

5.9 Natural Resources Stewardship



Introduction

The Santa Ana River Watershed historically contained an abundance of natural resources, including water captured from snowmelt in the local mountains, diverse wildlife populations, abundant aquatic life in streams and coastal waters, geological resources for building materials, and a wide range of plant communities from coastal sage, to wetlands, to evergreen forests. These assets were first utilized by Native Americans and then by European settlers, who began to change the land use in the watershed with irrigation and farming.

Over the past 200 years, human population has increased greatly in the Santa Ana River Watershed. Since the 1930s, controlling floods and providing a reliable water supply have taken precedence over other critical watershed issues. These priorities have changed the natural hydrology of the Santa Ana Watershed, diminishing the once abundant natural water resources in the region. This strain on water resources and associated urbanization has left only remnants of isolated habitat in highly populated areas. Other factors including invasive plant species, frequent local fires and rogue recreational uses also have contributed to a reduction or complete loss of available habitat in some areas.

The natural resources and habitat in the Santa Ana River Watershed are now a fraction of their historical values. Therefore, efforts must be made to sustain and conserve the remaining resources for the benefit of future generations of life in the ecosystems of the watershed, and even expand them where possible. The purpose of this chapter is to detail the current status of these natural resources, including their benefits as both habitat and recreational assets, and to identify opportunities to promote and

implement sustainability followed by recommendations for solutions that maintain ecological balance and economic health.

Resources of the Santa Ana River

Surface Water

Water is the key life-sustaining resource within the Santa Ana River Watershed. The river begins high in the San Bernardino Mountains, where it flows westward for approximately 18 miles and then picks up additional flows from Bear Creek, a major tributary. The river then runs southward and meets up with Seven Oaks Dam, which provides capacity for flood control and also serves as a reservoir, with a total capacity of 145,600 acre-feet. The released flows from the Seven Oaks Dam continue westward with additional flows into the river contributed by Mill Creek, City Creek, San Timoteo Creek, Warm Creek, Twin Creek, Cajon Creek, and Lytle Creek before reaching the reservoir at Prado Dam. The Prado Basin also is fed by Chino Creek and another stream named Mill Creek, and occasionally by Temescal Creek in wetter years.

Water released from Prado Dam continues westward into Orange County, where the river then is diverted into spreading grounds for groundwater recharge in the north Orange County aquifer. Any remaining flows are confined to concrete channels between earthen levees, and additional flows are received from Santiago Creek, located near the city of Anaheim. The flows continue in a concrete flood control channel until crossing Interstate 5 near the city of Santa Ana, where the river again flows through a soft-bottom channel before reaching its mouth between Huntington Beach and Newport Beach.

Much of the river's historical flows have been diverted for local use along its path. The majority of water that currently flows in the Santa Ana River during the non-rainy season now comes from effluent from wastewater treatment plants.

The Santa Ana River Watershed has one natural and several manmade lakes that retain water for use as drinking water, irrigation, recreation, and habitat for aquatic species. Big Bear Lake is manmade and resulted from the construction of a dam along Bear Creek to hold back the runoff and snowmelt for the purpose of providing a reliable source of irrigation water for citrus growers near Redlands. Recreational boating and fishing are also beneficial uses of Big Bear Lake. Lake Perris, located in the eastern side of the Santa Ana River Watershed, is also manmade. Completed in 1973, Lake Perris is the terminus of the State Water Project and is used as a recreational amenity for the region. Lake Mathews, also manmade, is located in the foothills of the Santa Ana Mountains and functions strictly as a drinking water reservoir. It is the terminus of the Colorado River Aqueduct.

Lake Elsinore is a natural lake that offers recreational boating and fishing. In recent years, the lake has been replenished with recycled water. Mystic Lake, in the San Jacinto Basin, is an ephemeral lake that appears in wetter years, receiving waters from overflows from the San Jacinto River.

Minerals

The geological composition in the Santa Ana Watershed has developed over a long period of time by the forces of natural seismic events and climate changes that affected the course and volume of the Santa Ana River. As flows from tributaries carried and deposited sediment along its varied alignments, areas referred to as alluvial fans were created. Most of the watershed from the base of the San Bernardino Mountains and north of the Santa Ana River are comprised of marine and non-marine sedimentary rocks. On the south, in the area of the Cleveland National Forest, shale, sandstone, limestone and slate dominate the geology. The San Bernardino Mountains' geology consists largely of a composite of Precambrian igneous and metamorphic rocks and Mesozoic granite.

The greatest mineral economic resource in the region is in aggregate, which can be in the form of natural sand and gravel, or produced by crushing rock. It is valued for its many uses in construction such as in Portland cement concrete, asphaltic concrete, road base, railroad ballast, and rip-rap. The California Geological Survey estimates that current permitted mining for this resource in the Santa Ana River Watershed region will meet only 25 percent of the estimated local demand. Importing this resource from other than local sources will result in higher project costs for all types of construction and have negative environmental impacts. Mining, however, also has been associated with negative environmental impacts including noise, dust, and habitat destruction. Mitigation of these impacts results in a lengthy process of five to ten years to acquire permits, which has greatly reduced the amount of aggregate mined in the region despite its abundance.

Vegetation in Habitat Areas

Habitat classifications can be very complex, and while complex information is available for interested parties, this document will refer to several generalized groups, including alluvial fan, riparian, wetland, coastal, chaparral, and forested habitats.

Alluvial fans are located where stream flows that originate in mountainous areas flatten and spread out. Fan-shaped deposits of sand and gravel sediment, brought down from higher elevations, are left in the wake of storm and flood events, building up over time. They also can be found in desert areas that are prone to flash floods. Alluvial fan areas create a unique habitat in the Santa Ana River Watershed, but most significantly, they are home to both endangered and threatened plants and animals. They also are in areas where historical groundwater recharge has occurred, increasing the importance for conservation of alluvial fan areas.

Riparian habitats are those areas that transition between land and rivers or streams, and sometimes are referred to as buffer zones. These riparian zones provide valuable wildlife habitat and serve as wildlife corridors, allowing for increased biodiversity by enabling wildlife, including aquatic life, to move freely along river systems. Keeping this connectivity intact is vital in avoiding development of isolated communities.

According to the Clean Water Act, wetlands are defined as: "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal

circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.” Wetlands serve as vital habitats for a wide range of birds and aquatic creatures. Coastal habitats consist of a combination of beaches and intertidal wetlands, which meet the definition of wetlands above.

Chaparral is comprised of hard-leaved evergreen shrubs that grow two to four meters tall with deep roots. An understory layer rarely exists. Chaparral habitat occurs in different types of terrain including plains, rocky hills, and mountain slopes. Forested habitats exist mainly in the higher elevations of the watershed.

Wildlife

Birds

Riparian ecosystems harbor the highest number of bird species in the watershed. Riparian habitat provides productive breeding grounds and offers vital over-wintering and migration stop-over areas for migrating birds. Loss and degradation of riparian habitat have negatively impacted bird populations throughout the watershed. Other factors affecting bird populations are brood parasitism by the brown-headed cowbird, and disruption of natural hydrological regimes from dams and levees.

The federally endangered least Bell’s vireo has experienced recent population growth within the watershed due to aggressive management activities that started within Prado Basin and spread to other riparian areas throughout the watershed. In 1986 there were only 16 pairs of vireos reported breeding in the Prado Basin. With the management and restoration provided by the Santa Ana Watershed Association (SAWA) and its constituent agencies, there were more than 1,200 vireo territories throughout the Santa Ana River Watershed in 2012.

This stunning recovery is due to the provision of a high quality habitat for the bird species, in part, due to invasive species removal, a project in place to control populations of the predatory cowbird, and other efforts on the part of the U.S. Fish and Wildlife Service (USFWS), Orange County Water District (OCWD), several resource conservation districts (RCDs), and SAWA. The Coastal California Gnatcatcher (*Polioptila californica*) is a focal species under California's Natural Communities Conservation Planning (NCCP) program and is listed as a Species of Special Concern in California. The USFWS listed it as threatened in 1993. Critical Habitat for the species was designated in 2000, but court-ordered review of the economic effects of this designation is under way. (*Mock 2004*)

Both the least Bell’s vireo and the federally endangered southwestern willow flycatcher are affected by cowbird brood parasitism. The implementation of cowbird management programs, in addition to preservation and restoration of riparian deciduous shrub habitat are needed to reduce current populations. The bald eagle, listed by the USFWS as endangered in 1978, has experienced population growth over the past two decades. The bald eagle could be considered a USFWS success story: reclassified as “threatened” in 1995 and first proposed for delisting in 2000. Delisting of a species is the USFWS’s ultimate goal and only happens when specific recovery goals have been met for a species. Unfortunately, delisting is an infrequent occurrence. In the case of the bald eagle, delisting has been

delayed while the USFWS determines how the species would be managed once it is no longer classified as threatened.

Aquatic Life

Fishes

The Santa Ana River and its tributaries historically provided habitat for eight species of native fish (species have multiple forms). Only four native non-game freshwater fishes currently are found in non-estuarine waters: arroyo chub, Santa Ana speckled dace, Santa Ana sucker, and threespine stickleback. All of these remaining fishes have limited distributions and face possible extirpation.

As previously mentioned, the Santa Ana sucker is listed by the federal government as a “threatened” species pursuant to the Endangered Species Act. Currently, the western brook lamprey is known to be extirpated from the watershed. The Pacific lamprey has been observed once in the past 47 years and it likely is extirpated as well. Introduced forms of the rainbow trout have been extensively stocked in the watershed for sport fishing for over 100 years, and it is unknown if any genetically pure rainbow trout stocks endemic to the watershed remain. The partially armored threespine stickleback was widely planted in the watershed for mosquito control in the early 1900s and now is found out of its natural historical range, e.g., Big Bear Lake. There are three current known occurrences of threespine stickleback: in Shay Pond, Juniper Springs Pond, and Sugarloaf Meadow Pond. During high water conditions, Shay Creek and Baldwin Lake also are occupied. Historically, they extended up Caribou Creek (Van Dusen Canyon), but water diversions and re-routing of drainages currently have made that unlikely. Juniper Springs drains to Arrastre Creek, which drains to the Mojave Desert. Shay Pond and Shay Creek drain to Baldwin Lake. Baldwin is considered a mountain playa lake and historically didn’t have an outlet. The connection to Big Bear Lake is an artificial man-made connection for flood control purposes, so now Baldwin Lake will drain to Big Bear Lake in an extreme flood event.

In contrast, at least 33 fishes have been introduced into the watershed and currently are present. New species can be expected to be found at any time due to inter-basin water transfers, ship ballast water hitchhikers, bait bucket introductions, and hobbyists disposing of unwanted fishes. Many of the introduced fishes are widespread, while a few are restricted to specific locations or habitats. Of the current inventory of introduced fishes, most were introduced by government agencies to serve as a food resource, for insect control, for sport fishing, or to serve as forage for sport fishes. A smaller number of fish have become established after arriving inadvertently via inter-basin water transfers or in ships’ ballast water. For a detailed discussion of the introduction of fishes to California, the reader is directed to Dill and Cordone (1997). Additional information about introductions of fishes to Southern California is presented by Swift *et al.* (1993). Supplemental records can be found in Moyle (2002).

Oncorhynchus mykiss is one of six Pacific salmon in the genus *Oncorhynchus* that are native to the North American coast. *O. mykiss*, along with other species of Pacific salmon exhibit an anadromous life history, which means that juveniles of the species undergo a change that allows them to migrate from freshwater to mature in salt water before returning to their natal rivers or streams (*i.e.*, streams where they were spawned) to reproduce.

Historically, these fish were the only abundant salmonid species that occurred naturally within the coast ranges of Southern California. Steelhead entered the rivers and streams draining the Coast Ranges from Point Sal to the U.S. Mexican Border during the winter and spring, when storms produced sufficient runoff to breach the sandbars at the rivers' mouths, and provided fish passage to upstream spawning and rearing habitats. These fish and their progeny were sought out by recreational anglers during the winter, spring and summer fishing seasons.

Steelhead are a highly migratory species. Adult steelhead spawn in coastal watersheds; their progeny rear in freshwater or estuarine habitats prior to migrating to the sea. Within this basic life history pattern, the species exhibits a greater variation in the time and location spent at each life history stage than other Pacific salmon within the genus *Oncorhynchus*.

The life cycle of steelhead generally involves rearing in freshwater for one to three years before migrating to the ocean, and spending from one to four years maturing in the marine environment before returning to spawn in freshwater. Adult steelhead do not necessarily die after spawning and may return to the ocean, sometimes repeating their spawning migration one or more times. It is rare for steelhead to spawn more than twice before dying, and most that do so are females.

This species may also display a non-anadromous life history pattern (*i.e.*, a "freshwater-resident" strategy); non-anadromous individuals that complete their entire life history cycle (incubating, hatching, rearing, maturing, reproducing, and dying) in freshwater commonly are referred to as rainbow trout. However, this terminology does not capture the complexity of the life history cycles exhibited by native *O. mykiss*. "Rainbow trout", which have completed their life history cycle entirely in freshwater, sometimes produce progeny that become anadromous and emigrate to the ocean and return as adults to spawn in freshwater. Conversely, it has also been shown that steelhead may produce progeny that complete their entire life cycle in freshwater.

There is a third type of life history strategy displayed by *O. mykiss* fish that is referred to as "lagoonanadromous", which may spend a majority of the freshwater phase of their life moving back and forth between the estuary or lagoon at a river's mouth and upstream freshwater habitats before emigrating to the ocean. Steelhead populations in Southern California have not been investigated to determine whether or to what extent they may exhibit this life history strategy; however, steelhead smolts have been documented rearing in Southern California estuaries.

Within each of the three basic life history strategies (fluvial-anadromous, freshwater-resident, and lagoon-anadromous), there is additional variation, including examples of finer-scale habitat switching, such as multiple movements between lagoon and freshwater habitats in the course of a single summer in response to fluctuating habitat conditions; and also so-called "adfluvial" populations that inhabit freshwater reservoirs but spawn in tributary creeks.

Closely related to these various life history strategies is the use by steelhead of a wide variety of habitats over their lifespan, including river mainstems, small montane tributaries, estuaries, and the ocean. Steelhead move between these habitats because each habitat supports only certain aspects of what the fish require to complete their life cycle. Different populations frequently differ in the details of the times

and habitats that they utilize while pursuing the general pattern of the anadromous life cycle. These differences can reflect the evolutionary response of populations to environmental opportunities, subject to a variety of biological constraints that are also a product of evolution.

See the National Marine Fisheries Services Southern California Steelhead Recovery Plan (2012) for more details, and supporting references, particularly Chapter 1 “Introduction”, and Chapter 2 “Steelhead Biology and Ecology”.

For the other native fish species, see C. C. Swift, T. R. Haglund, M. Ruiz, and R. N. Fisher “The Status and Distribution of Freshwater Fishes of Southern California” (1993).

The decline of indigenous steelhead/rainbow trout (*Oncorhynchus mykiss*) populations in the Santa Ana River watershed is the result of a multitude of anthropogenic activities that have degraded riverine and estuarine habitats, and fragmented riverine habitats through the construction of instream barriers such as dams, diversions, road-crossing, and flood control structures. The threats analysis conducted by NMFS as part of the recovery planning for the Southern California steelhead populations, identified “Dams and Surface Water Diversions”, “Flood Control”, “Groundwater Extraction”, “Levees and Channelization”, and “Urban Development” as the highest threats to the native trout/steelhead populations in the Santa Ana River Watershed.

Over-exploitation of rainbow trout/steelhead by recreational angling was not identified as a principal factor for the decline of this species in the Santa Ana River, or in Southern California generally. Stocking of *O. mykiss* to supplement an existing native freshwater recreational fishery was initiated and subsequently increased over the years in response to a variety of factors, including human population growth, increased accessibility to angling areas, expansion of leisure time, and to support expanding outdoor recreational activities as an important component in a developing tourist industry. The reported catches of large number of trout by anglers in local media (*e.g.*, the July 17, 1982 report in the *Citrograph*, a Redlands newspaper, of three individuals taking 592 trout in three hours from Bear Creek, a tributary to the Santa Ana River in San Bernardino County) provide an indication of the natural productivity of the native fishery of the watershed.

The California Legislature began regulating recreational angling (along with other forms of angling) in 1861, when the Southern California human population was a small fraction of its current levels. The increasing restrictions on recreational angling were prompted by the increasing human pressures on the indigenous fishery resources, but were not intended to address the underlying cause of the decline of the populations, nor to safeguard native fish populations or maintain natural ecosystem functions. While both the anadromous form and the freshwater resident forms of *O. mykiss* now have been reduced to critically low levels, residualized populations persist in the headwater tributaries above and below impassible barriers, and the lower reaches remain accessible to the anadromous form when hydrologic conditions permit upstream migration from the ocean.

In February 2012, the City of Riverside, showing community support for steelhead restoration, adopted Resolution 22351, “A Resolution of the City Council ...Supporting Restoration Efforts for the Southern California Steelhead in the Santa Ana River.” This resolution supports recommendations for restoring

the Santa Ana River steelhead population through mitigation actions identified in the U.S. National Marine Fisheries Service Southern California Steelhead Recover Plan.

See the National Marine Fisheries Services Southern California Steelhead Recovery Plan (2012) for more details, and supporting references, particularly Chapter 2 “Steelhead Biology and Ecology”, and Chapter 12 “Mojave Rim Biogeographic Population Group”.

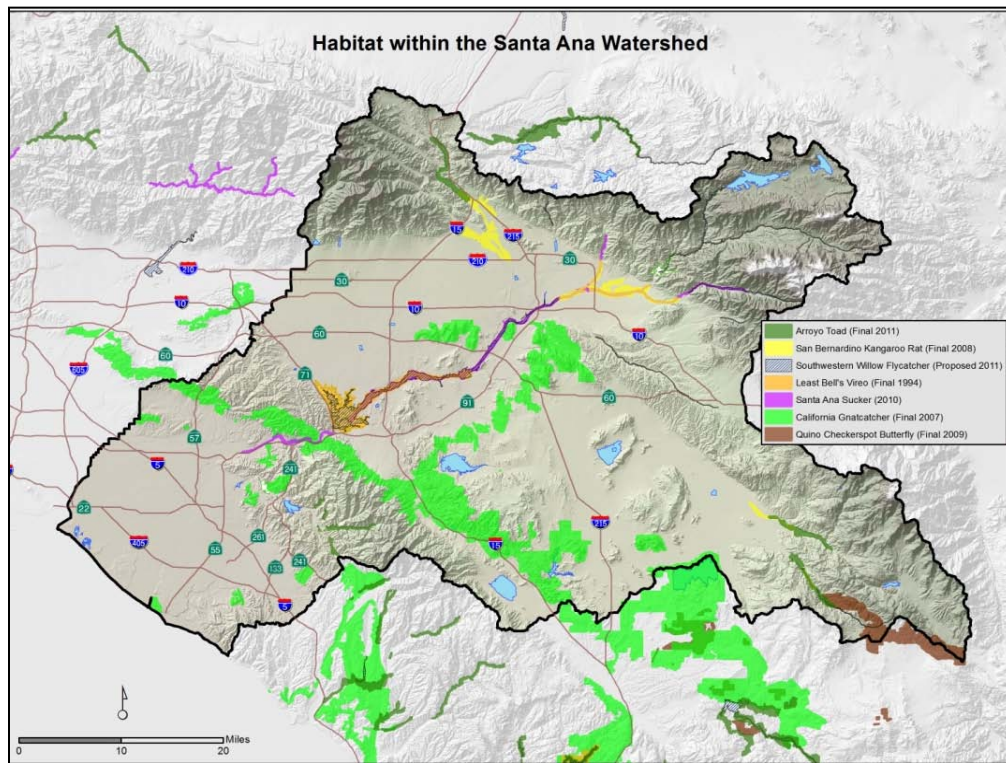
Amphibians

During the past 50 years, population growth and urban development in Southern California have displaced many amphibian species, and encroached upon much of the former amphibian habitat. These include the federally listed endangered arroyo toad (*Bufo californicus*) and mountain yellow-legged frog, (*Rana muscosa*), and the federally-listed threatened California red-legged frog (*Rana aurora draytonii*). Several species are thought to be extinct, and many others have fragmented populations that are at risk of extirpation. Amphibians are especially sensitive to environmental changes that alter the hydrology, ecology, and geology of a region because they have evolved, highly specialized adaptations that have allowed them to exist in these relatively arid regions. Introduced species also have been a major contributor to the decline in amphibian populations in Southern California. These non-native species increase competition for food sources, as well as prey upon many of the native amphibians.

Reptiles

The California Department of Fish and Wildlife (CDFW) considers the Southwestern pond turtle (*Clemmys marmorata*) a species of “special concern”. Recent reports on *C. marmorata* in Southern California indicate that a few viable populations remain in the regions (see also Brattstrom 1988). Approximately six to eight viable populations of the turtle remain south of the Santa Clara River system in California. Droughts have exacerbated the negative effects of habitat alteration accumulated over many years in much of this region from changes in land and water use, and abusive grazing practices. In particular, most western pond turtle populations examined in this region appear to show an age structure increasingly biased toward adults, indicating little or no recruitment is taking place. Recent surveys indicate that the southwestern pond turtle also is seriously threatened throughout most of its range outside of California.

Figure 5.9-1 Map of Critical Habitat within the Santa Ana River Watershed



Current Status of Resources

Water Quality and Quantity

Water quality in the mountain portion of the watershed is good overall, with low concentrations of total dissolved solids, nitrates, and other pollutants. Although elevated levels of total coliform and silt have been identified with storm flows, water quality exceeds the State standards set for the identified beneficial uses of the water. The water quality generally decreases, and turbidity increases with distance from the mountains. Multiple water reuse becomes a more dominant factor. The river courses through a large dairy preserve. Treated municipal wastewater is discharged into the river at many points between Riverside and the Prado Basin.

Fortunately, water quality in the SAR has improved in recent years due to technological developments and water quality planning. Most of the native fishes of the watershed are adapted to clear, unpolluted water that can support food resources and provide the various habitat conditions necessary to complete their respective life cycles. While fish kills that are due to the spill of toxic substances into streams are dramatic examples of the effects of pollution, these instances are acute, or short-term, rather than chronic. More insidious, however, are the chronic effects on aquatic resources of non-lethal forms of pollution that decrease growth, inhibit reproduction, or impair movement. Chronic elevated water temperatures or high sediment loads are examples of this type of pollution, even though toxic chemicals are not involved. Other examples include elevated but non-toxic levels of ammonia, increases in salinity, and low levels of dissolved oxygen (DO). Because most of the remaining native freshwater fishes live, at

some time, in treated wastewater, the issue of chronic, low-level pollution is of great concern, although the quality of wastewater has increased markedly in past years.

The base flow of the Santa Ana River continues to increase because of continuing urbanization. A minimum base flow of 42,000 acre-feet per year was adjudicated in 1969 as a result of litigation between OCWD and Chino. This flow rate is measured at Prado Dam and was based upon historical averages. However, rapid urbanization has resulted in increasing discharges of high-quality tertiary treated water from the many treatment plants located along the river. In 1999, the base flow had increased to 140,000 acre-feet and was once projected to rise to 230,000 acre-feet by 2020. However, increasing conservation measures and re-use, along with development standards that require water to be retained on site, put the future base flow of the river in question. Decreases in flow would result in diminishing supplies of water to maintain habitat restoration, especially along the river mainstem and its tributaries.

The flow through the alluvial scrub is seasonal. Between the cities of San Bernardino and Riverside, the river picks up enough urban discharge to support perennial flow and productive riparian habitat dominated by willows. The quality of the fish habitat also increases greatly and there are recent records for the occurrence of native fishes including the federally listed, threatened Santa Ana River sucker (*Catostomus santaanae*). The other native species recorded from several, scattered localities are the arroyo chub (*Gila orcutti*) and more rarely, the speckled dace (*Rhinichthys osculus*). Fish habitat will be particularly affected if flows are reduced because of less runoff and less water being discharged from treatment facilities.

Spotty Conservation Areas

Without a comprehensive, regional plan for water-oriented habitat conservation, independent efforts by various planners, regulators, and landowners can lead to fragmented habitat areas and fragmented management of those areas. In addition, a parcel-by-parcel, or piecemeal planning approach can lead to inconsistent, inequitable regulation of land development and unnecessary costs and delays. Broader planning and management approaches would benefit both the environment and development.

In general, the larger a habitat area, the healthier it is, with ample breeding, feeding and shelter opportunities for its inhabitants. Fragmented, small habitat areas can pose a threat to species diversity and the overall health of ecosystems.

Habitat fragmentation frequently is caused when native vegetation is cleared for activities such as agriculture or urbanization. Habitats, which were once continuous, become divided into separate fragments or islands. When habitat is fragmented, plants and animals lose their protective buffers around the fringes and access to each other, food, and water. Eventually the fragments become unable to support their natural diversity and species disappear.

The Army Corps of Engineers promotes a watershed approach to placement of compensatory mitigation in implementing its 2008 Mitigation Rule. The following is its definition of that approach: "Watershed Approach means an analytical process for making compensatory mitigation decisions that support the sustainability or improvement of aquatic resources in a watershed. It involves consideration of

watershed needs, and how locations and types of compensatory mitigation projects address those needs. A landscape perspective is used to identify the types and location of compensatory mitigation projects that will benefit the watershed and offset losses of aquatic resource conditions, past and projected aquatic resource impacts in the watershed, and terrestrial connections between aquatic resources when determining compensatory mitigation requirements for Corps permits.”

However, compensatory mitigation and its restrictions can result in fragmented management, especially when mitigation providers are required by regulatory agencies to assign long-term real estate instruments, conservation easements, or other restrictive covenants to land before funding for compensatory mitigation can be directed to the mitigation provider. In many areas of the Santa Ana Watershed where habitat has been significantly degraded, especially along the mainstem where most of the invasive plants thrive, providing long-term protection through such instruments is not feasible. Much of this land is owned by cities, counties, flood control districts, water districts, park districts and by the Army Corps itself. These entities historically have not been willing to grant easements or other restrictive covenants to third parties, such as non-profit environmental organizations and resource conservation districts.

Fragmented management refers to piecemeal approaches to conservation and restoration of water-oriented habitat. When management is approached in a collective, comprehensive manner, overall costs can be reduced, funding can be pooled, and wasteful or harmful practices can be minimized or eliminated. When management is fragmented, there is a potential for duplication of effort, conflicting practices, and excessive costs.

Special Status Species

Second only to Hawaii, the State of California is home to the highest number of endangered species in the United States. As defined within the Federal Endangered Species Act of 1973, an endangered species is any animal or plant listed by regulation as being in danger of extinction throughout all or a significant portion of its geographical range. A threatened species is any animal or plant that is likely to become endangered within the foreseeable future throughout all or a significant portion of its geographical range. Federal law prohibits the “take” of any individuals or habitat of federally-listed species without a special permit.

In addition to Federal laws, the State of California has its own California Endangered Species Act, with a separate listing of species and separate laws governing take of listed species. Enforcement of the Federal Endangered Species Act is administered by the USFWS and the National Marine Fisheries Service, while the CDFW enforces the California Endangered Species Act. Refer to [Figure 5.9-1](#) above for a map of critical habitat within the watershed.

The varied geography and natural features of the watershed provide habitat for a number of Federal and/or State-listed species. As the Santa Ana Integrated Regional Watershed Plan focuses on the resources in and around the Santa Ana River, listed species of concern herein are those that occupy aquatic, wetland, riparian, or riparian-adjacent areas. Of these, two are plants – the Santa Ana River woolly star (*Eriastrum densifolium*) and the slender-horned spine flower (*Dodecahema leptoceras*); one

fish – the Santa Ana River sucker (*Catostomus santaanae*); three amphibians – the arroyo toad (*Bufo californicus*), Mountain Yellow-legged frog, (*Rana muscosa*), and the California red-legged frog (*Rana aurora draytonii*); three birds – the least Bell’s vireo (*Vireo bellii pusillus*), the southwestern willow flycatcher (*Empidonax traillii*), and the bald eagle (*Haliaeetus leucocephalus*); two mammals – the San Bernardino kangaroo rat (*Dipodomys merriami parvus*) and Stephen’s kangaroo rat (*Dipodomys panamintinus*); one insect – the Delhi Sands flower-loving fly (*Rhaphiomidas terminatus abdominalis*) and one invertebrate - Riverside Fairy shrimp, (*Streptocephalus woottoni*). Reaches 4 and 5 of the Santa Ana River are federally-designated critical habitat for the Santa Ana sucker. Reach 5 also is federally-designated critical habitat for the San Bernardino kangaroo rat. Any project or policy recommended by the Santa Ana Integrated Watershed Plan will need to assess potential impacts to listed species, and incorporate measures to avoid impacts to these species.

Coastal Conditions

Essential Fish Habitat areas exist in the coastal waters off Orange County. The Magnusen Stevens Act defines Essential Fish Habitat as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” To clarify this definition, “waters” is defined as aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish. Substrate means “sediment, hard bottom, structures underlying the waters, and associated biological communities”; necessary means “the habitat required to support a sustainable fishery and the managed species’ contribution to a healthy ecosystem”; and spawning, breeding, feeding, or growth to maturity covers the full life cycle of a species.

An additional coastal resource is in the form of sea-grasses, including eelgrass. They have great economic benefits by providing habitat, nursery grounds, and refuge that is essential for the continued replenishment of fish, a vital economic resource in the form of food. The economic value of sea-grass also is seen in its ability to filter nutrients such as phosphates and nitrates that come from fertilizers used in gardens and lawns. According to a recent study, a value in the form of global nutrient cycling by the world’s sea-grasses is an estimated \$1.9 trillion per year. (Waycott 2009) Documented decline in the amount of sea-grass areas globally has made their preservation a priority. Sea-grasses are now federally-protected under the Clean Water Act.

Marine habitat, in the form of eelgrass habitat, also is affected by human activity because of its location in the shallow sub-tidal zones of coastal areas. Coastal development, boating, aquaculture and fishing, and urban runoff are all contributing factors that have the potential for causing damage due to pollution. The health of this habitat is important as nursery grounds and refuge from predation for many species of fish and invertebrates including juvenile halibut, lobster, sharks, scallops, and oysters. It also provides protective shade to prevent overheating, and there are many species that actually lay eggs on the blades for protection until they hatch. Eelgrass is also a food source to both aquatic and waterfowl species.

Agriculture and Dairies: Water Quality Protection

Regulatory agencies in the watershed have taken a number of regulatory actions to address water quality impacts related to agricultural and dairy practices in the region, including impacts to both surface

water and groundwater due to runoff from manure in dairy farm corrals, spreading of manure for fertilizer in agricultural fields, and use of pesticides.

In 2007, the Santa Ana Regional Water Quality Control Board (RWQCB) issued R8-2007-0001 (NPDES No. CAG018001): General Waste Discharge Requirements for Concentrated Animal Feeding Operations (Dairies and Related Facilities) within the Santa Ana Region (Santa Ana RWQCB, 2007), prohibiting all dairies in the watershed from discharging process wastewater or stormwater runoff up to a 25-year, 24-hour rainfall event, and requiring each facility to develop an Engineered Waste Management Plan. This permit was amended with adoption of R8-2013-0001, which directed dairies in the San Jacinto Watershed to collaborate with Eastern Municipal Water District's Salinity Management Program.

The Riverside County Ordinance 427.2 passed by the Riverside Board of Supervisors in 2001, regulates safe transportation and application of manure in certain county districts by requiring operators and/or landowners to report manure application. The purpose of the ordinance is to minimize impacts to neighboring properties, local waterways, underground water supplies, and soil resources.

The San Jacinto Basin Resource Conservation District (SJBRC) and the Western Riverside County Agriculture Coalition (WRCAC) developed a multi-phased process for establishing and running a Manure Manifest System (MMS). The MMS addresses nutrient and salt loadings by specifying that manure be applied to land at rates consistent with cropping practices and groundwater conditions. This will prohibit over-application at sites where potential impacts to groundwater basins are a concern.

Santa Ana Watershed Agricultural Report

The objective of this report is to provide an overview of agriculture in the Santa Ana Watershed. This report includes information on types of commodities produced in the watershed, value of these commodities, information on whether agriculture is shrinking, percentage of irrigated land and percentage of region covered by Confined Animal Feeding Operations (CAFO). The focus of this report is especially on regions in San Bernardino, Riverside, and Orange County, which is a part of the Santa Ana Watershed. One of the other objectives of this report also is to shed some light on the impacts of agricultural pattern or CAFO in the Santa Ana Watershed on the overall water quality of the region.

San Bernardino County

Livestock and poultry contribute to the highest value in the San Bernardino County region; this is followed by nursery and miscellaneous crops. Next, vegetables, fruit and nuts constitute the third and fourth most valuable crops within the region. Livestock and poultry cover the most amounts of acres compared to the any other type of crop that is produced in the region. Nursery and miscellaneous crops utilize the least amount of land compared to all other crop types, although it is of the second highest value in the region. All of the agriculture in the Santa Ana Watershed is irrigated and CAFO operations in the watershed include numerous dairies and chicken farms.

Riverside County

In Riverside County, nursery is the highest value crop followed by vegetable crop; the third most valuable crop is fruit and nuts. According to the Riverside County Agricultural Commissioner, everything in the Riverside area of the Santa Ana Watershed is irrigated with the exception of "Range" and "Grain" acreage. Although there are dairies in Riverside and San Jacinto districts, the Riverside County

Agricultural Commissioner could not provide any statistics on the CAFO as they do not regulate CAFO in the region.

Orange County

In Orange County the highest value crops are nursery and miscellaneous, followed by fruit and nut crops, and then by vegetable crops. As suggested by the County Agricultural Commissioner, agriculture is shrinking and operators are moving to high value crops in this region. The field crops in this region are grown without irrigation without any CAFO.

The Value of Understanding

The urban watersheds of the California coast provide a unique opportunity to explore the value of historical ecology research for developing contemporary wetland and riparian restoration plans. Studies have demonstrated that restoration and mitigation planning would be greatly improved if done within the context of ecosystem function (Kentula 1997, 2007; Kershner 1997; National Research Council [NRC] 2001; White and Fennessy 2005). Unfortunately, in the urban environments of California, much of the current understanding of wetland and riparian ecology is derived from systems highly modified by human activities. Thus, identifying appropriate functional reference conditions or distinguishing natural processes from anthropogenic effects can be difficult. Recent historical ecology studies in California have provided new and surprising evidence of wetland resources previously not recognized, particularly in Southern California where evidence suggests wetland ecosystems were larger and more diverse than previously thought (Stein et al. 2010; Grossinger et al. 2011; San Dieguito River Park 2010). This suggests that historical ecology not only provides important information about functional reference conditions but also sheds light on previous misconceptions about the historical environment.

The value of historical ecology has been questioned in the urban coastal regions of Southern California where natural hydrologic processes are unlikely to be fully recoverable. Arguably, historical ecology may provide confusion in the face of a systematic incapability to return wetland ecosystems to their pre-development condition, often due to the permanent loss of natural hydrodynamic processes that were present prior to human contact. Understanding the historical template is as important as understanding the contemporary condition. Knowledge of historical ecosystem components is key to creating management and restoration plans that make sense relative to the contemporary landscape. The historical perspective provides an understanding of the relationship between physical settings that support natural wetland functions, the driving forces behind ecosystem degradation, and perhaps most important, the value of wetland ecosystems that remain intact (Stein et al. 2010). Considerable evidence supporting the importance of historical ecology in contemporary wetland management, even in highly urbanized areas, now exists (Kentula 1997; White & Fennessy 2005; Stein et al. 2010). In addition, new technical tools provide shared access to data collected for historical ecology projects, creating an opportunity for cross-disciplinary collaboration and ongoing discovery of historical reference conditions beyond traditional reports.

Current Threats to Resources

Primary threats to aquatic resources within the Santa Ana River Watershed include past and ongoing loss and degradation of native habitat—approximately 90 percent of the wetland habitat in the Santa Ana River Watershed has been lost. Non-native invasive plants have taken over approximately half of the remaining wetlands, resulting in greatly increased threat of fire, greatly reduced wildlife values, and increased flooding issues, particularly from the arundo breaking off and forming huge debris dams. Non-native vertebrate and invertebrate species are wreaking havoc as competitors and predators of native species. There has been a historical lack of coordinated natural resources management to counteract some of the effects of human-induced impacts on the wetlands, along with a lack of public awareness and stewardship of wetland resource. The future availability of water is also a significant issue in habitat restoration and ongoing maintenance.

Unnatural Hydrology

The Santa Ana River and its tributaries have been largely channelized and dammed to provide flood protection for the growing human population. There are many lakes, reservoirs, and dams on the tributaries including Santiago Dam, Villa Park Reservoir, Brea Dam, Fullerton Dam, Prado Dam, Carbon Canyon Dam, San Antonio Dam, Lake Hemet, Railroad Canyon Lake, Lake Elsinore, Lake Mathews, Big Bear Lake, and Baldwin Lake. Seven Oaks Dam is situated on the mainstem near its emergence from the San Bernardino Mountains, and captures about 7.2 percent of the total watershed. Prado Dam is located near the middle of the mainstem, capturing 52 percent of the watershed.

As noted by Moyle (2002), most of California's inland waterways today bear little resemblance to the streams and lakes encountered by the first European explorers and settlers. In the watershed, this observation is certainly true as flood control and channelization activities have left portions of streams channelized and concrete-lined where once riparian forests grew along a meandering stream. Fortunately, today only 20 percent of the Santa Ana River is concrete-lined. Dam construction and flood control activities were not the only factors influencing the watershed in ways that adversely impact habitat critical for aquatic resources. The following factors also have played a role:

- Stream channel alteration
- Draining of streams and lakes, especially adjacent wetlands
- Livestock grazing and the impact on aquatic and riparian vegetation, sedimentation, and water pollution
- Historical logging practices
- Invasive plant infestations
- Invasive and feral animal populations
- Bark Beetle infestation
- Mining, particularly in-stream aggregate mining
- Watershed changes resulting in cumulative effects to aquatic resources

Invasive Species

Human development and activities in the watershed have greatly reduced the floodplain and associated habitats, and deleteriously affected the river's natural function and processes. One of the most

challenging agents of deleterious change has been a multitude of non-native, invasive species, primarily, but not exclusively, plants. One major problematic species, *Arundo donax*, at one point was reported to have taken over approximately 10,000 acres of river bottom, replacing native wetland habitats. The Santa Ana River has been transformed by giant reed. Other weedy species are major local issues including perennial pepperweed (*Lepidium latifolium*), tamarisk (*Tamarix* spp.), castor bean (*Ricinus molle*), and tree of heaven (*Ailanthus altissima*), among others, but *Arundo* is pervasive. Giant reed provides no redeeming wildlife value— it carries fire, causes obstruction to flood flows and results in damages to bridges and other structures, and results in expensive beach clean-ups. Compared to native habitat, *Arundo* consumes nearly three times the water, and it provides poor stream shading, impacting water quality. *Arundo* consumes an estimated 56,200 acre-feet of water annually from the Santa Ana River alone—enough for more than 100,000 households.

Achieving total eradication of *Arundo* in some parts of the Santa Ana River Watershed will take decades. *Arundo* control started in the upper watershed and continues downstream because *Arundo* invades by pieces that wash down and sprout in moist soil. *Arundo* seeds are sterile in our area, so the spread of *Arundo* has been entirely by vegetative means in the watershed.

Arundo on the Santa Ana River mainstem has been nearly completely eradicated in an area that stretches upstream from the Mission Bridge in Riverside, through San Bernardino and Redlands, and through the major tributaries of Mill Creek and San Timoteo Canyon. The San Bernardino National Forest also has projects focused on *Arundo* removal. *Arundo* has been nearly eliminated also in the Riverside County areas of Mystic Lake, the San Jacinto River, and Mockingbird Canyon/Woodcrest. In Orange County, it has been nearly eradicated in Carbon Canyon, Modjeska Canyon, Santiago Creek and Blackstar Canyon areas. All of these areas are being kept under control. This leaves the mainstem areas from Mission Bridge downstream, and then through the Prado Basin and the lower reaches in the Santa Ana Canyon. There are still thousands of acres of *Arundo* in these areas. Mitigation providers need to be given access to these lands and develop long-term agreements with the public and private landowners to complete the task of eradicating *Arundo* from the Santa Ana Watershed.

Certain species of non-native vertebrates like the brown-headed cowbird are extremely harmful to native species and are managed in association with endangered species monitoring to ensure no harmful effects to listed species. More than 100,000 cowbirds have been removed from the Santa Ana River Watershed since 1986.

In coastal regions, an invasive algae nicknamed “killer algae” or the alien seaweed *Caulerpa taxifolia* was found, according to NOAA, in Southern California’s coastal waters located in Huntington Harbour in Orange County. It is actually the result of a clone developed for aquarium foliage that “escaped” into the coastal waters. It originally was discovered in the Mediterranean where it has had devastating consequences. In areas where the species has become well established, it has caused ecological devastation by overgrowing and eliminating native seaweeds, sea grasses, reefs, and other communities, and economic devastation by harming tourism, pleasure boating, and recreational diving, and had a costly impact on commercial fishing. The dense carpet that this species can form on the bottom could inhibit the establishment of juveniles of many reef species, and its establishment offshore

could seriously impact commercial fisheries and navigation through quarantine restrictions to prevent the spread of this species. This alga poses a substantial threat to marine ecosystems in Southern California, particularly to the extensive eelgrass meadows and other benthic environments that make coastal waters such a rich and productive environment for fish and birds. The eelgrass beds and other coastal resources that could be directly impacted by an invasion of *Caulerpa* are part of a food web that is critical to the survival of numerous native marine species including the commercially and recreationally important spiny lobster, California halibut, and sand basses. Eradication methods have been undertaken in Huntington Harbour, however, constant monitoring is necessary to insure that this threat is eliminated. (NOAA)

Invasive Fishes

Introduced fishes have a great impact on the aquatic resources of the watershed. The 33 species of introduced fishes greatly outnumber the four remaining native fish species. The number of species, *per se*, is not the problem but, rather, the impact that introduced fishes and other aquatic organisms, have on the native fishes of the Watershed. Introduced fishes have dramatically changed the composition of the watershed's fish community and now act as a deterrent to the restoration and enhancement of the native fishes that remain. Some of the aquatic species that continue to be destructive include: carp, bass, African clawed frogs, and red-eared sliders.

The manner in which introduced fishes can affect the aquatic resources of the Watershed include:

- Competition between native and introduced fishes for food and space
- Predation by introduced species on native fishes
- Habitat interference by introduced fishes that change habitat characteristics
- Introduction of diseases that may infect native fish or other aquatic animals
- Hybridization between closely related species

Each of the aforementioned factors has acted in concert over a long period of time to reduce the native fish community of the watershed to that which remains today. The Santa Ana Integrated Regional Watershed Management Plan recognizes that history cannot be undone and the aquatic community cannot be restored to its pre-settlement condition; however, a conservation strategy can be implemented that will ensure the long-term viability of the watershed's aquatic communities

Other invasive species

Destruction to habitat also can be caused by animals such as feral dogs, cats, and pigs. With no natural predators, the numbers of these animals have greatly increased in recent years. The feral pigs are the most destructive. They root, trample and eat their way through sensitive plant and animal species' habitats. On National Forest managed lands, they have harmed the riparian habitat and oak grasslands by wallowing and turning over the soil in search of grubs, tubers and bulbs. The eggs of ground-nesting birds also are on their menu as they compete for vegetative food sources with other native animals. Their consumption of seeds such as acorns affects the ability for a habitat to regenerate naturally, potentially leaving areas they frequent in a desolate state.

Diminished Habitat Areas and Wildlife Linkages

Development, especially during the past 50 years, has destroyed hundreds of thousands of acres of habitat. The result is now that much of the remaining habitat is fragmented, and connections among some remaining habitat areas have been irretrievably lost. The challenge to watershed stakeholders is to find innovative ways of preserving those connections that remain and creating new ones.

Transportation infrastructure—including roads, bridges and rail lines—presents significant obstacles to wildlife movement, especially for large mammals that are accustomed to roaming extensive territories. Commercial and residential developments, unlike roads, create many other issues along with being a barrier. These issues include introduction of non-native plants and non-native, predatory animals into the surrounding habitat areas.

Wildlife movement and habitat connectivity should be important considerations in any residential or commercial development. Community planners should make it a priority.

Current major efforts to preserve habitat connections in the Santa Ana River Watershed focus on the high country ringing the watershed and facilitating movement in and out of the watershed from outside areas, including the San Gabriel River Watershed, the Santa Barbara Mountains, San Diego County and the eastern and northern desert areas of San Diego, and Riverside and San Bernardino Counties. One example is an effort to preserve the linkage between the Palomar Mountains and the inland ranges of San Diego County through the southern Riverside County area to the Santa Ana Mountains.

While efforts to keep our watershed linked with surrounding natural areas are vital to species diversity and abundance, it is also important that intra-watershed linkages be preserved and created. Within the watershed, many conservation efforts are conducted with a focus on preserving habitat areas with linkages for wildlife (see Current Conservation Measures below).

Several efforts in the Santa Ana River Watershed are focused on road and freeway barriers. Many critical former wildlife movement corridors have been significantly disrupted by major freeways.

Riparian areas of the Santa Ana River and subwatersheds and drainages provide opportunities to preserve linkages for wildlife movement, especially for larger wildlife. Studies have shown that large mammals prefer to move through areas that are less confined and contain quality habitat on both sides of the obstruction and in the crossing area itself over areas that lack one or more of these characteristics.

Alluvial fan areas—such as those found along the lower elevations of the front ranges of the San Gabriel, Santa Ana, San Bernardino and San Jacinto Mountains—should be considered valuable not only for their aquifer-recharge abilities, but also for use as wildlife linkages. According to the California Alluvial Fan Task Force’s *Planning Manual for Development on Alluvial Fans*, “Alluvial fan areas can provide connectivity between lowland and highland areas and provide critical habitat for sensitive plant and animal species downstream and downwind of the fans themselves.” For this reason, preservation of sensitive alluvial fan areas should be considered in all development plans.

Population increases in the Santa Ana Watershed have resulted in the need for additional commercial and residential development, making the remaining open space areas attractive for these purposes.

Developmental goals often conflict with conservation efforts to preserve habitat and the region would benefit from collaborative land use planning to ensure that continuous wildlife corridors are preserved to promote biological diversity and prevent isolated conservation areas that diminish species viability.

Climate Change and Natural Factors

The habitat within the Santa Ana Watershed is affected by natural occurring droughts, seasonal floods and fires resulting from both natural occurring lightning and human activities. Climate change is an additional uncertain variable that can influence the intensity of these natural events and the resulting damage to habitat.

Unsanctioned Recreational Uses

It is recognized that the Santa Ana River, in areas where stream flow is substantial, is a destination for recreation and relief from the heat of hot summer days. There are, however, no designated areas for such uses along the mainstem (except in the San Bernardino National Forest) and efforts to restrict access have had limited success. Sensitive habitat is vulnerable to damage in the form of pollution as there are no trash receptacles or restroom facilities, as well as foot traffic. In some cases, people have constructed dams out of plastic bags in order to make a larger pool of water for swimming. This type of activity can damage the native aquatic habitat and natural hydrology of the stream flow.

Sensitive habitat also is at risk from all terrain vehicle recreation. Continued use can result in the development of ruts in which rainfall can find its way into, exacerbating the problem by increasing erosion and runoff debris, as well as forming new channels that change the natural hydrology of the area.

Other restricted activities specifically along the Santa Ana River Trail are as follows:

- Discharge of firearms and hunting is prohibited along the Trail
- Motor vehicles are prohibited
- Possession of alcoholic beverages is prohibited
- No overnight camping is allowed along the Trail, although it may be allowed in some adjoining park areas
- Fireworks, grills and campfires are prohibited
- Geocaches are allowed where they do not affect natural, cultural and historical resources, visitor safety, or other park users.

Implemented policies such as these are submitted and then reviewed by the Policy Advisory Group (PAG) and Technical Advisory Committee (TAC) for the Trail. Comprised of eight elected representatives from county and city government, these groups are responsible for policy creation and modification.

Recreational Opportunities of Natural Resources

Most park and open space areas are local amenities, so the implementation of projects to develop them becomes a local decision intended to serve a focused, local population often residing within a few miles of a given developed park or open space area.

On the other hand, regional parks and open space areas tend to be larger, and provide more diverse amenities than those found in locally operated park facilities, and are managed to attract visitors from a wider area. Visitors come from within the Santa Ana River Watershed or from adjoining areas. The diversity of available facilities may enhance the region's attractiveness to visitors, and thereby provide economic growth through increased tourism. Most notably, parkland containing exceptional natural resources may attract eco-tourists looking for an opportunity to experience outdoor activities unavailable in their own areas. The wide variety of topography and natural resources within the watershed provide excellent opportunities for the development of this type of tourism.

Regional park facilities also may serve an important role in the continued economic development of the region. Businesses interested in attracting highly-skilled workers often use the proximity to well-developed recreational resources in attracting and retaining talent. Among the amenities often considered by skilled professionals are culture and the arts, nightlife, and the availability of outdoor recreation opportunities. From the ocean to the mountains, the watershed provides numerous opportunities for such a population.

Running through the watershed is the Santa Ana River Trail and Parkway (SART), a regional recreational amenity linking open space areas throughout the watershed. Models, such as the SART, could be developed in other parts of the watershed, such as in San Timoteo Canyon, along Lytle Creek, and within the San Jacinto Watershed. Completion of these linear park amenities and their connection with the existing trail backbone could create a world-class recreation system available to millions of residents and visitors.

Funding for recreational projects vary on location and type of project. Typically, projects are funded by various grants from agencies within the benefiting area. Other sources of funding include the California Department of Parks and Recreation, and additional grants available through the federal government.

Anaheim Park Projects

OCWD and the City of Anaheim have forged a creative partnership to address the lack of open space and resources. On November 15, 2011, Anaheim opened a 14-acre nature park and a 1-½ mile bike path on public lands owned by OCWD near the City's urban core.

In the early 2000s, it was apparent that the City of Anaheim needed to find open space to provide an opportunity for nature and exercise. However, due to the built-out environment, lack of land, and high land prices, the City had few opportunities for large-scale nature parks. So The City forged a relationship with the largest landowner in Anaheim, the OCWD. The OCWD's Burris Basin is a 116-acre ground water replenishment facility on the west bank of the Santa Ana River. It is located only one-half mile north of the Platinum Triangle, Honda Center, Angel Stadium, and the Anaheim Regional Intermodal Transportation Center (ARTIC) that currently is under construction.

In 2005, the OCWD granted a 25-year lease to the City of Anaheim to open 14 acres of land for a public trail and nature park for an annual payment of \$1. The agreement required the City to pay for the

construction, maintenance, and security of the public park area. The City immediately began an intense public input process and funding campaign. The City of Anaheim received \$6.3 million in grants from the Rivers and Mountains Conservancy, California River Parkway Grant, and the Recreational Trails Program.

Anaheim Coves at Burris Basin offers a resting spot for Santa Ana River Trail users and nearby neighborhoods. There are two parking lots and restrooms, along with ample seating and opportunities for bird watching. Integrated public art interprets the natural environment with bird images embedded in the concrete seating, and metal pelican shapes in the gates that welcome patrons. This is a place for people (including the elderly and young children) to exercise, socialize, commute, and enjoy nature at the same time. There also has been a drastic reduction in calls for service and crime within the area.

The signage interprets OCWD's mission of groundwater recharge and the importance of water conservation; it also presents local history and the native flora and fauna. All landscaping is comprised of plants and trees indigenous to the Santa Ana River Watershed.

On April 30, 2013, a Memorandum of Understanding was ratified between OCWD and the City for the extension of the bike path almost one mile north and an eleven-acre nature park on the OCWD 5 Coves facility. Anaheim Coves at Burris Basin represents a great example of how cities and local water agencies can partner to further meet the needs of the community.

Parks, Recreation and Open Space

The former Parks, Recreation and Open Space Pillar (now integrated in to the Natural Resources Stewardship Pillar) brought together park, recreation, and open space advocates from the three counties, including cities, other governmental agencies, and citizens who are interested in public access relative to water resources in the watershed. This group focused attention on the larger "picture" of opportunities. However, they consider the SART as a model for the development of additional regional amenities where close cooperation across many areas and jurisdictions is necessary.

The general findings included a survey of current Regional Park and open space offerings and conditions. While there have been many accomplishments, especially with regard to river access, more planning, management and coordination are needed. Urban development patterns, high land prices, and low availability of land for recreation make expansion of opportunities difficult. Also, new parks or trails may impact habitat with limited land remaining for public access and recreation.

Possible future threats include availability of funding for new trails and parks within the watershed, a shortage of ongoing maintenance funds, and the ability to maintain a high level of security and care for the parks and trails.

Strategies for addressing existing threats include: 1) seeking more stable funding through assessments; 2) increasing public awareness of park, recreation and open space issues; 3) developing a plan to leverage existing resources and expertise; 4) forging and maintaining partnerships; 5) improving resource mapping; 6) curtailing vandalism by increased patrol presence; and 7) ensuring regional park master plans include proper trail and open space protections. One of the most important regional

strategies is to fund and complete the SART. It also is imperative to help local agencies find support for their recreation needs radiating from the SART backbone. The model developed on the mainstem of the Santa Ana River (SAR) to develop the SART can be adapted to tributaries such as San Timoteo Creek and the San Jacinto River.

Current recreation opportunities in the watershed include bicycling, hiking, walking, skiing, snowboarding, rock climbing, geocaching, bird watching, swimming, horseback riding, and organized team and individual sports. The availability and level of participation in such activities is dictated by terrain, the location within the watershed, and degree of urbanization. For example, approximately 18 percent of the Watershed is within the San Bernardino National Forest. Recreational opportunities in this area are much different than in highly urbanized areas such as the cities of San Bernardino and Huntington Beach. In the upper watershed, hiking, rock climbing, and mountain biking are very popular on national forest lands. In the lower, more urbanized areas in the watershed, jogging and cycling are more common, as well as organized sports such as soccer and baseball. Sports fields are located adjacent to the river along its length.

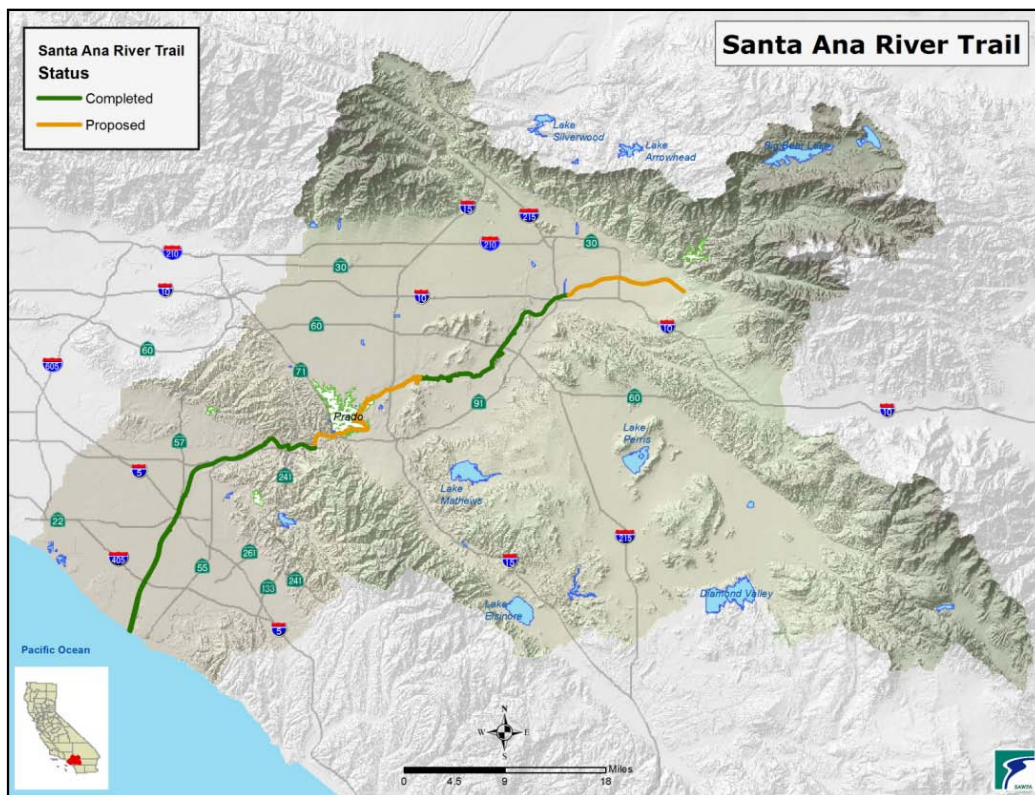
The centerpiece of recreation in the watershed is the SART, a 100-mile trail currently under development, extending from the crest of the San Bernardino Mountains to the coast of the Pacific Ocean. The trail runs through three counties, 15 cities, and multiple jurisdictions. The trail is approximately 65-percent complete with plans to complete the remaining portions over the next five years ([Table 5.9-1](#)).

Table 5.9-1 Status of Santa Ana River Trail and Parkway

County	Completed (miles)	In Construction (miles*)	Planned (miles*)
San Bernardino	7	0	14.0
Riverside	12	0	21.0
Orange	24	0	4.5
Total Miles	43	0	39.5
*Mileages are approximate and do not include earthen trail in San Bernardino National Forest.			

The SART, shown in **Figure 5.9-2**, is a common thread through each county, and **Figure 5.9-3** lists the recreational opportunities available in the Watershed. **Table 5.9-2** describes each county's unique set of recreational resources.

Figure 5.9-2 Santa Ana River Trail Parkway



24 | Natural Resources Stewardship

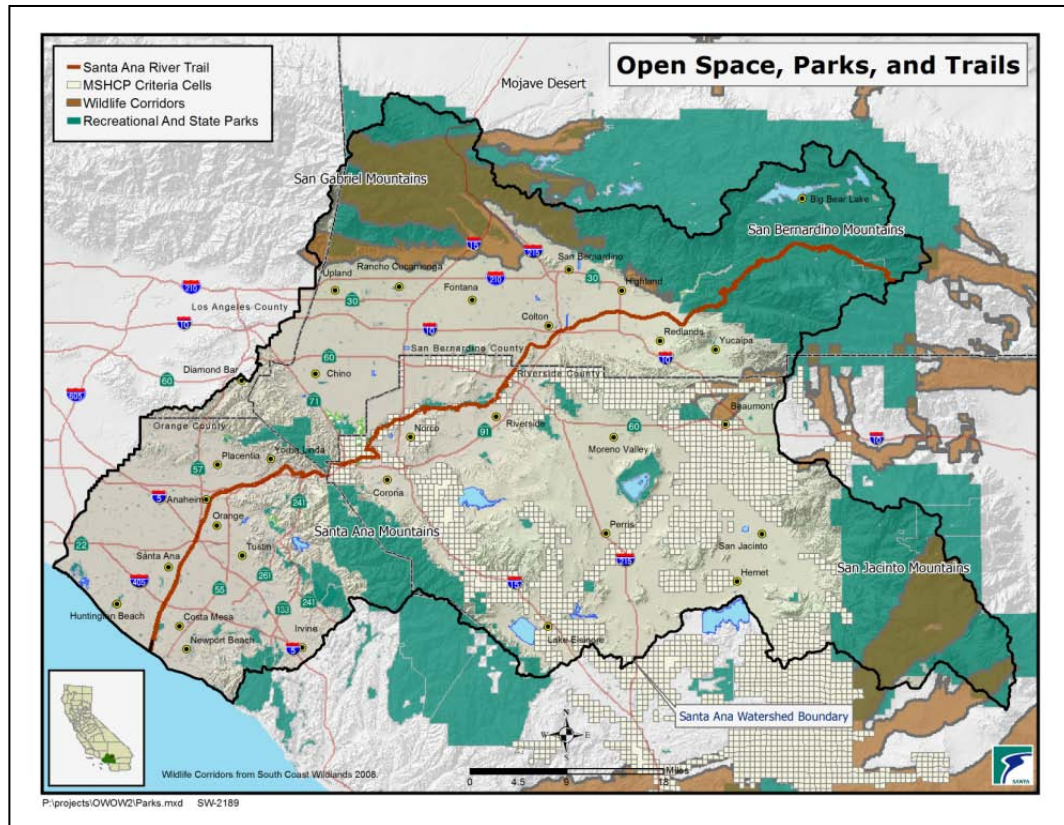


Table 5.9-2 Regional Recreational Resources by County

County	Name and Location of Recreational Resource	Description of Resource and Available Activities
San Bernardino County	San Bernardino National Forest	Approximately 672,000 acres 352 miles of trails Camping, fishing, hiking, equestrian, skiing, outdoor education, biking, target shooting and motorized sports
	Chino Hills State Park Chino Hills	6,000 acre park Mostly open space Hiking, bird watching, mountain biking
	Wildwood Canyon State Park Yucaipa	Under development 1,200 acres currently; plans to expand to 5,000 acres and to develop trails and campgrounds
	County Parks: Glen Helen, Prado Basin, Cucamonga Guasti, and Yucaipa	Approximately 4,500 acres total Camping, fishing, swimming and general day use
	City Parks: Cities of Chino, Chino Hills, Redlands, San Bernardino, Colton, Highland and Loma Linda	Various locations, facilities and acreages with mostly urban uses
	Rails to Trails Upland and Fontana	
	Wildlands Conservancy Los Rios Rancho, Oak Glen	6,000 acres of open space with hiking and outdoor educational facilities
Riverside County	County Parks: Hidden Valley Wildlife Area, Martha McLean-Anza Narrows, Rancho Jurupa, and Louis Rubidoux Nature Center	Hiking, bird watching, equestrian, camping, and outdoor education
	City Parks: City of Riverside, Norco River Trails, Mt. Rubidoux Park, Fairmount Park, and Butterfield	Various locations, facilities and acreages with mostly urban uses

Table 5.9-2 Regional Recreational Resources by County (continued...)

County	Name and Location of Recreational Resource	Description of Resource and Available Activities
Orange County	County Parks: 3 regional parks along SART	
	City Parks: 9 City parks along SART	
	Burris Basin currently under development	
	Existing equestrian facilities: Rancho Del Rio and Singletree Farms	
	SART bikeway: 27 miles complete Riding and hiking trail: 23 miles complete	
	Talbert Marsh	Multi-purpose trail on 25 acres. Bird watching
	Upper Newport Bay State Ecological Reserve/Interpretive Center	Bird watching, outdoor education, biking, and walking
	Irvine Ranch Wildlands and Parks	Hiking, equestrian, outdoor education, and mountain biking
	Bolsa Chica Ecological Reserve Bolsa Chica State Beach	300 acres Outdoor education, hiking, biking, bird watching, and camping

Regional Strengths, Threats and Weaknesses in Recreation

Physical

One of the great strengths of the region is that each county is geographically distinct, providing a variety of recreational opportunities. However, this diversity in topography also creates some threats and challenges. The biggest threat to recreation in the region is arguably patterns of urban development. The upper portion of the watershed, in San Bernardino County, is mountainous and relatively less populated than other areas in the watershed. The lower valleys are more urban with a discernible pattern of higher density near the coast. However, recently, relatively lower land values inland have resulted in increasing urbanization in these areas. Open space is being converted at a rapid pace, reducing opportunities to establish large parks and natural recreational amenities. The result most likely will be the development of more urban parks, which will support more urban recreational activities.

The upper portion of the watershed, being mountainous, results in a diversity of activities associated with forested environments. These include skiing, camping, hiking, rock climbing, and fishing. The middle portion of the watershed is relatively flat, valley terrain and is more densely urbanized. Activities in these areas include walking, jogging, bike riding, and horseback riding. Also, activities associated with more urban environments such as organized team sports played on developed fields, are more common in these areas.

The proximity of the ocean in the lower parts of the watershed is a draw for outdoor recreation in Orange County. The beach provides recreational opportunities found nowhere else in the watershed.

This is a strength, in that unique activities are available, but also a weakness in that the area is heavily used and requires additional maintenance and management. Facilities require greater upkeep and the potential for conflicts among users is higher here than elsewhere.

The presence of the Prado Dam in the center of the watershed also creates some unique challenges and opportunities. The area behind the dam is a largely undisturbed wetland, habitat to a number of threatened and endangered bird species. Bird watching is popular in this area, but access is challenging. Additionally, the river below the dam has water year round, providing recreational opportunities such as boating and fishing. The river upstream of the dam is more intermittent and does not offer these same opportunities in the same way.

The presence of the SART and various State and regional parks adjacent to the river along its course provide a ready-made infrastructure on which to build future trail linkages. There are few recreational trails adjacent to water in Riverside and San Bernardino counties, but opportunities exist to develop recreational amenities at flood control facilities.

Institutional

All counties and cities in the watershed have some type of park and recreation management agency in place. These agencies provide an existing framework from which to plan and implement future projects. Several working groups currently exist to address specific issues that also provide forums from which to collaborate. Additionally, many agencies have developed management plans for various parks and resources under their purview. For example, most cities have master plans that reference recreation along the river. A major institutional strength is that most of the agencies currently cooperate and maintain good working relationships with one another as they endeavor to build trails. Most cities in the watershed have completed or are in the process of completing some type of vision document for the Santa Ana River Trail within their jurisdictions. Sponsored mainly by the Wildlands Conservancy, these “blue ribbon” committees have assembled stakeholders in each city to craft a vision for recreation adjacent to the river. Each city will have a document that can be used to guide future recreational development.

Private institutions, such as the Wildlands Conservancy, located in San Bernardino County, provide key private support and involvement. The Wildlands Conservancy has provided critical and substantial funding and works effectively with government agencies to further outdoor recreational and educational programs. Other groups, such as the Crafton Hills, Yucaipa Valley, San Bernardino Mountains, and Riverside land conservancies are working with their own contacts and partners to acquire lands, build connecting trails, and encourage elected officials to make recreation and open space a priority. The SART Partnership, a relatively new collaboration between public and private entities in the watershed also has been effective in bringing about funding and planning in the watershed. In 2006, the three counties, SAWPA, and the Wildlands Conservancy signed a Memorandum of Understanding to form the SART Collaborative Partnership. This group brings political will to bear, and directs the agencies under its umbrella to coordinate, seek funding, and leverage resources to finish building the SART. This group has developed the first regionally adopted plan for completing the unfinished segments of the trail.

Many of the group's participants felt that lack of funding to implement management plans was a widespread problem. Much of the funding focused on non-native species removal, such as *Arundo donax* (giant cane). The group also expressed that funding was available for new park development, but not for maintenance and operations. Many expressed the need for acquiring lands to expand or build new facilities.

Current Conservation Measures

There are several active, proposed and inactive conservation plans in the Santa Ana River Watershed. The following is a list of some of the current plans. There are large gaps between these plans in the watershed, including in Western Orange County and in San Bernardino County.

Upper Santa Ana River Wash Land Management and Habitat Conservation Plan

The project is located in the eastern valley portion of San Bernardino County, mostly within the cities of Highland and Redlands, but also partially within county jurisdiction. The plan area is bounded by Greenspot Road to the north and east, Alabama street to the west, and the SAR Wash to the south. The purpose of the proposed project is to allow the continued use of land and mineral resources while maintaining the biological and hydrological resources of the planning area in an environmentally sensitive manner. The Wash Plan is intended to coordinate and manage the present and future activities in the wash that are part of multiple jurisdictions, each with different needs. The goal of the project is to balance the ground-disturbing activities of aggregate mining, recreational activities, water conservation, and other public services with quality, natural habitat for endangered, threatened and sensitive species (San Bernardino Valley, 2007).

Western Riverside County Multiple Species Habitat Conservation Plan

The Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP) is a comprehensive, multi-jurisdictional Habitat Conservation Plan (HCP) focusing on the conservation of species and their associated habitats in Western Riverside County. The MSHCP is one of several large, multi-jurisdictional habitat-planning efforts in Southern California with the overall goal of maintaining biological and ecological diversity within a rapidly urbanizing region. Large-scale HCP planning efforts have been completed in San Diego and Orange Counties, and a similar effort is under way in the Coachella Valley. The MSHCP will allow Riverside County and its cities to better control local land use decisions and maintain a strong economic climate in the region, while addressing the requirements of the State and Federal Endangered Species Acts.

Riverside County's population in 2000 was approximately 1.5 million people. Its population is expected to double by 2020, to reach approximately 3.5 million by 2030, and be approximately 4.5 million by 2040, according to forecasts by SCAG. This is nearly a 400% increase over the next 40 years. Most of Southern California's growth over the next 40 years is expected to occur in the Inland Empire (San Bernardino and Riverside Counties) (SCAG 2001).

Accommodating an increase in population of this magnitude will involve urbanizing thousands of acres of undeveloped land and result in significant conflicts with regulations protecting species and their habitats. Conflicts and delays will escalate costs for all development projects, uncoordinated mitigation efforts will fragment habitats, the region will miss opportunities to improve the quality of life, and economic development opportunities for the current and future residents of Riverside County also will not be realized.

The MSHCP plan area encompasses approximately 1.26 million acres (1,966 square miles). It includes all unincorporated Riverside County land west of the crest of the San Jacinto Mountains to the Orange County line, as well as the jurisdictional areas of the cities of Temecula, Murrieta, Lake Elsinore, Canyon Lake, Norco, Corona, Riverside, Moreno Valley, Banning, Beaumont, Calimesa, Perris, Hemet, and San Jacinto. This HCP is one of the largest plans ever attempted. It covers multiple species and multiple habitats within a diverse landscape, from urban centers to undeveloped foothills and montane forests, all under multiple jurisdictions. It extends across many bioregions as well, including the Santa Ana Mountains, Riverside Lowlands, San Jacinto Foothills, San Jacinto Mountains, Agua Tibia Mountains, Desert Transition, and San Bernardino Mountains. It will provide a coordinated MSHCP Conservation Area and implementation program to preserve biological diversity and maintain the region's quality of life.

Existing Reserves within the Western Riverside County MSHCP

- | | |
|---|---|
| • Box Springs Reserve | • Riverside County Flood Control and Water |
| • Bureau of Land Management Lands | |
| • Cleveland National Forest | • Conservation District Lands |
| • Emerson Oaks Reserve | • San Bernardino National Forest |
| • Harford Springs Reserve | • San Diego Gas and Electric Lands |
| • Kabian Park | • San Jacinto Wildlife Refuge |
| • Lake Mathews-Estelle Mountain Reserve | • San Timoteo Creek State Park |
| • Lake Perris Recreation Area | • Santa Margarita Ecological Reserve |
| • Lake Skinner Recreation Area | • Santa Rosa Plateau Nature Reserve |
| • March Air Reserve Base Reserve Lands | • Southern California Edison Lands |
| • Metropolitan Water District Lands | • Southwestern Riverside County Multi Species Reserve |
| • Mount San Jacinto Wilderness State Park | |
| • Norton Younglove Reserve | • Sycamore Canyon Wilderness Park |
| • Orange County Water District Lands | • UC James San Jacinto Mountain Reserve |
| • Prado Basin | |

Orange County Natural Communities Conservation Plan

The purpose of this project is to create a sub-regional multi-habitat-based HCP that balances resource protection with reasonable economic growth. This effort provided an opportunity to preserve coastal sage scrub and oak woodland habitats that have nearly disappeared from Southern California. The remote canyons of the 13,000-acre northern boundary, east of the City of Orange, are notable for "The

Sinks" area of Limestone Canyon, a huge, steep-walled sandstone ravine that resembles a mini-Grand Canyon. The land harbors some of Orange County's richest oak and sycamore woodlands, as well as

streams and springs laced with blackberries and monkey flowers and shared by animals of all sizes – from mountain lions to rare lizards. The ranch's 12,000-acre Weir, Gypsum and Fremont Canyons, adjacent to the Cleveland National Forest, are home to many native animals and plants. These include the rare Tecate cypress, found only in three other areas of California. The 14,000-acre southern boundary, with its hills, meadows, wooded canyons and sweeping views of the Pacific, connects Crystal Cove State Park and the Laguna Coast Wilderness Park. The Irvine Ranch Wildlands and Parks are home to bobcats, red-tailed hawks, coyotes, mule deer, meadowlarks, and an abundance of other wildlife (Nature Conservancy, 2008).

The Irvine Ranch Conservancy was established in 2005. It is a non-profit, non-advocacy organization, created to help care for the 50,000 acres of permanently protected wildlands and parks on the historic Irvine Ranch. The organization works with its partners to enhance the public's appreciation, understanding and connection to the land, while helping other landowners and managers with all aspects of stewardship. The Irvine Ranch Conservancy contributes its resources, expertise and energy to achieve the best possible balance of preservation and public participation. Nearly 50,000 acres of wildlands and parks have been designated as permanent open space on The Irvine Ranch. However, protecting the land is only the first step. Mediterranean ecosystems like these need extremely attentive stewardship. The rare plants, animals, and habitats found here are adapted to specialized conditions and need our long-term management to survive. The mission of the Irvine Ranch Conservancy is to make sure that these lands are cared for and enjoyed to the highest possible standards.

The wildlands of the North Ranch are connected to the Cleveland National Forest and are one of the few places where natural habitat ranges relatively unbroken from lowland scrub, grassland and oak woodlands up to higher altitude montane chaparral and conifers. The Venturan and Diegan associations of coastal sage scrub and native grasslands of Southern California are all critically endangered, and the Irvine Ranch Wildlands and Parks and adjacent wildlands offer one of the last, best places to protect these ecosystems and many of the species associated with them.

This area also is sufficiently large and continuous to support native ecosystems that still benefit from the presence of large predators such as mountain lion, coyote, golden eagle and bobcat. Their ecological role as top carnivores helps maintain a healthy and resilient ecosystem. The wildlands are some of the last and most extensive lower elevation habitat for these important predators. For all of these reasons, The Irvine Ranch Wildlands and Parks have been identified by The Nature Conservancy as one of the top 50 priority conservation landscapes in California.

Not only are these natural areas a globally important conservation priority, they are remarkably close to one of the world's largest urban regions. This offers an unparalleled opportunity for people to experience and enjoy these extraordinary native ecosystems in their own backyard, while enhancing understanding and support for their protection and stewardship (Irvine Ranch Conservancy, 2008).

Existing Conservation Plans Western Riverside County MSHCP

Plan	Agency	Acres	Status
WRC MSHCP	WRC RCA		Underway
Cleveland NF	USFS		Completed
San Bernardino NF	USFS		Completed
Prado Basin	OCWD		Completed
Bureau of Land Management Lands	BLM		Fluctuates
Lake Perris SRA	CA State Parks		Completed
San Jacinto WR	CA State Parks		Underway
San Timoteo Creek SP	CA State Parks		Underway
Mt San Jacinto Wilderness SP	CA State Parks	10,000	Completed
Santa Margarita Ecological Reserve			Completed
Santa Rosa Plateau Nature Reserve		8,300	Completed
Motte Rimrock Reserve	UC NRS		Completed
Box Springs Reserve	UC NRS	1,155	Completed
Emerson Oaks Reserve	UC NRS		Completed
James San Jacinto Mountain Reserve	UC NRS	160	Completed
Kabian Park	RC Parks	640	Completed
Norton Younglove/De Anza Reserve			Completed
Harford Springs Reserve	RC		Completed
Lake Skinner Recreation Area	RC Parks		Completed
Lake Mathews-Estelle Mountain Reserve	MWD		Completed
SW Riverside County Multi Species Reserve	RCHCA		Completed
Metropolitan Water District Lands	MWD		Completed
March ARB Reserve Lands	USAF		Completed
Southern California Edison Lands	SCE		Completed
San Diego Gas and Electric Lands	SDGE		Completed
Total Acres:		500,000	

San Bernardino County MSHCP

PLAN	AGENCY	ACRES	STATUS
San Bernardino National Forest	USFS		
San Bernardino County MSHCP	SB County		Hiatus
Upper Santa Ana River Land Management & Habitat Conservation Plan	SBVWCD		Draft

Orange County MSHCP

PLAN	AGENCY	ACRES	STATUS
Cleveland National Forest	USFS		Completed
Irvine Ranch Wildlands	Nature Conservancy	50,000	Under way
Irvine Open Space Preserve - South	City of Irvine	4,000	Under way
	Total Acres:	54,000	

Innovative Conservation Arrangements

Restoring the river requires many partners, agencies and landowners. Some of the key agencies include the following. The Corps has provided major funding through mitigation requirements and permits the wetland activities under Section 404 of the Clean Water Act. EPA receives, administers, and has distributed funds earmarked for this program through the efforts of Congressman Calvert and others. The CDFW permits the wetland activities under Section 1601 of the Fish and Game Code, has directed mitigation funds to SAWA, and contributes expertise to deal with some of the resource issues. The USFWS oversees and must approve activities that could affect wetland resources and endangered species. The RWQCB approves activities that could affect water quality and provides oversight of the recognized beneficial uses of the wetland resources. OCWD, which is responsible for managing water resources and providing water to more than two million Orange County residents, has provided major funding, provides personnel to manage wetlands and endangered species, and manages 2,400 acres near the middle of the river in the Prado Basin, attempting to maximize wildlife resources. The county flood control agencies maintain sections of the river for flood conveyance, cooperate toward achieving mutual goals, and issue entry permits.

Other programs include the Federal Safe Harbor Policy, which protects the ability of landowners to use their land responsibly in exchange for the setting aside of large land parcels for conservation of specific threatened or endangered species.

Opportunities for Improvement

As the watershed has been developed over the past two centuries, many water-oriented habitats have been altered by man. Where water-oriented habitats have been reduced, the flora and fauna have adapted, moved or disappeared. Through the OWOW process, stakeholders will investigate how to successfully manage water-oriented habitats while ensuring adequate public water supply, protecting water quality, and providing housing and commerce for a growing population.

The following is a list of issues/challenges, followed by a brief discussion of potential approaches that take advantage of opportunities for improvement.

Create managed system and restoration targets

A plan for sustainable management of conservation areas with targeted restoration efforts is essential for preventing further deterioration of habitat. Consideration for characteristics of each of the main

habitat types: alluvial fan; riparian, wetland and coastal and their specific ecosystems, will require habitat specific management plans and restoration criteria.

Potential Approaches:

- Develop a map of the watershed reflecting all the water-oriented habitat areas as described in this chapter
- Develop a landownership database along riparian corridors
- Work with landowners to manage habitat more effectively and provide “assistance agreements”
- Develop an urban habitat management model that softens/blurs the transition from urban development to surrounding habitat areas, and allows urban gardens and green space to be used safely/responsibly by wildlife based in the habitat areas
- Partner with transportation agencies to minimize fragmentation and incorporate wildlife crossings
- Incorporate vector control efforts into habitat management efforts to avoid conflicting activities
- Consolidate the various “vision plans” by various agencies regarding water-oriented habitat conservation

The region’s favorable climate and historically high employment rate make the region prime for development and urban growth, and it is expected to remain so in the future. This produces a great deal of pressure on water-oriented habitat. To address these pressures, this Plan recommends that the development community consider water-oriented habitats early in the development planning process.

Potential Approaches:

- Analyze the economic value of environmental and habitat enhancement to new and existing communities
- Identify early what general and specific areas should be preserved at full build-out of the Watershed rather than identifying them after landowners have prepared development plans (the latter approach can result in inequitable, piecemeal conservation efforts)
- Incorporate water-oriented habitat conservation into land use planning in a manner that provides a return on investment while protecting the environment
- Modify the State tax structure to encourage conservation
- Facilitate cooperation among regulators and private landowners to prioritize lands that could be purchased and set aside as public lands
- Identify funding sources for such purchases or facilitate development agreements that transfer such lands to public agencies for future management
- Consider the natural configuration of water-oriented habitat that does not recognize political jurisdictional boundaries. A regional coordination effort is needed to provide consistent planning and regulation across multiple jurisdictions

Create Sustainable wildlife corridors and expansion of restored areas

Creating sustainable wildlife corridors will require land use planning coordinated across jurisdictional boundaries. Cooperation also must take place among all of the current regional conservation plans, mitigation providers, resource conservation districts, and non-profit conservation organizations.

Potential Approaches:

- Facilitate legislation to simplify landowner habitat conservation programs
- Develop an inventory of existing mitigation lands
- Develop a Watershed-wide, water-oriented habitat conservation program
- Create mitigation banks to “pool” smaller mitigation requirements to enable the creation of larger, more beneficial habitat mitigation projects
- Work with private landowners to manage habitat more effectively, provide “assistance agreements” that help those landowners manage their lands partnership, and management education
- Build on successes of the Western Riverside County MSHCP and other similar efforts to expand conservation opportunities

Provide sustainable funding sources for ongoing maintenance of conservation areas

Over the past few decades, development interests, regulators and environmental groups have worked together to encourage habitat conservation and enhancement while allowing for reasonable land development. Such efforts include Natural Community Conservation Plans and HCPs. These programs have provided large conservation areas to accommodate large developments, but have taken years and large financial commitments to develop and implement. Despite significant bond funding in recent years, there still is a shortage of funding available in both the private and public sectors to purchase, operate, and maintain valuable habitat areas.

Challenges to the effort to restore areas of the mainstem include an in-lieu fee program and other mitigation program regulations that insist on long-term protections such as conservation easements, fee-title ownership, and real estate instruments over all areas where removal and restoration occur. This is not feasible in many places along the Santa Ana River because these lands are controlled by flood control agencies, parks districts, cities, counties, and the Army Corps itself. However, other long-term agreements need to be made among these agencies and organizations whose missions include invasive removal and native habitat restoration. Public and private landowners with ownership and jurisdiction over these areas need to work with mitigation providers, such as non-profit organizations, conservation authorities and resource conservation districts to develop long-term protection agreements that will satisfy the requirements of the Army Corps of Engineers, the California Department of Fish and Wildlife, the US Fish and Wildlife Service, and the Regional Water Quality Control Board.

The Integrated Regional Watershed Management Plan should include consensus among all agencies and organizations with ownership/stewardship over areas of the Santa Ana River mainstem and tributaries that provide for long-term protection of areas where habitat restoration efforts are occurring or need to occur. This kind of cooperative agreement will be critical to the ability of governmental and non-profit organizations to secure mitigation funding to do the necessary habitat restoration work needed in the watershed. Without such agreements, the fragmentation of restored habitat in the watershed will continue to be a problem.

Potential Approaches:

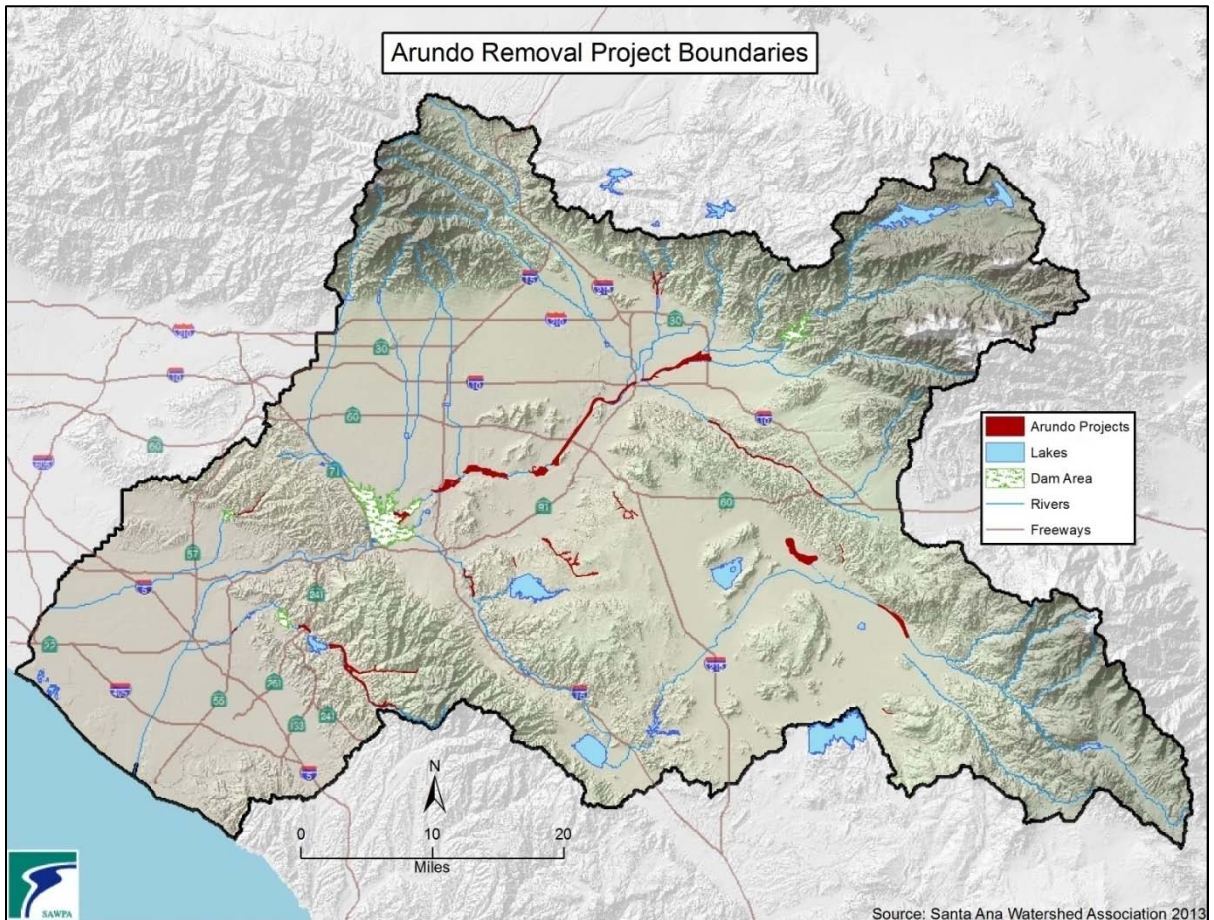
- Research and develop innovative funding arrangements to buy high priority, water-oriented conservation lands, construct needed improvements for appropriate public access, and fund on-going operation and maintenance of those lands
- Create cooperative agreements among public landowners and organizations that conduct long-term maintenance of habitat areas that provide reasonable protections in perpetuity for ongoing restoration

Invasive species eradication and maintenance funding

Restoring the river requires many partners, agencies and landowners. Some of the key agencies include the following. The Army Corps of engineers has provided major funding through mitigation requirements and permits the wetland activities under Section 404 of the Clean Water Act. EPA receives, administers, and has distributed funds earmarked for habitat program. The CDFW permits the wetland activities under Section 1601 of the Fish and Game Code, and has directed mitigation funds to mitigation providers, and contributes expertise to deal with some of the resource issues. The USFWS oversees and must approve activities that could affect wetland resources and endangered species. The RWQCB approves activities that could affect water quality and provides oversight of the recognized beneficial uses of the wetland resources. The county flood control agencies maintain sections of the river for flood conveyance, cooperate toward achieving mutual goals, and issue entry permits. OCWD, which is responsible for managing water resources and providing water to more than two million Orange County residents, has provided major funding for habitat restoration throughout the watershed, provides personnel to manage wetlands and endangered species, and manages 2,400 acres near the middle of the river in the Prado Basin, attempting to maximize wildlife resources.

The historical and current sources of habitat restoration funding include developer fees directed by the Army Corps to in-lieu fee mitigation providers. Outside of in-lieu fee mitigation, the CDFW and the RWQCB order mitigation measures that result in developer fees that are directed to non-profit and governmental mitigation providers and conservation organizations. Grant and bond funding in the watershed also have funded the removal of thousands of acres of invasive plants, initial and ongoing restoration of habitat areas, biological monitoring of sensitive species, and conservation of habitat areas. The image below, **Figure 5.9-4**, illustrates the multiple areas affected by the *Arundo Donax*.

Figure 5.9-4 Arundo Donax Removal Areas



All of these sources and more should continue to support restoration and ongoing maintenance. Access to such funding should be expanded to benefit the watershed. New, innovative partnerships should be developed to direct funding to habitat issues.

Potential Approaches:

- Create and update watershed-wide, public contact list of mitigation and conservation organization organizations, their capabilities and areas of expertise
- Create a regional grant opportunities network and clearinghouse to direct more funding to the watershed for restoration and public education
- Develop a wider range of in-lieu funding programs, habitat banks for water-oriented habitats throughout the watershed
- Create and encourage innovative public/private/non-profit partnerships and collaboration to improve opportunities for bringing grant funding to the watershed.

Habitat Restoration Projects

Much of the remaining invasive plant biomass and areas that could benefit from Re-establishment activities (removal of invasive species followed by long-term, active planting and biological monitoring) in the watershed is on land owned by Federal, State, and local governments for purposes other than water-oriented habitat conservation. In many cases, these lands currently are left unmanaged or are managed in a manner that discourages the development of habitat. There are many unused portions of public lands that could be set aside for habitat enhancement without impacting the landowner's primary purpose. An example may be flood control channels and basins that could provide habitat while still providing critical flood protection.

Potential Approaches:

- Develop a public land database as a first step toward a more comprehensive, coordinated management plan
- Develop a regional plan for public land use
- Develop regional "safe harbor" type agreements that allow for long-term management of public lands for multiple uses including habitat conservation
- Coordinate wildlife management with local parks departments
- Provide expert assistance to public agency landowners to help them better understand how they can manage their lands for multiple purposes, especially short- or long-term habitat enhancement
- Partner with public utilities in utility corridors

Pollutant Trading Programs

Constructed wetlands can be used to remove pollutants from surface runoff using natural processes. Formal pollutant trading programs provide the mechanism to pool funding from multiple, smaller sources to construct wetlands that would create habitat and increase the pollutant removal benefit. Potential Approach:

- Develop formal pollutant trading programs that facilitate pooling of funds to construct wetlands

Create community involvement in habitat conservation and restoration

As development moves into the arroyos and hillsides of the watershed, more people are living closer to valuable habitat. Unfortunately, not enough emphasis has been placed on developing a land ethic across the watershed, even among those residents who live directly adjacent to some of the watershed's richest habitats. There is a great deal of potential to improve the connection between people and local habitats. For instance, along the northeastern slope of the Santa Ana Mountains, stewardship groups could be formed among residents to care for the habitat and wildlife in the local canyons and forest water courses.

Some of the watershed's high quality, water-oriented habitats are near disadvantaged communities, where little attention has been paid to stewardship of the local resources. Developing local "ownership" of these habitats could benefit both the habitat and the community.

Potential Approaches:

- Develop a social marketing campaign, including opinion surveys to determine how to best enhance the people/habitat connection
- Develop community “ownership” of local water courses and wetlands by forming wetland societies or stewardship/“friend” groups
- Create educational centers near water-oriented habitat areas
- Provide educational tours of both local and regional water-oriented habitat areas
- Sponsor conferences that include outdoor seminars
- Produce/distribute wildlife habitat maps and make them available on-location and on the Internet
- Increase citizen science opportunities/involvement
- Increase access to high-quality habitat
- Provide field trips to elementary and high school students to increase watershed awareness

Sediment restored downstream of dams

Sediment buildup behind Prado Dam is a problem for this Army Corps flood control and water retention facility because its capacity to store water is being continuously degraded by upstream sediment that has nowhere to go once it reaches the dam.

Water that is discharged from Prado Dam picks up existing sand and sediment below the dam and transports the material to the coast. Because Prado Dam is cutting off the replacement source of sediment, the River below Prado Dam is “sand starved.” The lack of replenishment sand to the lower Santa Ana River will have significant negative impacts to groundwater recharge efforts in Orange County. Because sands are unable to get past Prado Dam, areas of the River below Prado Dam have started to armor. Riverbed armoring occurs when replenish sediments are restricted allowing the particle size distribution to change and the remaining sediment to become more densely packed, resulting in reduced permeability. This process severely impedes the recharge capacity of the river. The decreased flow of sediments downstream of Prado Dam also has affected natural habitats and decreased replenishment of beach sands. Multiple studies and field surveys have been performed to quantify the degradation of the Santa Ana River Channel below Prado Dam.

OCWD has proposed its “Prado Basin Sediment Management Demonstration Project.” The purpose of this project is to demonstrate the feasibility of taking on a long-term sediment management plan for the basin. The Corps is also currently engaged in development in a feasibility study for ecosystem restoration throughout the Prado Basin.

Creating MSHCPs and RCDs in areas that are currently not covered

There are several areas of the watershed where special conservation districts and formal habitat conservation plans do not exist that could benefit from their establishment.

A regional multi-species habitat conservation plan is needed for the more populated areas of San Bernardino County. There have been several efforts in specific places, but there is no MSHCP covering the quickly growing southwestern San Bernardino County region. Western Orange County also has not been covered by an MSHCP.

In addition to the positive effects of habitat conservation plans, resource conservation districts (RCDs) provide valuable services that preserve and restore habitat, and help landowners protect and enhance habitat on their properties. There currently is no Resource Conservation District in Orange County. Other resource conservation districts (including Inland Empire RCD, in conjunction with SAWA) in the watershed have conducted habitat restoration work in Orange County, but this requires special permission from the Local Agency Formation Commission (LAFCO) to allow them to work outside of their district boundaries. Orange County has a unique mix of habitat that includes forest, chaparral, riparian, coastal sage scrub, marsh and open ocean, and could benefit greatly from the formation of an RCD to serve the area.

Project Proposals

Two of the most immediate needs in the Santa Ana River watershed in natural resources preservation and protection are Arundo removal and wildlife connections. **Table 5.9-3** shows two concepts from the Natural Resources Stewardship Pillar Implementation Concept Projects table.

Table 5.9-3 Natural Resources Stewardship Pillar Implementation Concept Project

Project Title		Project Concept
NR2	Establish sustainable wildlife corridors and expansion of restored areas	Creating sustainable wildlife corridors will require land use planning coordinated across jurisdictional boundaries. Cooperation also must take place among all of the current regional conservation plans, mitigation providers, resource conservation districts and non-profit conservation organizations.
NR4	Project that provides invasive species eradication and maintenance funding	All of these sources and more should continue to support restoration and ongoing maintenance. Access to such funding should be expanded to benefit the watershed. New, innovative partnerships should be developed to direct funding to habitat issues.

These two projects would occur along the mainstem of the Santa Ana River, but would have far-reaching positive effects for habitat restoration, recreation, wildlife movement, disadvantaged communities and water retention.

NR2—Project to Create Sustainable Wildlife Linkages and Expand Restored Areas

There are several areas in the Santa Ana River Watershed that have been identified by regulatory agencies and conservation groups as vital linkages that need to be preserved for movement of wildlife and species diversity. Most of these areas preserve a link among natural habitats from the San Diego County Mountains and deserts, through southwestern Riverside County, through the Santa Ana Mountains and Cleveland National Forest, and then n across the Santa Ana Canyon through to Chino Hills State Park and the Prado Basin, and the rest of the Santa Ana River upstream. Of course the linkages work in the other direction as well.

Significant chokepoints in these wildlife movement linkages are created in the watershed by roadways, especially Interstate 15 in the Temecula area, the 241 Toll Road in Orange County, and the 91 Freeway in the Santa Ana Canyon adjacent to the river.

The biggest challenge to such a project is providing a large enough crossing with the right characteristics to encourage crossings by everything from the smallest insects to the largest mammals. In a study published in *Biological Conservation* titled, “Use of highway undercrossings by wildlife in Southern California,” the authors wrote the following regarding wildlife crossings: “Our results show that while many native animals used passages beneath highways, the presence of suitable habitat on either side of the passage was a particularly important factor for predicting use.” The study also found that size of the passage was important especially with large carnivores and deer. The study authors recommended the following: “To increase the likelihood of utilization and to help prevent animals from crossing road surfaces, we suggest that simple improvements, such as habitat restoration near crossing points and animal-proof fencing that serves to funnel wildlife to passages, can facilitate animal movement between fragmented habitats that are bisected by roads.” (Ng, et al 2003)

The 91 Freeway in the Santa Ana Canyon provides a significant barrier to wildlife movement, especially large mammals, including carnivores such as bobcats, coyotes and mountain lions. At B Canyon in Riverside County adjacent to the upstream edge of the Green Valley Golf Club, the freeway creates a barrier between two of the Riverside County MSCHP’s major habitat areas—Existing Core A (Prado Basin/Santa Ana River) and Existing Core B (Cleveland National Forest). In the Plan, this is known as Constrained Linkage 1. The Plan recommends creating an adequate wildlife underpass or overpass at this location. Plans have been submitted by the Riverside County Transportation Commission to enlarge a culvert under the freeway to improve movement of wildlife. However, further measures are needed to improve this linkage for the future.

In the Santa Ana Canyon outside of the MSHCP area, the 91 Freeway also constrains the linkage between the Cleveland National Forest and Chino Hills State Park, most notably at Coal Canyon. The corridor under the freeway was never vegetated and mountain lions are no longer using it, although historical use of this linkage is well documented. Currently, there is a considerable amount of construction taking place in this area, which also is hampering animal movement

Suggested solutions include re-vegetating the Coal Canyon ramp undercrossing and improving oak-riparian structure coming down the drainage that leads to the large culvert there to enhance the likelihood that certain wildlife, including mountain lions, would even approach the crossing. Other solutions include keeping the culvert clear of heavy sediment but with a sandy or dirt floor, cutting light and noise impacts at the crossing with sound walls or other measures, moving Caltrans and other equipment and construction-related activities to other locations, and improving some of the fencing around this area.

We recommend a project that would begin with a study of the current mitigation and construction measures taking place in these areas, determine what is lacking in planning and funding, and then

develop a plan to create crossings that meet criteria for successful crossing sites. Implementation would include crossing construction, funnel fencing construction, initial and ongoing habitat restoration, mitigation of lighting and noise effects, and landscaping and monitoring. Partners could include the Western Riverside Regional Conservation Authority, the Army Corps of Engineers, Caltrans, Riverside County Transportation Commission, Santa Ana Watershed Association, Riverside-Corona Resource Conservation District, and the counties of Orange and Riverside.

NR4—Project to Eradicate Invasive Species and Provide Native Habitat

As noted earlier, Arundo has been nearly completely eradicated in the upper Santa Ana River watershed upstream from Riverside, and the San Bernardino National Forest also has projects focused on Arundo removal. There are also several ongoing invasive-removal and maintenance operations in Norco, Eastvale, and in the Prado Basin. These downstream projects are in constant danger of re-infestation because of scattered, large Arundo infestations on the Riverside area of the mainstem in the area between the Mission Bridge and the Goose Creek Golf Course.

Within this stretch of the mainstem, there are significant “gaps” where Arundo is present and presents a threat of re-infesting downstream areas that have been cleared by the Army Corps, SAWA, the resource conservation districts and OCWD. However, the area also contains several large eradication and restoration projects managed by the Santa Ana Watershed Association and Riverside County Parks and Open Space District totaling nearly 1,500 acres. In the middle of this stretch of the river is Hidden Valley Wildlife Area, where SAWA has been eradicating approximately 775 acres of invasive plants over an approximately 1,000-acre project area since 2008 with Proposition 50 funding. In 2013, active planting and restoration has occurred on some of the more bare areas of the project. In 2014, the Proposition 50 grant will expire and other funding will be needed to keep this area under control and in active restoration. Riverside County Parks also is working to remove Arundo on its own property.

Funding for removal and restoration of these “Arundo gaps” in the Riverside area of the Santa Ana River mainstem will result in a more systematic removal of Arundo from the watershed, and remediate some of the problems mentioned earlier in this chapter of spotty conservation areas and fragmented management of natural resources. Removing these large areas of Arundo also returns a significant amount of water to the river every year because of the plant’s rapid growth and heavy water use compared to native vegetation. The removal of Arundo and restoration of native habitat also provide benefits to sensitive species including the least Bell’s vireo, the southwestern willow flycatcher, and the Santa Ana sucker.

Potential partners in this project could include Riverside County Flood Control and Water Conservation District, Riverside County Parks and Open Space District, California Department of Fish and Wildlife, the Inland Empire Resource Conservation District, Riverside-Corona Resource Conservation District, the City of Riverside, and the City of Jurupa Valley.

Summary

One of the greatest questions for the future of habitat restoration in the Santa Ana River Watershed is future hydrology. As conservation and reclamation efforts grow within water and sanitation districts

and the Regional Water Quality Control Board seeks to eliminate urban runoff, areas that currently experience year-round flows may become dry. This will have an adverse effect on native vegetation and native fishes, birds and other wildlife. In addition, the effects of climate change on watershed hydrology are uncertain. In the face of these challenges, maintaining current flows or restoring natural stream flows may be problematic and expensive.

There are many opportunities for improving habitat in the Santa Ana Watershed, and there are numerous benefits for wildlife and people. However, the current fragmented management of habitat is one of the greatest barriers to success. Restoring and maintaining valuable habitat throughout the watershed will require a “big tent” approach that involves all of the stakeholders in the watershed. One Water, One Watershed is an example of the kind of effort that is needed to bring all of the elements and organizations together.

References

- Dill, W.A., and A.J. Cordone. 1997. History and status of introduced fishes in California, 1871-1996. California Department of Fish and Game. Fish Bulletin 178.
- Grossinger, R. M., Stein, E.D. Cayce ; Askevold, K. R.; Dark, S.; Whipple, A. 2011. Historical Wetlands of the Southern California Coast: An Atlas of US Coast Survey T-sheets, 1851-1889. Technical Report 589. Southern California Coastal Water Research Project. Costa Mesa and Oakland, CA: San Francisco Estuary Institute.
- Kentula, M.E. 1997. A comparison of approaches to prioritizing sites for riparian restoration. *Restoration Ecology* 5(4S):69-74.
- Kentula M.E. 2007. Monitoring wetlands at the watershed scale. *Wetlands* 27:412—415
- Kerschner, J.L. 1997. Setting riparian/aquatic objectives within a watershed context. *Restoration Ecology*. 5 (4S):2-3.
- Mock, P. 2004. California Gnatcatcher (*Poliophtila californica*). In The Coastal Scrub and Chaparral Bird Conservation Plan: a strategy for protecting and managing coastal scrub and chaparral habitats and associated birds in California. California Partners in Flight.
- Moyle, P. B. 2002. Inland Fishes of California Berkeley: University of California Press 502 pp. Matern, S. A., P. B. Moyle, and L. C. Pierce. 2002.
- Ng, S. J.; Dole, J. W.; Sauvajot, R. M.; Riley, S. P. D.; Valone, T.J., 2004. Use of highway undercrossings by wildlife in southern California. *Biological Conservation* (115)
- Stein E. D.; Dark, S.; Longcore, T.; Grossinger, R.; Hall, N.; Beland, M. 2010. Historical ecology as a tool for assessing landscape change and informing wetland restoration priorities. *Wetlands* 30:589-601.

Swift, C. C., T. R. Haglund, M. Ruiz, and R. N. Fisher. 1993. The status and distribution of the freshwater fishes of Southern California. *Bulletin of the Southern California Academy of Science* 92(3):101-167.

Waycott, M. , Duarte, CM; Carruthers, J.B; Orth, R. J.; Dennison, W.C.; Olyarnik, S; .Calladine, A; Fourqurean, J. W.; Heck, Jr. K. L.; Hughes, A. R. ; Kendrick, G. A.; Kenworthy, W. J.; Short, F. T.; Williams, S. L. 2009. Accelerating loss of seagrasses across the globe threatens coastal ecosystems. *Proceedings of the National Academy of Sciences* 106:12377-12381.

White, D.; Fennessey S. 2005. Modeling the suitability of wetland restoration potential at the watershed scale. *Ecological Engineering*. 24:359-377

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