NRST3
Reform School for Juvenile Offenders (Fred C. Nelles School)	Whittier	SHL, NRST2
Bassett Elementary School	Bassett	SPHI
Soledad-Acton Schoolhouse	Acton	SPHI
Whittier Union High School	Whittier	NRST2
Duarte School, Duarte School Administration Building	Duarte	NRST3
Claremont Colleges	Claremont	NRST5
Webb School of California	Claremont	NRST3
VISUAL AND PERFORMING ARTS		
Padua Hills Theater	Claremont	NR-local, SPHI
Pomona Fox Theater	Pomona	NR-local
Mabel Shaw Bridges Music Auditorium	Claremont	NRST2
Lyric Theater, Crest Theater	Monrovia	NRST3
Mcnees, Bruens, Warner Bros Theaters, Whittier Theater	Whittier	NRST3
LITERATURE		
Upton Sinclair House	Monrovia	NHL
ARCHITECTURE, LANDSCAPE ARCHITECTURE, AND URBAN DESIGN		
Clarke Estate	Santa Fe Springs	NR-state
Episcopal Church of the Ascension	Sierra Madre	NR-state
Glendora Bougainvillea	Glendora	NR-state, SHL
Workman Family Cemetery (El Campo Santo)	Industry	NR-state
Abraham Lincoln Elementary School	Pomona	SPHI
Atchison, Topeka and Santa Fe Railroad Station	Claremont	NR-local
Aztec Hotel	Monrovia	NR-local
Brea City Hall and Park	Brea	NR-local
DeWenter Mansion	La Verne	NR-local
Hoover Hotel	Whittier	NR-local
Ygnacio Palomares Adobe	Pomona	NR-local, SHL
John Carlton Pegler House	Sierra Madre	NR-local
Phillips Mansion	Pomona	NR-local, SPHI
Pitzer House	Claremont	NR-local

Resource Name	Location	Listing Status
La Casa Primera de Rancho San Jose	Pomona	NR-local
Lincoln Park Historic District	Pomona	NR- local
San Dimas Hotel	San Dimas	NR-local, SPHI
Scripps College for Women	Claremont (within .5 mi of study area)	NR-local
Charles E. Straight House	La Verne	NR-local
Temple Mansion	Industry	NR-local
The Oaks	Monrovia	NR-local
La Casa de Carri**ó**n	La Verne	SHL, NRST3
Glendora Historic District	Glendora	NRST2
Leven Oaks Hotel	Monrovia	NRST3
12 individual listings for houses	Whittier	NRST3
36 individual listings for houses, 26 with no name	Monrovia	NRST3
28 individual listings for houses, 1 with no name	Claremont	NRST3
1 listing for a house	Pico Rivera	NRST3
1 listing for a house	Sierra Madre	NRST3
Pomona	NRST5	
Approximately 80 individual listings for houses and avenues or blocks in Claremont	Claremont	NRST5
GOVERNMENT		
Azusa Civic Center	Azusa	NR-local
Glendora District Office	Angeles NF	Eligible (w/o concurrence)
Pio Pico Casa	Whittier	NR-state (NHL Evaluation in progress)
Vetter Peak Lookout	Angeles NF	NRST2
MILITARY		
Pomona Assembly Center-Temporary Detention Camps	Pomona	CR, SHL
Los Pinetos Nike Installation	Angeles NF	NRST2
Morris Dam Test Facility	Angeles NF	NRST2
Mount Gleason Nike Installation	Angeles NF	NRST2
Pomona Armory, National Guard Building	Pomona	NRST2
POLITICAL IDEAS, CULTURES, AND THEORIES		
Site of Llano Del Rio Cooperative Colony	Llano, on State Hwy 138	SHL
INDUSTRY *(gold mining, petroleum, energy)*		
Edison Historic District	Pomona	NR-local
Orin Jordan House	Whittier	NR-local
Pitzer House		
Standard Oil Building	Whittier	NR-local
Olinda	Brea	SHL
Pomona Water Powerplant	Claremont	SHL
Golden West Refining Company	Santa Fe Springs	NRST2
East Whittier Water Company Pumphouse	Wittier	NRST3

Resource Name	Location	Listing Status
AGRICULTURE		
College Heights Lemon Packing House/Claremont Packing House	Claremont	NRST2
Parent Haas Avocado Tree	La Habra Heights	NRST5
TRANSPORTATION		
Route 66	Extends through study area	NPS preservation program
Pomona City Stable	Pomona	NR-local
Southern Pacific Railroad Station	Whittier	NR-local
Lang (Southern Pacific: golden spike at Lang connected Los Angeles with San Francisco)	Santa Clarita	SHL
Lyons Station Stage Coach Stop	Santa Clarita (within .5 mi of study area)	SHL
Azusa Santa Fe Railroad Depot	Azusa	NRST2
Pomona Southern Pacific Railroad Depot	Pomona	NRST2
Santa Fe Railroad Depot	Monrovia	NRST3
Union Ice House, Ice House	Claremont	NRST3
Union Pacific Railroad Station	Whittier	NRST3
COMMERCE		
National Bank of Whittier Building	Whittier	NR-local
National Bank of Pico	Pico Rivera	NRST2
Wells Fargo Bank	Azusa	NRST2
SCIENCE AND TECHNOLOGY		
Mount Wilson Observatory	Angeles NF	(NHL nomination prepared)
Paradox Hybrid Walnut Tree	Whittier	SHL
Mount Lowe Railway	Altadena /Angeles NF	NR district-state
San Dimas Experimental Forest	Angeles NF	NR district (nomination prepared)
ENVIRONMENT		
Angeles National Forest		SHL
Changing Role of the United States in the World Community		
Juan Bautista de Anza National Historic Trail	Extends through study area	NHT
Old Spanish National Historic Trail	Extends through study area	NHT
Rio San Gabriel Battlefield	Montebello	SHL
OTHER RESOURCES: THEMES UNKNOWN		
Captain William Banning Home	Walnut	SPHI
Old El Monte Jail	El Monte	SPHI
Richardson House	Sierra Madre	SPHI
Rosemead Historical Park	Rosemead	SPHI
Temple Hall – check if same as Temple Mansion	Industry	SPHI
The East Wing/Azusa Auditorium	Azusa	In CHRIS, not in NRIS
SR 30, Widen Baseline Road	Claremont	NRST2
no name (program reference # HUD880901H)	Azusa	NRST2
Baldwin Park City Hall	Baldwin Park	NRST2

Resource Name	Location	Listing Status
Central School Auditorium, Baldwin Park Civic Auditorium	Baldwin Park	NRST3
Azusa Ioof Hall / Odd Fellows Building	Azusa	NRST2
Baughman House	Claremont	NRST2
Johnson Bros Ranch	Claremont	NRST2
Johnson House	Claremont	NRST2
Keeler Residence	Claremont	NRST2
W.K. Kellogg Arabian Horse Ranch	Baldwin Park	NRST2
2 sites with no name	San Dimas	NRST2
2 sites with no name	La Puente	NRST2
Covina Fire Station	Covina	NRST3
Orton Englehardt Historic Shop Building	Glendora	NRST5
Approximately 80 individual listings for homes and avenues or blocks in Claremont	Claremont	NRST5
Sarah J. Abbott House	Monrovia	NRST5
Umbach House, Mildred Umbach Residence	Monrovia	NRST5
no name	Monrovia	NRST5
Sites that have potential for listing on the NR, CR, or local listing/designation: There are 135 historical sites within the study area appear eligible for listing on the National Register, California Register, or other local listing as individual sites and contributors to a district. Most of these sites need survey evaluation to determine eligibility. These are NRST 7N: Needs to be reevaluated (Formerly NR Status Code 4 – may become eligible for listing on the NR) There are 106 sites that need to be reevaluated to determine whether they have potential for listing on the NR, CR, or local listing/designation.		

Sources:

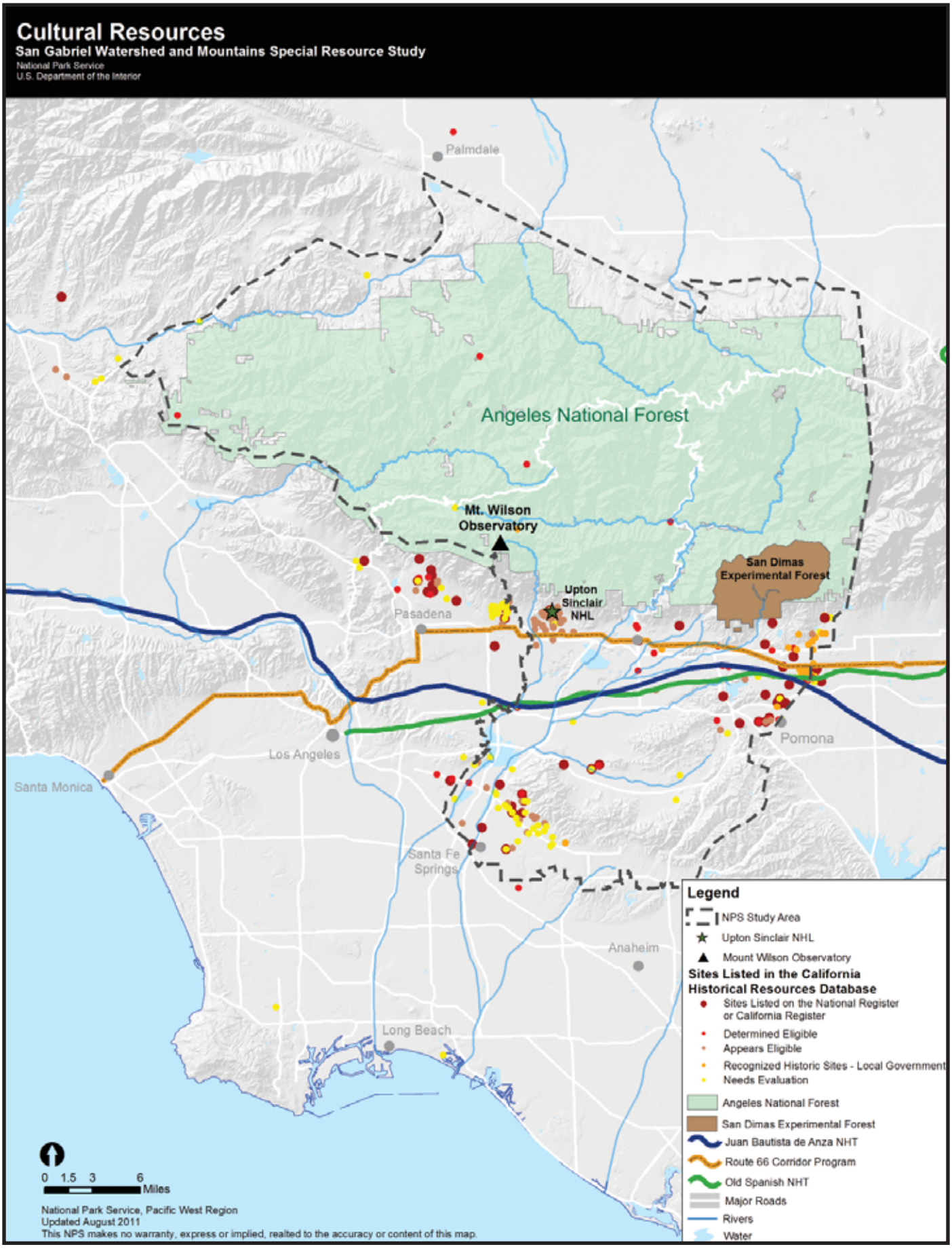
- National Park Service, National Register of Historic Places Database
- Angeles National Forest, Heritage Resources Database
- State of California, Lists of State Historic Landmarks, Points of Historical Interest, Historic Resources Inventory database, Archeological Resources Determination of Eligibility Database
- County of Los Angeles, Department of Regional Planning, list of resources within the county including unincorporated lands

Notes:

- Data was compiled in 2007. Data is not comprehensive at the local level. Many cities have their individual local landmarks. This information has not been collected for every city/community within the study area.
- Although many resources represent more than one theme/topic, they are listed under their primary them/topic.
- Location information for archeological sites and historic sites on private land that have been determined eligible/or potentially eligible for listing on either the National Register of California Register is not identified.

Status codes:

NHL = National Historic Landmark
NHT = National Historic Trail
NR = National Register
NRST2 = Determined eligible for listing on the National Register or California Register
NRST3 = Appears Eligible for NR as an individual property through survey evaluation
NRST5 = Eligible for local listing or designation
SHL = California State Historic Landmark
SPHI = California State Point of Historic Interest


Cultural Resources
San Gabriel Watershed and Mountains Special Resource Study
National Park Service
U.S. Department of the Interior
Palmdale
Angeles National Forest
Mt. Wilson Observatory
San Dimas Experimental Forest
Upton Sinclair NHL
Pasadena
Los Angeles
Pomona
Santa Monica
Santa Fe Springs
Anaheim
Long Beach
Legend
NPS Study Area
Upton Sinclair NHL
Mount Wilson Observatory
Sites Listed in the California Historical Resources Database
Sites Listed on the National Register or California Register
Determined Eligible
Appears Eligible
Recognized Historic Sites - Local Government
Needs Evaluation
Angeles National Forest
San Dimas Experimental Forest
Juan Bautista de Anza NHT
Route 66 Corridor Program
Old Spanish NHT
Major Roads
Rivers
Water
0 1.5 3 6
Miles
National Park Service, Pacific West Region
Updated August 2011
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Recreational Resources

Introduction

With its diverse landforms and landscapes, the study area features a variety of scenic and recreational resources. Large, wild, open spaces in the mountains and hills are contrasted with dense urban areas. Within the large expanse of urban areas, hidden "wild places" that provide recreational opportunities can be found. A short drive can take a person from one of America's most densely populated regions, to stark desert and serene wilderness areas. Sub-alpine mountain environments are located just miles away from dry deserts and mild coastal beaches.

Recreational resources in the study area range from the Angeles National Forest in the San Gabriel Mountains to small neighborhood parks. Recreational activities include: organized sports activities, recreational mining, spiritual gatherings, swimming, hiking, biking, swimming, camping, picnicking, fishing, wildlife viewing, hang-gliding, use of off-road vehicles, and hunting. Despite the diversity of recreational opportunities and open spaces, the region has had difficulties preserving enough open space and recreational areas to meet the needs of its ever growing population.

This section describes an overview of recreational use in the study area, an inventory of recreational resources, an analysis of recreational needs and demand, and future opportunities for recreation within the study area.

Inventory of Existing Parks and Open Space

OVERVIEW OF PARKS AND OPEN SPACE

The study area features a variety of areas devoted to recreation in some form, often in conjunction with the preservation of natural open space or historic sites. These include the federal, state, joint powers authority lands, and an assortment of regional and local parks, nature centers, and preserves. Parks and open space are not evenly distributed throughout the region, and access for those without private transportation is limited.

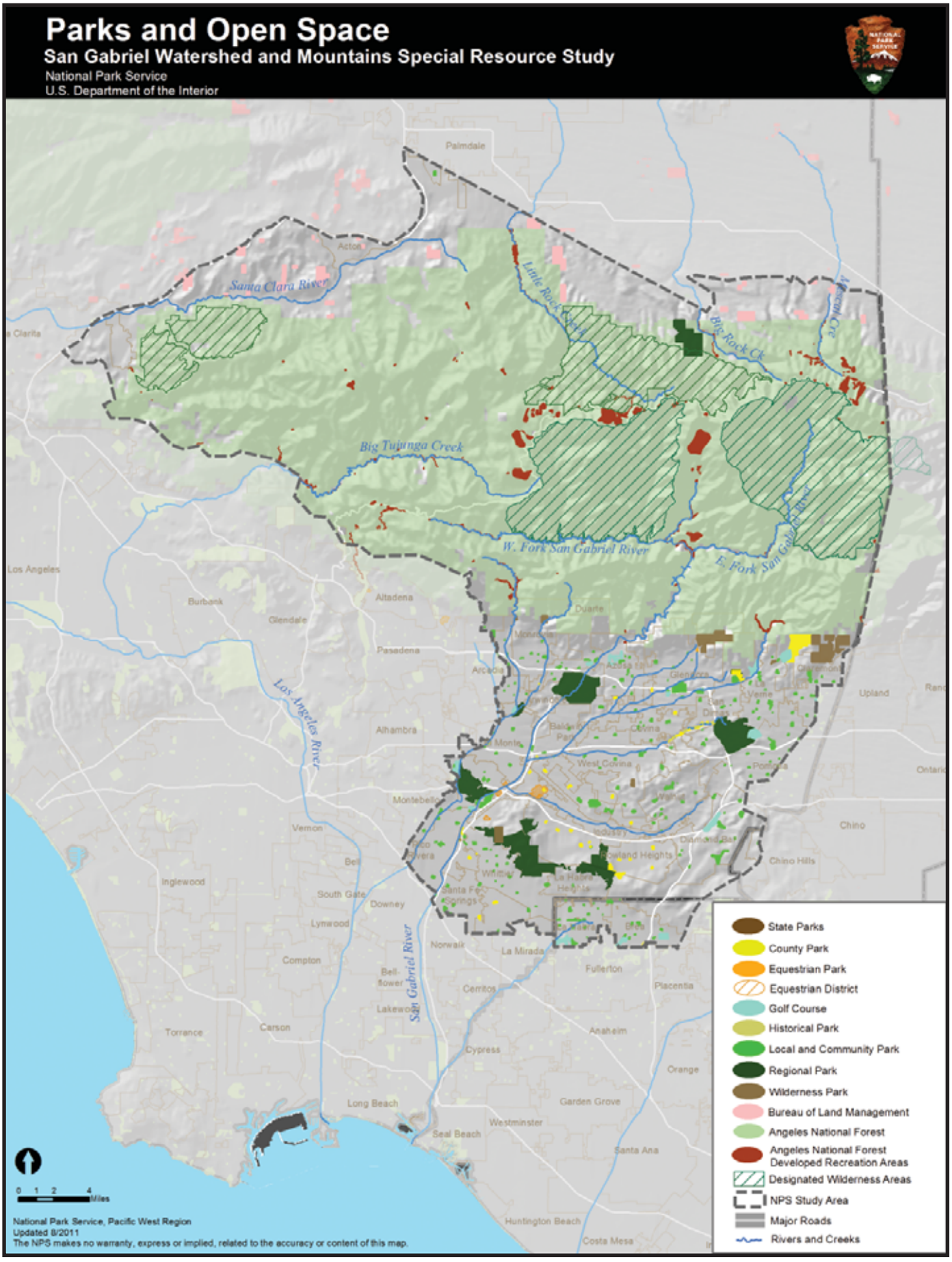
With the exception of the Puente Hills Landfill Native Habitat Preservation Authority Area, and two county regional parks, large open spaces in the more urbanized portions of the study area are relatively sparse, consisting of isolated patches or narrow, disconnected corridors of green space in a matrix of urban development.

Open space may be described as any land that is not developed for urban use. This may include natural areas set aside for species protection, lands used for agriculture or natural resource extraction, recreational areas, or areas unsuitable for development either due to a potential hazard (such as slide areas or floodplains) or due to other uses such as groundwater recharge or flood protection (San Gabriel and Los Angeles Rivers and Mountains Conservancy 2001).

Parks are a type of open space that is designed and managed for multiple uses such as recreation, natural resource conservation, and education.

Table 4. Agencies Administering Parks and Open Space in the Study Area

Federal	USDA Forest Service (USFS)
	US Army Corps of Engineers (ACOE)
	Bureau of Land Management
State	San Gabriel and Lower Los Angeles Rivers& Mountains Conservancy (RMC)
	Santa Monica Mountains Conservancy
	California State Parks
Regional Park Districts	Puente Hills Landfill Native Habitat Preservation Authority
Joint Powers Authorities (JPAs)	Mountains, Recreation and Conservation Authority
	Puente Hills Native Habitat Preservation Authority
	Watershed Conservation Authority
County	Los Angeles County Department of Parks & Recreation
	Los Angeles County Department of Public Works
	County of Orange Resources and Development Management Department / Harbors, Beaches and Parks Division
Districts	School Districts
Cities	City Parks and Recreation Departments, Community Services Departments


Parks and Open Space
San Gabriel Watershed and Mountains Special Resource Study
National Park Service
U.S. Department of the Interior
Palmdale
Acton
Santa Clara River
Little Rock Creek
Big Rock Ck
Big Tujunga Creek
W. Fork San Gabriel River
E. Fork San Gabriel River
Los Angeles
Burbank
Glendale
Altadena
Pasadena
Duarte
Arcadia
Los Angeles River
Alhambra
Montebello
Vernon
Inglewood
South Gate
Downey
Lynwood
Compton
Bell
Bell Gardens
Norwalk
La Mirada
Fullerton
Placentia
Cerritos
Lakewood
San Gabriel River
Torrance
Carson
Anaheim
Cypress
Orange
Long Beach
Garden Grove
Westminster
Seal Beach
Santa Ana
Huntington Beach
Costa Mesa
Upland
Chino
Chino Hills
0 1 2 4 Miles
National Park Service, Pacific West Region
Updated 8/2011
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State Parks
County Park
Equestrian Park
Equestrian District
Golf Course
Historical Park
Local and Community Park
Regional Park
Wilderness Park
Bureau of Land Management
Angeles National Forest
Angeles National Forest Developed Recreation Areas
Designated Wilderness Areas
NPS Study Area
Major Roads
Rivers and Creeks

Recreational use may be designated active, passive, or both. Passive use refers to activities that are generally low impact such as hiking, fishing, picnicking, bird watching, or non-motorized boating. Active recreational use may include facilities designed for sports such as soccer or baseball, lakes for motor-boats and jet skis, bicycle trails or equestrian trails.

This section examines parks and open spaces that are specifically managed for recreation or conservation purposes as well as areas which are not exclusively managed for public recreation and conservation purposes but offer some recreational opportunities. The latter areas include country clubs, botanical gardens, schools and universities, and cemeteries.

Within the study area, agencies from all levels of government provide open space, park, and recreational amenities (See Table 4, Agencies Administering Open Space and Recreation in the Study Area.)

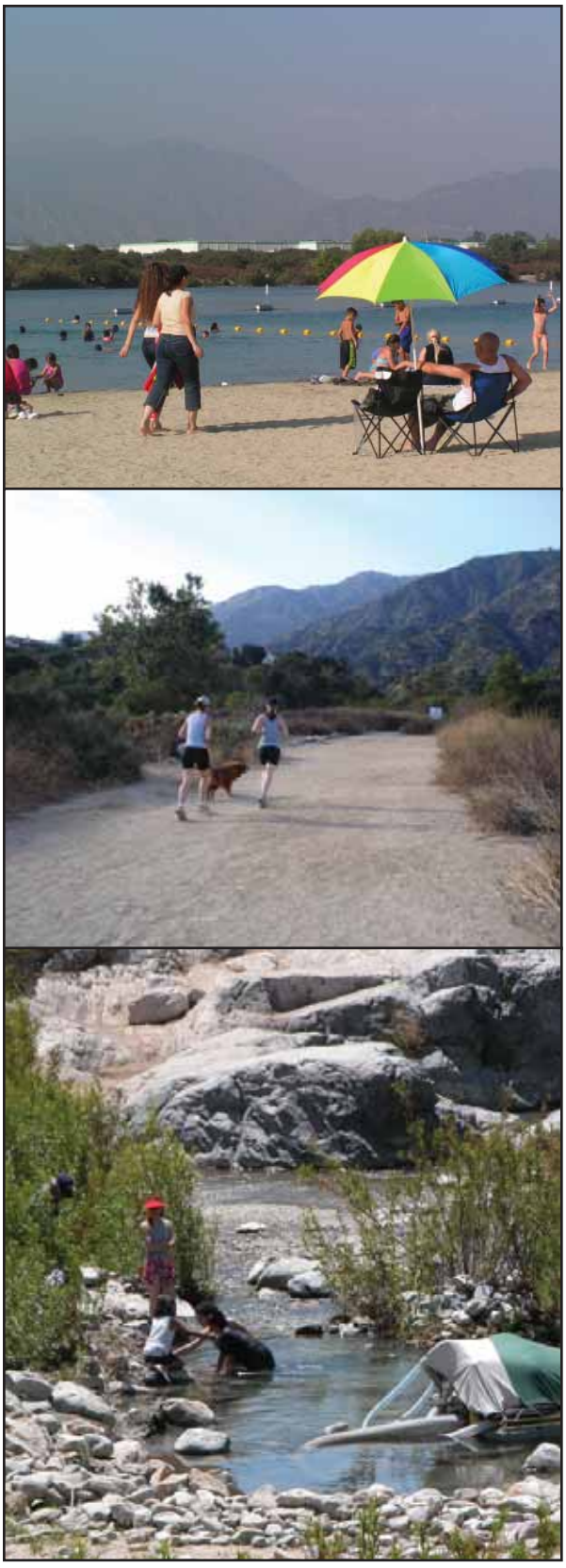
PARKS AND OPEN SPACE MANAGED FOR RECREATION AND CONSERVATION

The following section describes parks, open space and regional recreation areas that are specifically managed to provide recreational opportunities. A summary of these areas within the study area is provided in Table 5. Also, see Map: Parks and Open Space for an overview of distribution throughout the study area.

Local and Community Parks

Local and community parks are generally less than 50 acres and are designed to serve the active recreational needs of neighborhoods and communities. The types of parks that would fall in this category include tot-lots, athletic fields and courts, and playgrounds. Activities include play, organized sports, picnicking, barbequing, and hiking or walking on trails. Over 200 local and community parks are located in communities throughout the study area. Together these parks provide over 2,500 acres of land for managed specifically for recreation. These parks are typically managed by city park agencies and community services departments.

An analysis conducted by the Trust for Public Land demonstrated that higher density communities with lower than average median income in Los Angeles County typically do not have adequate access to local and community parks. While many cities in the study area have ample access to local and community parks, others have few or no



Photos (top to bottom): 1. Santa Fe Dam Recreation Area. NPS photo. 2. Eaton Canyon Natural Area. NPS photo. 3. East Fork San Gabriel River. NPS photo.

Table 5: Approximate Acreage of Study Area Parks and Open Space

Parks and Open Space	Units	Approximate acreage within study area	% of study area (707,000 acres)
Local and Community Parks	241	2,500	<1%
County and Regional Parks	35	11,050	1.6%
Golf Courses	20	1,650 public course (1300 private)	<1%
Wilderness Parks	8	3,100	<1%
Historical Parks and Cultural Sites	3	115	<1%
Equestrian Parks (public) and Districts	7	535	<1%
Bureau of Land Management Lands (BLM)	28	3640	<1%
Angeles National Forest	1	415,000 (5,000 acres or 1.1% of the forest lands are considered *developed recreation areas**)	59%
Total Open Space (including forests and BLM lands) = 437,590 acres			
Total Open Space (excluding national forest lands and BLM Lands that have not been developed for recreational access) = 23,950 acres			

*Developed recreation areas in the Angeles National Forest include campgrounds, parking areas, day use areas, picnic areas, visitor centers, rest areas, lakes and reservoirs used for recreation, river access, and scenic overlooks.

** Congressionally-designated Wilderness areas acreage is included in the total acreage for the Angeles National Forest

Sources: Green Visions Parks GIS Database (2006), Puente Hills Landfill Native Habitat Authority (2007), Protected Open Space Lands GIS Database (2005), USFS (2005), Southern California Association of Governments Land Use GIS Data (2001).

parks available. The section, *Recreation Needs and Opportunities*, discusses this issue further.

County and Regional Parks

The Los Angeles County Department of Parks and Recreation manages numerous parks throughout the study area. Some county parks function as local and community parks for unincorporated areas of Los Angeles County while others function as large regional parks that offer many types of recreation opportunities to a large service area. The County of Orange manages Craig Regional Park which spans the cities of Brea and Fullerton.

Major flood protection facilities in the Los Angeles Basin function as regional recreational areas. These include Whittier Narrows Recreation Area, Frank G. Bonelli Recreation Area, and Santa Fe Dam Recreational Area. Each of these regional parks provides over 1,000 acres of land for recreation. They afford a wide variety of recreational opportunities including trails and bike paths, boating, athletic fields, concession services, swimming, nature centers, camping (Frank G. Bonelli Regional Park only), fishing, event venues (such as amphitheaters), and barbeque/picnic areas. Whittier Narrows and Santa Fe Dam Recreational Areas also have nature centers and natural areas. Walnut Creek County Park is a linear park that follows Walnut Creek from Frank G. Bonelli County Regional Park several miles west through San Dimas and Covina.

Devil's Punchbowl is a 1,300-acre regional park managed by Los Angeles County at the northern end of the study area. Adjacent to the Angeles National Forest and near the San Andreas fault, this park was set aside so that visitors could learn about and enjoy the dramatic sandstone formations. Devil's Punchbowl features a nature center and miles of hiking trails. Wildlife viewing is another popular visitor activity at this park.

The largest of the regional parks is the Puente Hills Landfill Habitat Preservation Authority Preserve (Preserve) which includes 3,860 acres of land in the Puente Hills. The Preserve was established in 1994 and is managed by a joint powers authority with a Board of Directors represented by the City of Whittier, the County of Los Angeles, the Sanitation Districts of Los Angeles County, and the Hacienda Heights Improvement Association. Solid waste fees from the Puente Hills Landfill provide funding for the Preserve (Puente Hills Landfill Native Habitat Preservation Authority 2007).

Golf Courses

Large and small golf courses are found throughout the study area. Although Los Angeles County

and several municipal governments manage golf courses for the general public, many golf courses in the study area are privately managed. Public golf courses also typically require usage fees. The study area features almost 3,000 acres of golf courses. More than half of these (1,650 acres) are available for the general public. Approximately 1,300 acres are part of private clubs where membership is required. Golf courses are typically land- and resource-intensive facilities. Golf courses in the study area are about 60 acres on average, although they range in size from a few small courses at 10-20 acres to large 100-200-acre courses.

Wilderness Parks

In recent years land conservancies and municipal governments have cooperated to preserve wilderness parks. Wilderness parks are large, undeveloped open spaces that provide passive recreational opportunities and protect habitat for wildlife. Recreational activities include hiking, biking, horse-riding and dog-walking. Wilderness parks are typically located in foothill communities such as Claremont, Glendora, Arcadia, La Verne, and Pasadena and provide connections to the Angeles National Forest. Galster Wilderness Park in West Covina is located in the San Jose Hills. Over 3,100 acres of land in the study area has been designated as this type of parkland.

Pasadena manages a unique kind of natural park called a watershed park. The Hahamongna Watershed Park is located above Devil's Gate Dam adjacent to the Angeles National Forest. Established in 1997, these lands were previously used for sand and gravel mining operations. When these operations ceased, habitat was restored and a park was established based on community input and participation. The park is meant to be a showcase for water and natural resources education and utilization, preservation of native plants and habitat, Native American culture, and both passive and active recreation.

Historical Parks and Cultural Sites

Often cultural and historic sites occur within a park-like setting and are managed by government agencies or non-profit organizations. These facilities tend to have an educational mission, which provide opportunities for outreach and education. Only one state park is located within the study area, Pio Pico State Historical Park. Local historical parks, museums, and markers that commemorate historical events and features are found throughout the study area.

Equestrian Parks, Centers, and Districts

Use of trails and river corridors by equestrians has a long history in the study area. The horse also was the center of nearly all sporting events for the Spanish and Mexican settlers. Horse races, bullfights, rooster pulls, rodeos (or charreadas), and a variety of other daring feats performed on horses demonstrated the level of one's horsemanship while entertaining an enthusiastic audience (Welles 1972). This tradition continues today. The Pico Rivera Sports Arena near the San Gabriel River still hosts traditional charreadas.

Various equestrian facilities are located throughout the study area. Although many of these equestrian facilities are privately managed, the City of Industry and Glendora feature public equestrian parks. Equestrian facilities are also located in Pico Rivera at Bicentennial Park and Whittier Narrows

Los Angeles County has designated equestrian districts in several places in the study area. Equestrian districts are established to recognize particular areas where the keeping or maintaining of horses and other large domestic animals for the personal use of members of the family residing on the premises has become, or is intended to become, an integral part of the character of the area (Los Angeles County Code, Title 22, Chapter 22.44, Part 3). Of the eight Equestrian Districts designated throughout Los Angeles County, five are located in the study area. All five of these areas are located in close proximity to Whittier Narrows, the San Gabriel River, and San Jose Creek.

BUREAU OF LAND MANAGEMENT LANDS

The Bureau of Land Management (BLM) manages over 3,000 acres of land in study area. These lands consist of isolated parcels scattered throughout Soledad Basin and the Antelope Valley. Lands in the Soledad Basin are managed by BLM's South Coast District Resource Management Plan. This plan has designated most of the parcels in the study area for sale or exchange under Federal Land Policy and Management Act of 1976 (FLPMA). The FLMPA declared it the policy of the United States that "... the public lands be retained in Federal ownership, unless as a result of the land use planning procedure provided in this Act, it is determined that disposal of a particular parcel will serve the national interest..." Several parcels are designated for exchange with the National Forest Service. Antelope Valley parcels are managed under the West Mojave Plan. These will be retained or consolidated to reflect their value wildlife habitat and rare species (BLM 1994 and 2006).

ANGELES NATIONAL FOREST

Visitation and Use

Located in the heart of the greater Los Angeles metropolitan region, over 15 million people live within a 90-minute drive to the Angeles National Forest (ANF). Proximity to such a large urban population means that the ANF is one of the most visited national forests in the United States. In 1992, the U.S. Forest Service reported that the Angeles National Forest was the second highest ranked national forest in the United States for intensity of use. The Forest Service estimates that over 3.5 million visitors come to the national forest on an annual basis, making recreation the predominant use of the forest.

Comprising over 70% of Los Angeles County's open space, the ANF primarily serves day-use and family recreation activities. Almost all of the visitors to the forest are local in origin. Because over 90% of the San Gabriel Mountains are steep and rugged, these visits tend to be concentrated in the developed recreation areas that are easily accessible by roads. Major destination areas include San Gabriel Canyon, Crystal Lake, Big and Little Tujunga Canyons, and the area surrounding Mt. Baldy. Summer visitation is heaviest along areas with water recreation such as the San Gabriel Canyon. Winter recreation is focused around the Mt. Baldy area with its developed ski resorts (USFS 2007). Primary visitor facilities within the study area include two visitor centers, campgrounds, ski areas, picnic areas, trails, and roads. There are several private camps and recreation areas that serve various organizations throughout the region.

Waterfalls are an important recreational feature of the San Gabriel Mountains portion of the ANF. Geologic uplift associated with the Sierra Madre fault system created numerous falls that dot the southern base of the mountains. Some of the most popular and easily accessed falls include the Pasadena glen Falls, Monrovia Canyon Falls, Millard Canyon Falls, Lewis Falls, Bailey Canyon Falls, San Antonio Falls, Eaton Falls, Sturtevant Falls, and Switzer's Falls (Chester 2004).

Angeles National Forest lands in the San Gabriel Mountains are also heavily used by communities of faith. The mountains and the San Gabriel River are used for baptisms, retreats, faith hikes, pilgrimages, camping, and other spiritual activities such as prayer and meditation. There are about a dozen church camps in the San Gabriel Mountains, most notably Sturdevant Camp and the several Christian-owned camps that border the Pleasant View Ridge Wilderness area.

Visitor Services

Visitor services provided in the Angeles National Forest include interpretive services, visitor center management, interpretive media, in-forest concessions, management, fee collection, community outreach, visitor safety, and law enforcement services. The overall mission of the interpretive services, visitor centers, and education program is to forge intellectual and emotional connections between people and their natural and cultural heritage.

Community outreach includes activities that encourage the stewardship of national forest lands through the participation of people from local areas. These efforts lead to sustainable recreation within the national forest. Partnerships and volunteers are emphasized to improve visitor services and increase opportunities for interpretation and environmental education.

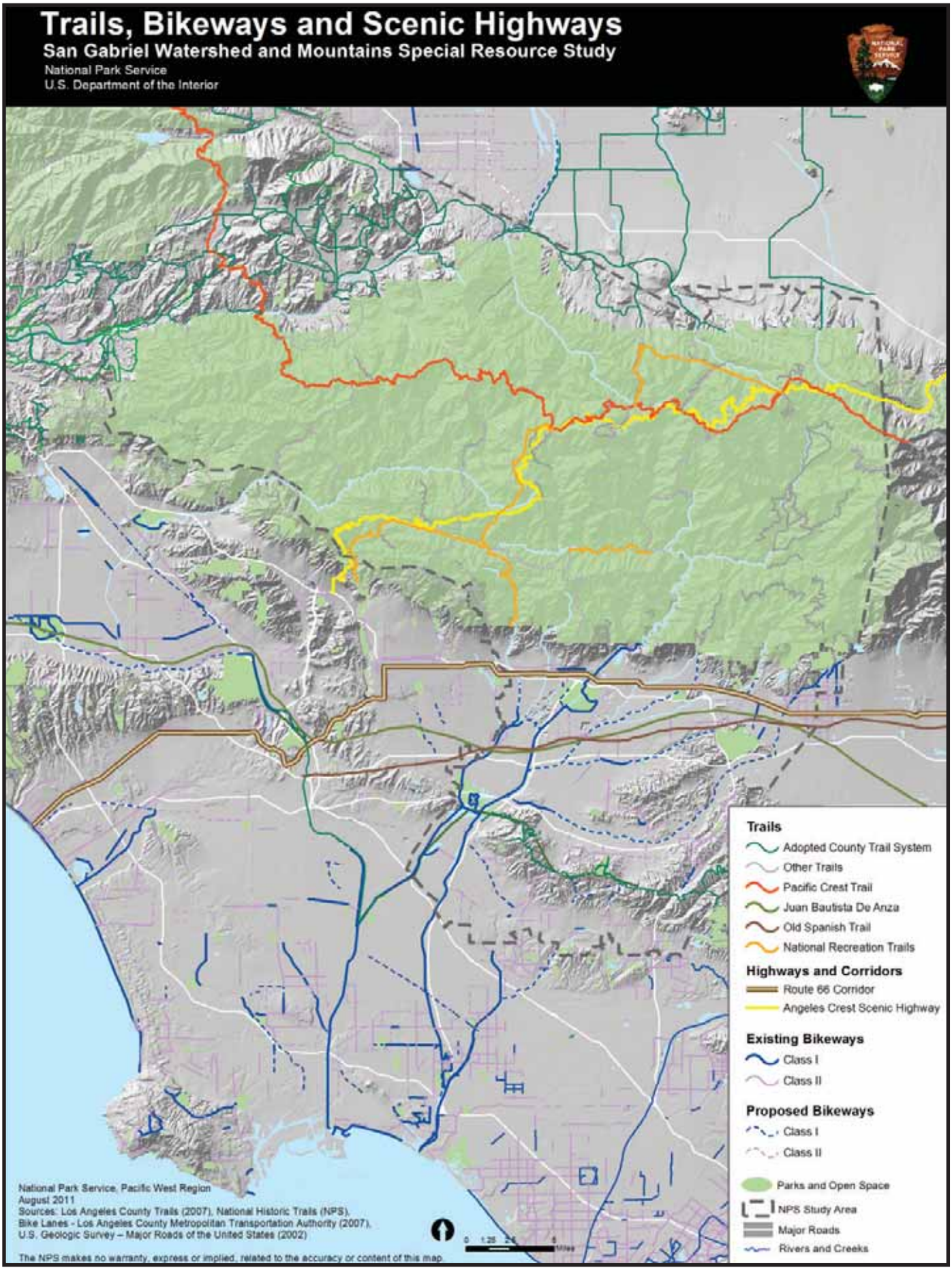
The Angeles National Forest manages approximately 500 recreation special-use authorizations, including four concession campground complexes, two concession target shooting areas, five ski areas, a marina, 26 organization camps, and over 450 summer homes. The forest also issues and administers numerous recreation events, such as mountain bike events and car rallies (USFS 2005).

Facilities

The Angeles National Forest operates over 350 buildings throughout the national forest. These range from restroom facilities and fire stations to administrative offices. In addition, the forest operates 63 campgrounds with over 1,100 individual campsites and an additional 36 picnic areas. Numerous trails are located on the forest; these trails are described in the following section, *Trails and Scenic Highways*.

Multiple agencies maintain a large road network in the national forest, including bridges, culverts, low-water crossings, and tunnels. The California Department of Transportation is responsible for three major highways: California State Route 2, California Interstate 5, and California State Route 39. Los Angeles and San Bernardino Counties also maintain a portion of the network. The U.S. Forest Service maintains 1,000 miles of roads.

The 2005 Forest Plan indicates that roads and trails will be maintained to minimize the level of effects to species and watersheds while safely accommodating use. National Forest staff plan to maintain approximately 10 percent of National Forest System roads to their objective


Trails, Bikeways and Scenic Highways
San Gabriel Watershed and Mountains Special Resource Study
National Park Service
U.S. Department of the Interior
Trails
Adopted County Trail System
Other Trails
Pacific Crest Trail
Juan Bautista De Anza
Old Spanish Trail
National Recreation Trails
Highways and Corridors
Route 66 Corridor
Angeles Crest Scenic Highway
Existing Bikeways
Class I
Class II
Proposed Bikeways
Class I
Class II
Parks and Open Space
NPS Study Area
Major Roads
Rivers and Creeks
National Park Service, Pacific West Region
August 2011
Sources: Los Angeles County Trails (2007), National Historic Trails (NPS),
Bike Lanes - Los Angeles County Metropolitan Transportation Authority (2007),
U.S. Geologic Survey – Major Roads of the United States (2002)
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maintenance level. Decommissioning of unneeded or unauthorized roads and trails will be emphasized. ANF staff plan to complete site-specific road analysis on approximately 30 percent of the unclassified roads and make appropriate designations.

Wilderness Areas

There are four Congressionally-designated wilderness areas in the study area, all of which are located in the Angeles National Forest. The *San Gabriel Wilderness* area is over 36,000 acres. It is located north and east of the West Fork of the San Gabriel River. It includes rugged terrain ranging in elevation from 1,600 to 8,200, most of which includes chaparral habitat. Higher elevations are dominated by fir and pine forests. Popular recreation activities that occur in this area include hiking, fishing, waterplay and picnicking. Most of this visitation occurs on trails and riparian woodlands located in canyon bottoms.

The *Sheep Mountain Wilderness* area is over 39,000 acres and located on the eastern end of the San Gabriel Mountains. Approximately 400 acres of this area is located on the San Bernardino National Forest. Elevations range from 2,400 ft. to over 10,000 ft. This highly scenic wilderness area is primarily chaparral habitat. Several pre-1964 mining operations are located in this area with special-use authorization (USFS 2005).

In 2009, Congress designated two new wilderness areas in the Angeles National Forest, both of which are located in the study area. The *Magic Mountain Wilderness* area is over 12,000 acres; it features steep narrow canyons with a combination of chaparral, pines and hardwood forests. This area provides habitat for many of the forest's threatened and endangered species. There are no officially designated trails that fall within this wilderness area. The *Pleasant View Ridge Wilderness* area, containing almost 27,000 acres is located in the northeastern section of the San Gabriel Mountains and includes the northern slope where the mountains meet the Mojave Desert. The area is known for its majestic peaks and spectacular views of the San Gabriel Mountains and desert basin. It is traversed by the Pacific Crest Trail.

Trails and Scenic Highways

Trails and scenic highways provide opportunities for hiking, horseback riding, running, biking, and leisure driving. They also provide a means of connecting people to places, including parks and open spaces where they can partake in other recreational activities. The study area contains a wide range of trail types, including roads that have designated bikeways, paved trails separate from roadways, unpaved trails, and nationally recognized scenic, historic, and recreational trails.

The Angeles Crest Scenic Highway is an important recreational feature of the study area. It is the only road that traverses through the entire Angeles National Forest from north to south; therefore it provides one of the best opportunities for people to access the forest via automobile. Many trailheads and recreational facilities are located along this highway. This road was designed expressly for recreational pleasure and features outstanding views and mountain scenery.

TRAILS

Trail corridors allow people to connect from their neighborhoods to open space and park resources, while experiencing their surroundings and contributing to their mental and physical well-being. Trail use also provides opportunities for social interaction. With the integration of educational and interpretive elements, trails also become spaces for connecting people to special places and their stories. The increasing demand for trails is exemplified in the Public Opinions and Attitudes on Outdoor Recreation (1997) conducted for California State Parks which revealed through surveys that the top outdoor activity in the state is recreational walking. When asked if they would increase their participation in any particular activities if good opportunities became available, respondents indicated that recreational walking and trail hiking were in the top three activities in which they would engage.

Trail corridors often follow waterways, but they also have the ability to traverse and connect sub-watershed areas as well as other open space areas. Trail corridors, depending on their widths, provide opportunities for integrating native vegetation and limited habitat and groundwater recharge and water quality improvement features such as bioswales.

Trails are maintained by a broad range of agencies. The Angeles National Forest offers 557 miles of hiking and equestrian trails which include 73 miles of National Recreation Trails and 176 miles of the Pacific Crest National Scenic Trail. Trails in the ANF are open to hiking and equestrian and mountain bikes use, except on the Pacific Crest National Scenic Trail and trails in designated wilderness areas.

In the urban areas, trails are primarily used for two purposes, recreation and non-motorized transportation. The County of Los Angeles manages the primary regional trail network. Their trails are

described as multi-use "riding and hiking trails," but not all of the trails are necessarily feasible for equestrian use.

Trail data for this area is sparse and inconsistent because of the many agencies that manage trails. Agencies which have trail data include the Angeles National Forest, the Lower Los Angeles and San Gabriel Rivers and Mountains Conservancy, and the Los Angeles County Department of Parks and Recreation. Various municipal governments also collect trail data. Trails of the western Puente Hills have also been digitized by the Puente Hills Native Habitat Preservation Authority.

National Trails

The study area contains trails designated under the National Trails System, a network of scenic, historic, and recreation trails created by the National Trails System Act of 1968. These trails provide for outdoor recreation needs, promote the enjoyment, appreciation, and preservation of open-air, outdoor areas and historic resources, and encourage public access and citizen involvement. There are two categories of these trails in the study area, National Scenic and Historic Trails and National Recreation Trails (See map: Trails, Bikeways and Scenic Highways).

National Scenic and Historic Trails preserve stories that are essential to a true understanding of the American experience. While National Scenic Trails and National Historic Trails may only be designated by an act of Congress, National Recreation Trails may be designated by the Secretary of Interior or the Secretary of Agriculture to recognize exemplary trails of local and regional significance in response to an application from the trail's managing agency or organization. National Scenic and Historic trails within the study area include the Pacific Crest National Scenic Trail, the Juan Bautista de Anza National Historic Trail, and the Old Spanish National Historic Trail. National Recreational Trails include the Gabrieleno Trail, the High Desert Trail, the Silver Moccasin Trail, and the West Fork Trail.

Established in 1968*, The Pacific Crest National Scenic Trail* spans 2,650 miles from Mexico to Canada through three western states, revealing the beauty of the desert, the Sierra Nevada, Transverse, and the Cascade Range Provinces. In the study area, the trail traverses the Angeles National Forest, entering at Cajon Pass and traversing across Blue Ridge, past Mt. Baden-Powell and eventually descending to Highway 14 at Agua Dulce where it enters the Sierra Pelona Mountains. The vistas from the trail in the Angeles National Forest include the Los Angeles Basin and Mojave Desert.

The Juan Bautista de Anza National Historic Trail, which is managed by the National Park Service, commemorates the route followed by a Spanish commander, Juan Bautista de Anza, in 1775-76 when he led a contingent of 30 soldiers and their families through what is now Mexico, Arizona, and California to found a presidio and mission near the San Francisco Bay. This unit of the National Park System has an auto route and a recreational route. The recreational route is currently planned through the Puente Hills to the Whittier Narrows area, and will coincide with the Schabarum/Skyline Trail and a portion of the Rio Hondo River Bike Trail.

The recently designated Old Spanish National Historic Trail commemorates the Santa Fe-to-Los Angeles route that sent dry goods west, and horses and mules east. The Old Spanish Trail forged the first overland link to California for the east coast markets served by the Santa Fe Trail and the trade-hungry markets of Mexico and New Mexico using El Camino Real de Tierra Adentro. The trail, which is more than 2,700 miles long and crosses New Mexico, Colorado, Arizona, Utah, Nevada, and California, goes through the Los Angeles region paralleling the Juan Bautista de Anza National Historic Trail.

The BLM and NPS will work with partners to provide recreation, public education, and interpretation, including: marking trails for public use, conducting historic and archeological research, developing visitor services and facilities, and protecting trail-related sites and segments along the historic routes.

The Gabrieleno Trail follows the route of an original 1920s road that ran from Pasadena north up the canyon past wilderness resorts and old rustic cabins. The road lost its appeal after the Angeles Crest Highway was built, but today has reinvented itself as a multiuse trail for hikers, horseback riders, mountain bikers, and birders. Much of the hike follows a gurgling stream past thick groves of live oak, sycamore, Douglas fir, and big-leaf maple trees. Except for the first half mile, the path is almost entirely in the shade, making it a great year-round hike. Some hikers prefer to begin at the northern end of the Gabrielino Trail, heading south into the forest from Switzer Falls Picnic Area and ending at the Arroyo Seco trailhead.

The High Desert Trail is a 27-mile backcountry trail that incorporates several trails, including the Burkhart Trail, Devil's Punchbowl Trail, Manzanita Trail, and South fork Trail. The High Desert Trail system joins the San Gabriel Mountains with the Mojave Desert, and combined with the Pacific Crest Trail, it forms two small loops or one large loop. The

trail affords the Pacific Crest Trail traveler a "high desert experience" alternative.

The Silver Moccasin Trail is the oldest designated national recreation trail and stretches 51 miles through the Angeles National Forest Backcountry. The trial runs from Red Box down the West Fork of the San Gabriel River, up Shortcut Canyon and across the head of Big Tujunga to Charlton Flat and onto Chilao. From this point it follows along the Pacific Crest Highway to Mt. Baden-Powell and ends at Vincent Gap. This trail has been used by the Boy Scouts of America since 1942. Those that successfully complete the 5-day trip receive a Silver Moccasin badge.

The West Fork Trail is a paved trail which extends six miles along the West Fork of the San Gabriel River. This trail is popular for bicyclists in the region and provides access to excellent fishing locations.

Angeles National Forest Trails

In addition to the popular National Recreation Trails described above, the Angeles National Forest provides hundreds of miles of trails and fire roads. John W. Robinson's *100 Hikes in the San Gabriel* provides good descriptions of these trails. They range from strenuous to easy and provide access to historic structures, high mountain peaks, and wilderness areas. With the exception of the wilderness areas, trails are generally open to mountain bikes. Equestrians also make use of the Angeles National Forest Trails. Many miles of trails are also available for off-highway vehicle use (OHV).

County and Regional Trails

Regional trails and greenways are located throughout the study area linking various parks and open spaces. Schabarum (also known as Skyline) Trail extends 17 miles through the Puente Hills from Workman Mill Road in the west to Fullerton Road in the East. It serves as the spine for the preserve's trail system and is maintained by Los Angeles County Parks. Schabarum Trail will also serve as a recreational route for the Juan Bautista de Anza National Historical Trail.

Los Angeles County manages a regional trail network within the study area that connects regional and county parks. The County's trail network connects all of the regional parks in the study area. A similar county trail network is planned for the Soledad Basin area and the Antelope Valley to the west and north of the Angeles National Forest.

The Marge Feinberg Rim of the Valley Trail Corridor encompasses the entire upper Los Angeles River

Photos (top to bottom): 1. Schabarum Regional Park, Puente Hills. NPS photo. 2. Equestrians in Arroyo Seco. NPS photo.

watershed area within the Angeles National Forest and portions of the Upper Santa Clarita River watershed. The trail is 150 miles long and approximately 60% complete. Trails connecting into the Rim of the Valley trail are the Backbone Trail, Pacific Crest Trail, De Anza Trail, and the Los Angeles River Parkway. Responsible jurisdictions are Los Angeles County, Ventura County, City of Los Angeles, US Forest Service, National Park Service, and California Department of Parks and Recreation (California Department of Recreation and Parks 2002).

Bikeways

There are several types of bicycle paths and trails available in the study area. Class I bikeways feature off-street, bi-directional paved paths designated for cyclists. The San Gabriel River and Rio Hondo River trails are examples of Class 1 bike paths. These river bike trails also serve as regional trails and greenways, connecting communities and park areas. Los Angeles County's San Gabriel River bike trail extends from the southern border of the Angeles National Forest in Azusa, all of the way to the Pacific Ocean. The total trail length is 39 miles. This trail includes access points from most major streets and direct access to 15 parks. The Rio Hondo River Trail links to the San Gabriel River Trail via the Whittier Narrows Recreation Area and converges with the Los Angeles River Trail near Downey, just south of John Anson Ford Park. The Whittier Greenway Trail is a 5-mile bicycle/pedestrian trail which replaced an abandoned right-of-way of the old Pacific Electric Railway.

Other bikeways are located along streets and roads. These include Class II bikeways, on-street, one-way striped lanes designated for cyclists, and Class III bike routes, on-street preferred bicycle routes designated by signs only.

The Los Angeles County Metropolitan Transportation Authority (Metro) developed a strategic plan in 2005 to describe a vision for bicycling as a viable transportation mode in Los Angeles County. The strategic plan establishes regional bicycle planning policies and provides tools for local agencies in creating local bicycle plans (Metro 2006).

Equestrian Trails and Access

Equestrian users need strategic access points and staging areas to use the many trails available for equestrian use. Staging areas are located throughout the study area in Azusa, Duarte, Santa Fe Dam Recreation Area, San Dimas, Walnut, and the nearby Whittier Narrows Dam Recreation Area. Equestrian trails parallel the San Gabriel and Rio Hondo River Trails along many portions of these rivers. Some specific equestrian facilities include the Pico Rivera Bicentennial Park & Equestrian Center located at the northern end of the Whittier Narrows area. This facility holds 168 horse stalls and provides access to miles of trails. Included in the City of Industry is the Industry Hills Equestrian Center, a 400-staff equestrian center that provides access to 15 miles of trails for riding and hiking. The City of Walnut also maintains 26 miles of multi-use trails which are equestrian-oriented.

Off-Highway Vehicle Trails

Trails for off-highway vehicle (OHV) use are found throughout the Angeles Forest in Soledad Basin and the Antelope Valley. Approximately 291 miles of unpaved road are open to OHV use on the Angeles National Forest while another 194 miles of unpaved road are closed to such use. It is estimated that the forest has 131,965 riders annually (Chavez and Knapp 2004). As OHV use grows in popularity, management conerns have arisen, including use of undesignated trails, soil erosion, water degradation, habitat destruction, the spread of endangered species, damage to cultural sites, and conflicts between different recreational user groups.

Trail Connectivity

Another key issue is trail connectivity, or the degree to which trails connect to each other and to open space and park resources. Within the San Gabriel River watershed, the Los Angeles County's regional trail system connects local parks, regional parks, and national forests. In the western portion of the study area, the Rim of the Valley Regional Trail connects open spaces along the western San Gabriel Mountains Foothills, the Verdugo Mountains, the San Gabriel and San Fernando Valleys, and the Santa Monica Mountains. This trail provides several connections to Angeles National

OHV use. Angeles National Forest. NPS Photo.

Forest Trails. Connectivity between cities and parks exists in some areas but there are many local trails that do not extend beyond jurisdictional borders. The Metropolitan Transit Authority has identified connections for bike trails and commuter bike lanes on city streets. Los Angeles County Parks and Recreation has planned a connected trail system for the Antelope Valley area that will connect national forest lands to local communities. Planning is underway for this effort.

SCENIC ROADS AND HIGHWAYS

Angeles Crest Highway

The Angeles Crest Highway is the only major roadway that traverses the San Gabriel Mountains. The highway traverses from La Canada Flintridge through the heart of the mountains to Wrightwood, on the northeastern base. Completed in 1956, the highway was first proposed in the early 1900s to provide access to the spectacular scenery, recreational areas, historic sites, geological features, and to mountain communities. In 1971 it was designated a California State Scenic Highway and in 1990, a National Forest Scenic Byway. From the highway, visitors can access campgrounds, ski areas, wilderness areas, historic sites, natural areas, picnic areas, and national recreation trails.

OTHER AREAS THAT OFFER RECREATIONAL OPPORTUNITIES

Various land uses in the study area not expressly managed for public recreational opportunities also provide opportunities for recreation. These areas include schools, colleges and universities, botanical gardens, and cemetaries.

Schools

Schools provide the opportunity to supplement open space resources in communities, particularly in areas that lack traditional parks and wildland areas. School grounds such as playing fields and playgrounds can be managed for multiple uses, providing community spaces close to neighborhoods when school is not in session, such as during afternoons, weekends, and holidays. Because the distribution of schools tends to be denser than the distribution of parks in the study area, they provide an important opportunity to provide close-to-home recreation opportunities. There are nearly 500 elementary, junior high, and senior high schools in the study area.

Colleges and Universities

Institutions of higher education provide multiple opportunities for providing recreation and conservation areas. In addition to having larger campuses than elementary, middle, and high schools, student populations are often energetic to engage in environmental issues. There are nine colleges and universities in the study area. Several colleges and universities managed open space for habitat conservation and recreation. For example, the Rio Hondo Wildlife Sanctuary at Rio Hondo College is available for research and educational use.

Botanical Gardens

Botanical gardens, although not expressly managed for public recreation, provide an opportunity to walk and hike while learning about plant communities. Approximately 25 acres of the 86-acre Rancho Santa Ana Botanical Gardens, managed by California Polytechnic University, Pomona, are within the study area. The garden is expressly designed to preserve and showcase native California plant communities.

Cemeteries

While not traditionally considered open space, larger cemeteries and memorial parks are typically open, landscaped areas. Through public-private partnerships, there could be opportunities to develop watershed management practices in these areas. There are even examples of cemeteries being used by communities for recreational uses such as walking. Within the watershed, there are seven large cemeteries over 10 acres. Rose Hills Memorial Park in the Puente Hills is the largest cemetery in the study area. At 1,500 acres, it is also one of the largest in the world.

The Angeles Crest Highway. 2005. NPS photo.

Recreation Needs and Opportunities

INTRODUCTION

The Los Angeles metropolitan region has struggled to provide adequate recreation opportunities for its growing urban areas since its first population boom at the end of the 19th century. Throughout the 20th century, population growth and development in the region has far outpaced the creation of recreational facilities. This has occurred despite the completion of previous comprehensive recreation studies that called for investment in more recreational facilities.

Deficiencies in recreation and open space remain for much of the Los Angeles Region. Over 15 million people live in the larger metropolitan region and the California Department of Finance projects another 13 million residents by 2050 (California Department of Finance 2007a). With existing recreation and park areas in most cases already taxed beyond capacity, it is safe to assume that significant efforts will need to take place to ensure sufficient opportunities for diverse recreational experiences in the future. In addition, communities of color and children have disproportionately low access to parks and open space in Los Angeles County. See also Chapter 7, *Environmental Consequences,* for a more discussion on current recreation trends.

NEEDS

Recreation Demand in Urban Areas

In addressing present and future open space concerns for the study area, disparities must be addressed regarding the disproportional access to park and recreational space. As recent reports from The Trust for Public Land (TPL) and the City Project indicate, public access, predominantly of minority populations, to parks and recreation facilities is a serious concern. According to TPL, Los Angeles County ranks at the bottom in comparison to the nation's seven major cities (Boston, New York, San Francisco, Seattle, San Diego, and Dallas) in terms of providing access to parks for children. In fact, the report, based on 2000 census data, indicates that "more than 1.5 million children in Los Angeles County do not live within walking distance of a public park." In most cases, parks in the Los Angeles region are not located near those areas with high concentrations of young children (Trust for Public Land 2004).

The issue of accessibility is of particular concern when measuring existing open and park space in comparison to population densities. As demonstrated in the City Project's work in Los Angeles, many families in the low income neighborhoods of the region often do not have cars nor are near public transportation systems that allow for access to regional parks. This is particularly true in the case of the 651,874-acre Angeles National Forest which, in making a simple per capita measurement (open space divided by population size), appears to indicate a sizeable measurement of potential recreation space in comparison to a local urban population. However, the aforementioned barriers to access and the inaccessibility of much of the forest's terrain, skews this measurement significantly.

Public interest in open space and recreation in the region is significant and concerted efforts are underway by a myriad of non-profit organizations, local and municipalities, community groups, and private and public groups to procure and maintain open space in various areas throughout the Los Angeles region. Furthermore, the $2.6 billion Proposition 40 has further sparked this interest in public space allowing for funds to be allocated for environmental and park projects throughout the state of California (Trust for Public Land 2004).

Regional stakeholders such as the state land conservancies, land trusts, and other non-profits have worked diligently in their respective efforts to maintain and acquire park and open space in the region. The Rivers and Mountains Conservancy (RMC), one of eight conservancies in the California Resources Agency, is working to "preserve open space and habitat in order to provide for low-impact recreation and educational uses, wildlife habitat restoration and protection and watershed

Photo caption: The Santa Clara River. 2007. NPS photo.

improvements within our jurisdiction." Their work has been instrumental in the allocation of several new parks and open spaces including the Woodland Duck Farms (in coordination with the Trust for Public Land and the El Monte/Gibson Road Community Park. RMC has also been instrumental in their work on the San Gabriel River Corridor Master Plan

The Emerald Necklace Plan, headed by Amigos de los Rios, is working with local communities to develop a 17-mile loop of parks and greenways that connect to the San Gabriel River, creating additional open space for the local communities, and providing opportunities to improve water quality and create habitat. It is their vision to serve 500,000 local residents with more than 1,500 acres of interconnected parks and open spaces. Amigos de los Rios' work with local communities has resulted in the establishment of several parks along this necklace including Lashbrook Park, and the current rehabilitation of Rio Vista Park, both in the city of El Monte.

National Forest Challenges and Demands

With over 10 million people within a 90-minute drive, the Angeles National Forest is highly used by local residents. Increasing recreation demands put increasing pressure on forest management. It is estimated that the recreational demand will increase by as much as 15-35% over the next two decades (UCLA Landscape Architecture Program 2006).

The effects of heavy recreational use in sensitive river corridors, particularly in the upper San Gabriel River Watershed, have impacted sensitive resources. With a mild climate, these areas receive year-round visitation. Additionally, on summer weekends, more than 10,000 visitors come to this area. Challenges include trash, graffiti, tree-carving, and other illegal activities (UCLA Landscape Architecture Program 2006).

As U.S. Forest Service budgets have been primarily allocated for wildfire preparedness, the Angeles National Forest has struggled to provide adequate staffing and facility maintenance for such heavily used areas. Base budgets for non-fire operations have remained relatively flat since 1995. When adjusted for inflation, such budgets have actually fallen. Meanwhile, recreation demands have continued to increase. With additional staffing, the U.S. Forest Service could expand education programs, ranger patrols, and facility maintenance to better address these needs (Richardson 2009).

Photos (top to bottom): 1. San Gabriel River bike trail, near Lashbrook Park. 2004. NPS photo. 2. The San Gabriel River. 2004. NPS photo. 3. Picnicking by Jackson Lake. 2007. NPS photo.

Station Fire Effects on Recreation

A number of campgrounds and picnic sites within the ANF were damaged by the 2009 Station Fire. Those campgrounds damaged by the Station Fire include Monte Cristo, Mt. Pacifico, Messenger Flats, Chilao, Valley Forge, West Fork, Devore, Millard, and Gould Mesa. Forest Service picnic areas damaged by the fire are: Wildwood, Vogel Flat, Stoneyvale, Pines, and Switzer. The U.S. Forest Service anticipates that most campgrounds will be opened to the public when the burn closure ends, even though some features are fire-damaged. Damaged tables, restrooms, etc. will be repaired or replaced following availability of funds.

After the Station Fire, many forest roads were left without guard rails and regulatory and safety road signage, making them unsafe for regular traffic. The damage to the surrounding land and hillsides also made the roads vulnerable to debris flow hazards during rain storm conditions. Because of this public safety danger, roads within the burned area are only open to residents, agency personnel, and construction crews. Trails were also damaged by fires and subsequent erosion. Reconstruction of trail sections will also be necessary in many areas of the forest affected by the burn (USFS 2010).

OPPORTUNITIES

An inventory of open space with the urbanized portion of the study area (excluding the Angeles National Forest) demonstrates that opportunity areas often exist within the watershed corridors of the San Gabriel and Rio Hondo Rivers, in addition to tributary creeks including Walnut Creek and San Jose Creek. Flood zones both within and outside of these particular corridors provide open space with potential for recreational use.

Additional opportunities for recreation and park development may also exist in industrial areas and Brownfield sites. Though remediation will no doubt be a concern, exhaustible extraction activities, namely oil and mineral sites, provide an opportunity for park and recreation space as these activities will at some point end.

The eventual expiration of quarry activities, in such areas as Irwindale, Pico Rivera, and Baldwin Park, may open up significant areas of open space within the San Gabriel River corridor, presenting additional opportunities for open space and recreation.

Utility right-of-way areas in many areas throughout the study area provide significant tracts of opens space that are, in places, used for such activities as biking, walking, equestrian, use and plant nursery activities. Safety is no doubt a concern and negotiations with utility companies and city municipalities will need to take place to determine the appropriateness of space associated with any rights-of-way.

Opportunities for further trail enhancements and connections exist throughout the study area. Efforts are underway to extend trail networks, particularly in and around the proposed Emerald Necklace project area. Additional efforts are underway to improve and link trail networks in Puente Hills, Schabarum Park, and the San Gabriel Foothills. Broader regional planning could greatly assist local agencies in realizing greater trail connectivity.

As many of these opportunity areas span political boundaries and are beyond local municipality control, a regional, effective, and comprehensive approach should be taken when examining these opportunity sites. In doing so, barriers related to the relatively fragmented political character of these cities must be overcome so as to ensure effective and comprehensive management policies for regional recreation and open space planning.

Wildflowers, Puente Hills. 2010. NPS photo.