The Santa Ana River

The **Santa Ana River** is the largest river of [Southern](http://en.wikipedia.org/wiki/Southern_California) [California](http://en.wikipedia.org/wiki/California) in the [United States](http://en.wikipedia.org/wiki/United_States). Its [drainage basin](http://en.wikipedia.org/wiki/Drainage_basin) spans four counties.[[2]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-1) It rises in the [San Bernardino Mountains](http://en.wikipedia.org/wiki/San_Bernardino_Mountains) and flows past the cities of [San Bernardino](http://en.wikipedia.org/wiki/San_Bernardino%2C_California) and [Riverside](http://en.wikipedia.org/wiki/Riverside%2C_California), before cutting through the northern tip of the [Santa Ana Mountains](http://en.wikipedia.org/wiki/Santa_Ana_Mountains) and flowing southwest past [Santa Ana](http://en.wikipedia.org/wiki/Santa_Ana%2C_California) to spill into the [Pacific Ocean](http://en.wikipedia.org/wiki/Pacific_Ocean). The Santa Ana River is 96 miles (154 km) long,[[3]](http://en.wikipedia.org/wiki/Santa_Ana_River%22%20%5Cl%20%22cite_note-NHD-2) and drains a watershed of 2,650 square miles (6,900 km2).

For its size the Santa Ana drainage basin is quite diverse. It ranges from high peaks of inland mountains in the north and east, to the hot, dry interior and semi-desert basin, to flat coastal plains in the west. Its climates range from dry [alpine](http://en.wikipedia.org/wiki/Alpine_climate) to [chaparral](http://en.wikipedia.org/wiki/Chaparral) and [desert](http://en.wikipedia.org/wiki/Desert), and the watershed as a whole is very arid. Relatively little water actually flows in the river or most of its [tributaries](http://en.wikipedia.org/wiki/Tributary). One of its largest tributaries, the [San Jacinto River](http://en.wikipedia.org/wiki/San_Jacinto_River_%28California%29), rarely reaches the Santa Ana except in extremely wet years. The relative lack of vegetation also makes the river prone to [flash flooding](http://en.wikipedia.org/wiki/Flash_flood). Even so, a wide variety of animal and plant life has always been dependent on the river.

People have lived on the Santa Ana River for at least 9,000 years. There were four distinct indigenous groups in the area, all of which depended heavily on the river for their livelihoods. The river was first explored by Europeans in 1769, and received its name from [Spanish](http://en.wikipedia.org/wiki/Spanish_people) [mission](http://en.wikipedia.org/wiki/Mission_%28Christian%29) fathers in the 19th century. Because it is one of the largest water sources in the four-county region, many large [ranchos](http://en.wikipedia.org/wiki/Ranchos_of_California) developed alongside the river and one of its major tributaries, [Santiago Creek](http://en.wikipedia.org/wiki/Santiago_Creek). This period of growth culminated in the establishment of many large cities on the river, including Santa Ana and Riverside, both of which derived their names from the River. In the early 20th century, devastating [floods](http://en.wikipedia.org/wiki/Flood) poured down the Santa Ana River, leading to much of the river being [channelized](http://en.wikipedia.org/wiki/River_engineering#Channelization) and [dammed](http://en.wikipedia.org/wiki/Dam) in recent times.

One of the largest river basins in Southern California and the largest on the South Coast,[[11]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-PradoBasin-10) the Santa Ana River watershed covers 2,650 square miles (6,900 km2) in parts of four California counties. The main stem of the river flows through three of these counties, and tributaries drain parts of [Los Angeles County](http://en.wikipedia.org/wiki/Los_Angeles_County) into the Santa Ana. The watershed is characterized by the flat, arid basin of the [Inland Empire](http://en.wikipedia.org/wiki/Inland_Empire_%28California%29) and the coastal plain of north-central Orange County, and is bisected by the Santa Ana Mountains, which run nearly perpendicular to the river—northwest to southeast.[[14]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-USGSBasin-13) There are over 50 major tributaries to the once free flowing and perennial river. The Temescal Creek valley constitutes a major portion and physiographic feature of the Santa Ana River watershed. The area drained by Temescal Creek and the [San Jacinto River](http://en.wikipedia.org/wiki/San_Jacinto_River_%28California%29) constitute some 45% of the watershed and extend its boundaries as far south as the [Anza-Borrego State Park](http://en.wikipedia.org/wiki/Anza-Borrego_State_Park) area.[[15]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-Watershed-14)

About 4.8 million people lived in the Santa Ana River basin as of 2000.[[15]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-Watershed-14)[[16]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-WaterQuality-15) Most of the population is concentrated close to the river in urban centers such as San Bernardino, Riverside, and Santa Ana. In the Inland Empire, most people live in a thin ribbon of land along the river, while the rest of the land is used for [agriculture](http://en.wikipedia.org/wiki/Agriculture) and [ranching](http://en.wikipedia.org/wiki/Ranching). In Orange County, however, nearly all the land is urban. As a result, the Santa Ana River watershed can be thought of as having two distinct parts, separated by the Santa Ana Mountains. Some major bodies of water in the watershed include [Lake Elsinore](http://en.wikipedia.org/wiki/Lake_Elsinore), [Lake Irvine](http://en.wikipedia.org/wiki/Lake_Irvine), [Lake Mathews](http://en.wikipedia.org/wiki/Lake_Mathews), [Lake Perris](http://en.wikipedia.org/wiki/Lake_Perris), [Diamond Valley Lake](http://en.wikipedia.org/wiki/Diamond_Valley_Lake), [Lake Skinner](http://en.wikipedia.org/wiki/Lake_Skinner), and [Big Bear Lake](http://en.wikipedia.org/wiki/Big_Bear_Lake).[[16]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-WaterQuality-15) Only one, Lake Elsinore, is naturally formed.[[16]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-WaterQuality-15) The rest are all formed by dams constructed by county or state water agencies. As an example, Diamond Valley Lake is for the [California State Water Project](http://en.wikipedia.org/wiki/California_State_Water_Project).

However, the area that the river drains in Orange County downstream of Santiago Creek is extremely narrow,[[18]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-17) because of the diversion of its former Orange County drainage area to the Talbert and Huntington Beach flood control channels, which empty into the Pacific very near the mouth of the Santa Ana. Most of the Santa Ana through Orange County now functions as a conduit to carry runoff from upstream areas directly to the Pacific and drains very little area downstream of the Santiago Creek confluence. In fact, the original mouth of the river which drained eventually into the Pacific Ocean, was located at what is today the entrance to Newport harbor. Based on a U.S. Coastal Survey from 1878, Newport Bay was predominantly a river estuary with few open channels. The river flowed into the bay bringing with it heavy silt and making boating difficult. To eventually create Newport Harbor, sand that was deposited by the Santa Ana River had to be kept from choking the bay. In 1920, the Bitter Point Dam was built to divert the river away from the bay and on its current course to the ocean at Huntington Beach. Stone jetties were built to form the new river mouth. All of the Islands in Newport Harbor are the product of dredging and man made forming from the sands and silt deposited over time by the Santa Ana River. [[21]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-20)

Hundreds of species of animals and plants characterize the Santa Ana River's diversity of climates and vegetation zones. There are over ten of these vegetation zones in the watershed—including the sparsely vegetated [alpine](http://en.wikipedia.org/wiki/Alpine_climate) and [subalpine zones](http://en.wikipedia.org/wiki/Subalpine_zone) in the mountains, mid-elevation [forests](http://en.wikipedia.org/wiki/Forest) of [pine](http://en.wikipedia.org/wiki/Pine), [lodgepole](http://en.wikipedia.org/wiki/Lodgepole_pine) and [oak](http://en.wikipedia.org/wiki/Oak), [chaparral](http://en.wikipedia.org/wiki/Chaparral), [coastal sage scrub](http://en.wikipedia.org/wiki/Coastal_sage_scrub), the increasingly rare [riparian forest](http://en.wikipedia.org/wiki/Riparian_zone) and [marshes](http://en.wikipedia.org/wiki/Marsh) along the river bed, lined with trees and rushes, and the thinly vegetated coastal areas virtually flush with [sea level](http://en.wikipedia.org/wiki/Sea_level). The watershed supports up to 200 [bird](http://en.wikipedia.org/wiki/Bird) species, fifty [mammal](http://en.wikipedia.org/wiki/Mammal) species, 13 [reptile](http://en.wikipedia.org/wiki/Reptile) species, 7 [amphibian](http://en.wikipedia.org/wiki/Amphibian) species, and 15 [fish](http://en.wikipedia.org/wiki/Fish) species, including [steelhead trout](http://en.wikipedia.org/wiki/Steelhead_trout).[[27]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-26)

The largest portion of the watershed, the Inland Empire portion, is dominated by a hot, dry [desert](http://en.wikipedia.org/wiki/Desert) climate that supports little wildlife, while the climate and vegetation of the [San Jacinto River](http://en.wikipedia.org/wiki/San_Jacinto_River_%28California%29) and [Temescal Creek](http://en.wikipedia.org/wiki/Temescal_Creek_%28Riverside_County%29) watershed is similar to that of the southern [Central Valley](http://en.wikipedia.org/wiki/Central_Valley_%28California%29).[[28]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-CDS4-27) Downstream of the desert was once the [coastal sage scrub](http://en.wikipedia.org/wiki/Coastal_sage_scrub) and dry [grassland](http://en.wikipedia.org/wiki/Grassland) community of the Orange County coastal plain, but that region has been almost entirely lost to urbanization. Rimming the arid portions of the watershed are the [chaparral](http://en.wikipedia.org/wiki/Chaparral) zones, consisting of [sclerophyllous](http://en.wikipedia.org/wiki/Sclerophyll), thick, low bushes and small trees. The chaparral generally is found between elevations of 1,000 feet (300 m) and 6,500 feet (2,000 m), and occurs mainly closer to the coast on the windward side of the Peninsular Ranges. The [scrub oak](http://en.wikipedia.org/wiki/Scrub_oak) is one of the most common plants in chaparral regions, forming a dense groundcover that makes it difficult for humans and large animals such as [mountain lions](http://en.wikipedia.org/wiki/Mountain_lion), [coyotes](http://en.wikipedia.org/wiki/Coyote), and [bobcats](http://en.wikipedia.org/wiki/Bobcat) to traverse.[[29]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-28) Chaparral growth is determined by [wildfires](http://en.wikipedia.org/wiki/Wildfire) and droughts, and depends on the semi-arid climate of the region.[[30]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-29)

Perennial and seasonal streams often are lined with [live oak](http://en.wikipedia.org/wiki/Live_oak) and [sycamore](http://en.wikipedia.org/wiki/Sycamore), which transition into the riparian zones of the main stem Santa Ana River. The inland riparian marshes upstream of the Riverside/Orange County line, although degraded by pollution, have otherwise been mostly left in their natural state.[[31]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-30) Although much of the riparian system along the river has been degraded, one of the largest places where it occurs is the enormous marsh behind [Prado Dam](http://en.wikipedia.org/wiki/Prado_Dam), an area closed to development because it functions as a flood control basin, similar to the [Sepulveda Dam](http://en.wikipedia.org/wiki/Sepulveda_Dam). The [Santa Ana sucker](http://en.wikipedia.org/wiki/Santa_Ana_sucker), a small bottom-dwelling fish, once was found throughout riparian zones, but now is rarely seen in the Santa Ana River drainage.[[32]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-EndangeredSpecies-31) Near the mouth, the river was once abundant in [salt marshes](http://en.wikipedia.org/wiki/Salt_marsh), which stretched for miles on either side of the river, even near [Upper Newport Bay](http://en.wikipedia.org/wiki/Upper_Newport_Bay), which has also served as an alternate mouth of the river.[[28]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-CDS4-27)

The alpine and subalpine zones, despite their high elevation (above 9500 feet, 2900 meters) and significant rainfall (up to 35 inches, 89 cm per year), are sparsely vegetated. The windswept terrain of the alpine zone is primarily small brush and weeds, while trees—mostly small gnarled [pines](http://en.wikipedia.org/wiki/Pine) and [junipers](http://en.wikipedia.org/wiki/Juniper)—occur in canyons and shielded depressions in the subalpine zone. Inland elevations above 5,000 feet (1,500 m) support much denser forest. [Jeffrey pine](http://en.wikipedia.org/wiki/Jeffrey_pine), [ponderosa pine](http://en.wikipedia.org/wiki/Ponderosa_pine), [black oak](http://en.wikipedia.org/wiki/Quercus_kelloggii), [lodgepole pine](http://en.wikipedia.org/wiki/Lodgepole_pine), and willow constitute most of the forested lands. The mountain habitats of the watershed support many animals typical of Californian mountain regions, including [squirrels](http://en.wikipedia.org/wiki/Squirrel), [chipmunks](http://en.wikipedia.org/wiki/Chipmunk), [black bears](http://en.wikipedia.org/wiki/American_Black_Bear), [mule deer](http://en.wikipedia.org/wiki/Mule_deer), and many species of migratory birds.[[33]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-32) In the canyons of the San Bernardinos, the river is abundant in landlocked [rainbow trout](http://en.wikipedia.org/wiki/Rainbow_trout) and is lined with [alders](http://en.wikipedia.org/wiki/Alder), willow and cottonwoods.[[34]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-33) Where the river and its large upper tributaries empty out of the mountain canyons into the Inland Empire basin, they are surrounded by the alluvial scrub zone, a mix of desert and upper riparian vegetation. Along the main stem, this zone begins at the base of [Seven Oaks Dam](http://en.wikipedia.org/wiki/Seven_Oaks_Dam) and ends at the [Lytle Creek](http://en.wikipedia.org/wiki/Lytle_Creek_%28California%29) confluence.[[28]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-CDS4-27)

Historically, the Santa Ana was named "the best stream in Southern California [for steelhead trout habitat]".[[35]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-CEMARsteelhead-34) The steelhead is an [anadromous fish](http://en.wikipedia.org/wiki/Anadromous_fish), similar to [salmon](http://en.wikipedia.org/wiki/Salmon), that migrates up rivers and streams to spawn. Unlike salmon, which usually only reproduce once, steelhead may reproduce multiple times and have a much longer life span. Steelhead was once found along the entire main stem of the Santa Ana River, as well as on some of its main tributaries—[Santiago Creek](http://en.wikipedia.org/wiki/Santiago_Creek), San Antonio and Chino Creeks, Cucamonga Creek, [Lytle Creek](http://en.wikipedia.org/wiki/Lytle_Creek_%28California%29), City Creek, and [Mill Creek](http://en.wikipedia.org/wiki/Mill_Creek_%28Southern_California%29). Few, if any, steelhead were present in Temescal Creek (although one of its tributaries was stocked in the 1930s[[35]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-CEMARsteelhead-34)) and none inhabited the [San Jacinto River](http://en.wikipedia.org/wiki/San_Jacinto_River_%28California%29), because it is disconnected from most of the Santa Ana River system.[[10]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-SteelheadMap-9) Up to the 1950s, significant numbers of steelhead trout still migrated in from the ocean.[[35]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-CEMARsteelhead-34) Because of pollution and modifications to the river, very few steelhead still use the river.[[36]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-35) The exception is the presence of landlocked rainbow trout—the freshwater phase of steelhead—upstream of Seven Oaks Dam and in the upper reaches of a few tributaries.[[35]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-CEMARsteelhead-34) Despite the rarity of steelhead, in recent years fin samples from 13 trout were collected from Harding Canyon in the [Santiago Creek](http://en.wikipedia.org/wiki/Santiago_Creek) tributary of the Santa Ana River and genetic analysis has shown them to be of native and not hatchery stocks.[[37]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-Clemento-36)

Invasive species—those that are not native to the region—have caused problems in the watershed for many years. One of the most troublesome invasive species is the [giant reed](http://en.wikipedia.org/wiki/Giant_reed), which plagues many coastal Southern California waterways. The giant reed is similar to a tall grass or thin [bamboo](http://en.wikipedia.org/wiki/Bamboo), but grows quickly and can take over native stands of vegetation, block the streambed, hurts the habitat of native animals, and increases the hazard of [wildfires](http://en.wikipedia.org/wiki/Wildfire).[[38]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-Arundo-37) Perhaps the largest effect that giant reed has is its usage of water. To supplement its fast growth growth rate, the giant reed population in the Santa Ana River watershed can consume 56,200 acre feet (69,300,000 m3) of water per year.[[38]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-Arundo-37)[[39]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-38)

Other invasive species also have affected the Santa Ana River. One of the most prominent is the [brown-headed cowbird](http://en.wikipedia.org/wiki/Brown-headed_cowbird), which feeds off parasites and insects identified with [cattle](http://en.wikipedia.org/wiki/Cattle), which were brought to Southern California during the Spanish Rancho period. The brown-headed cowbird is a "brood parasite", or a bird that lays its eggs in another bird's nest. One of the most afflicted birds is the [Least Bell's Vireo](http://en.wikipedia.org/wiki/Least_Bell%27s_Vireo), whose population also suffers from the loss of riparian habitat. The Least Bell's Vireo is considered an endangered species, as is the [southwestern willow flycatcher](http://en.wikipedia.org/wiki/Empidonax), whose habitat is often shared with the other bird.[[32]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-EndangeredSpecies-31) The [saltcedar](http://en.wikipedia.org/wiki/Saltcedar) is another invasive large weed that also, like the giant reed, uses large amounts of water. Unlike giant reed, the saltcedar has deeper roots, not only making it more difficult to remove but allowing it to access and use up deep [groundwater](http://en.wikipedia.org/wiki/Groundwater). However, the saltcedar is similar in that it also provides little usable habitat for native animals.

### Pollution and restoration

As with many Southern California rivers, the Santa Ana is heavily polluted and used. The main stem above [Seven Oaks Dam](http://en.wikipedia.org/wiki/Seven_Oaks_Dam) is free flowing, as are many of its upper tributaries. Once the river enters the Inland Empire basin, however, much of its flow is diverted for [municipal](http://en.wikipedia.org/wiki/Municipal) and [agricultural](http://en.wikipedia.org/wiki/Agricultural) water use. Most of the flow in the river below the city of San Bernardino consists of effluent from 45 [wastewater treatment plants](http://en.wikipedia.org/wiki/Sewage_treatment) and dry season [urban runoff](http://en.wikipedia.org/wiki/Urban_runoff), which is collected behind [Prado Dam](http://en.wikipedia.org/wiki/Prado_Dam).[[63]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-ED1-62) Any flow that makes it downstream to Orange County is diverted by another pair of dams into approximately 1,100 acres (4.5 km2) of [groundwater](http://en.wikipedia.org/wiki/Groundwater) recharge basins, providing approximately 218,000 acre feet (269,000,000 m3) of municipal water for the county every year, or one-third of its water supply.[[64]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-63) Downstream of that dam, the river gathers further urban runoff before finally making it into the Pacific.[[16]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-WaterQuality-15) The Santa Ana River is included on the [U.S. Environmental Protection Agency](http://en.wikipedia.org/wiki/U.S._Environmental_Protection_Agency)'s (EPA) list of "304 (l) 'toxic hot spots' list of impaired waterways."[[63]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-ED1-62)

A number of organizations have been formed to try and gain public interest in restoring the river. One of the most prominent is the Santa Ana Watershed Project Authority (SAWPA), formed by five municipal water districts in the Santa Ana River area. A second one is the Santa Ana River Dischargers Association. Both have conducted studies as to what beneficial uses the Santa Ana River would have aside from water supply and flood control, as well as the removal of some of the concreted sections of the lower river. This set of studies is known as the "Use-Attainability Analysis", which was submitted to the state Congress, which approved it. However, upon submission to the EPA, it was rejected. As a result, little work has been done to repair the ecological damage that has been caused by urbanization along the river.[[65]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-NRC103-64) Other projects include the Santa Ana Watershed Planning Advisory Committee,[[65]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-NRC103-64) and the Santa Ana River Watershed Alliance (SARWA).[[66]](http://en.wikipedia.org/wiki/Santa_Ana_River#cite_note-65)

