

7 *Colorado Desert Region*

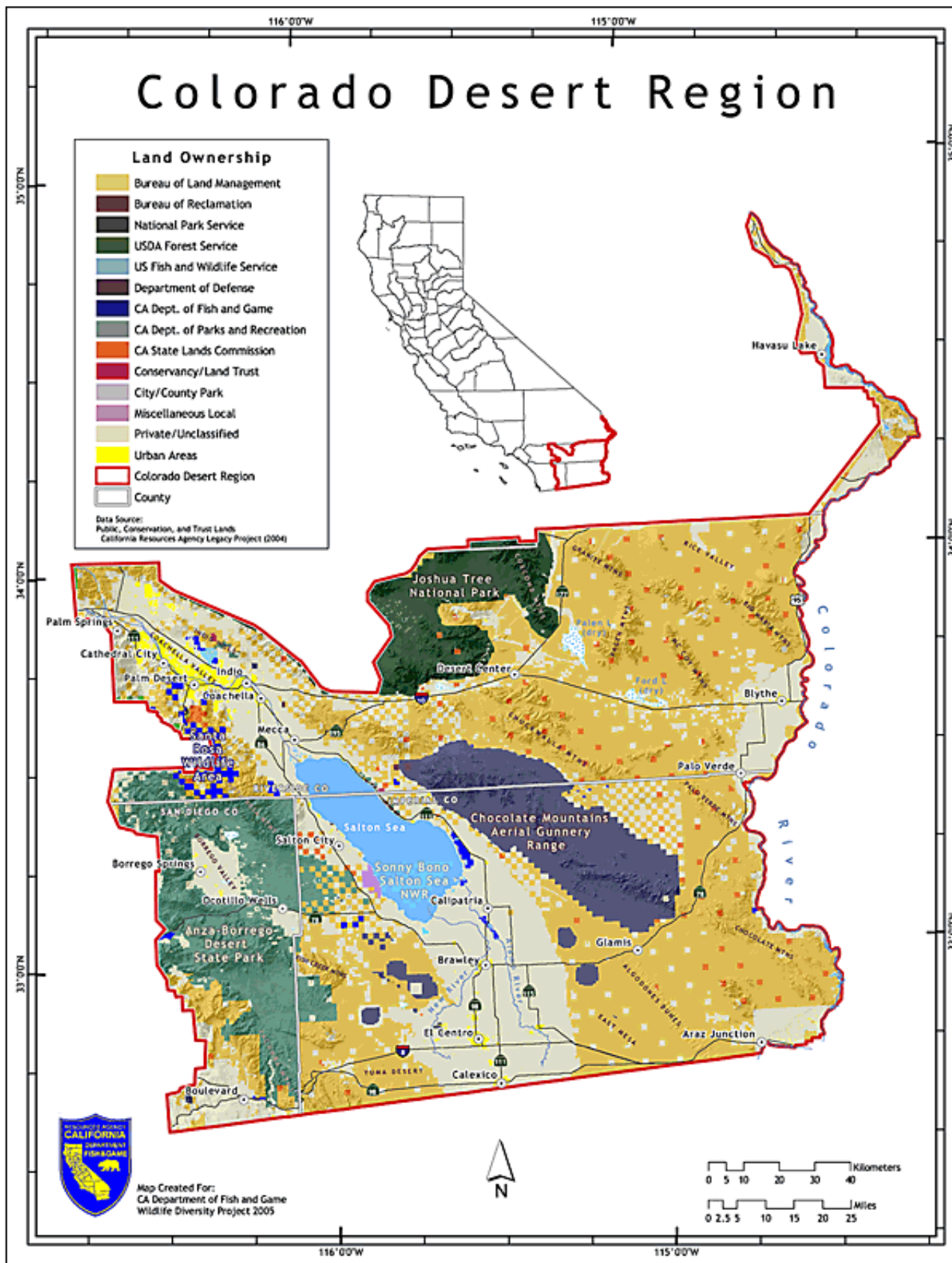
I. Overview

California's Colorado Desert is a part of the larger Sonoran Desert, which extends across southwest North America. The Colorado Desert region encompasses approximately 7 million acres, reaching from the Mexican border in the south to the higher-elevation Mojave Desert in the north and from the Colorado River in the east to the Peninsular mountain range in the west.

The majority of the Colorado Desert lies at a relatively low elevation, below 1,000 feet, with the lowest point of the desert floor at 275 feet below sea level in the Salton Trough. Although the highest peaks of the Peninsular Range reach elevations of nearly 10,000 feet, most of the region's mountains do not exceed 3,000 feet. These ranges block moist coastal air and rains, producing an arid climate.

The Colorado Desert's climate distinguishes it from other deserts. The region experiences greater summer daytime temperatures than higher-elevation deserts and almost never experiences frost. In addition, the Colorado Desert, especially toward the southern portion of the region, experiences two rainy seasons per year, in the winter and late summer, while the more northerly Mojave Desert has only winter rains.

The region's terrestrial habitats include creosote bush scrub; mixed scrub, including yucca and cholla cactus; desert saltbush; sandy soil grasslands; and desert dunes. Higher elevations are dominated by pinyon pine and California juniper, with areas of manzanita and Coulter pine. In addition to hardy perennials, more than half of the desert's plant species are herbaceous annuals, and appropriately timed winter rains produce abundant early spring wildflowers. In the southern portion of the region,



the additional moisture supplied by summer rainfall fosters the germination of summer annual plants and supports smoketree, ironwood, and palo verde trees. Common desert wildlife include mule deer, bobcat, desert kangaroo rat, cactus mouse, black-tailed jackrabbit, Gambel's quail, and red-diamond rattlesnake. Among **sensitive species** are flat-tailed horned lizard, Coachella Valley fringe-toed lizard, desert tortoise, prairie falcon, Andrews' dune scarab beetle, Peninsular bighorn sheep, and California leaf-nosed bat.

In the Colorado Desert's arid environment, aquatic and wetland habitats are limited in extent but are critically important to wildlife. Runoff from seasonal rains and groundwater springs forms canyon-mouth-associated alluvial fans, desert arroyos, desert fan palm oases, freshwater marshes, brine lakes, desert washes, ephemeral and perennial streams, and riparian vegetation communities dominated by cottonwood, willow, and non-native tamarisk. Two of the region's most significant aquatic systems are the Salton Sea and the Colorado River.

While most desert wildlife depend on aquatic habitats as water sources, a number of species, such as arroyo toad, desert pupfish, Yuma clapper rail, and southwestern willow flycatcher, are restricted to these habitats. In some places, summer rains produce short-lived seasonal pools that host uncommon species like Couch's spadefoot toad.

Desert fan palm oases are rare ecological communities found only in the Colorado Desert. They occur only where permanent water sources are available, such as at springs or along fault lines, where groundwater is forced to the surface by the movement of hard impermeable rock (NPS 2002), and can be found in the San Jacinto, Santa Rosa, and Little San Bernardino mountains, Indio and Mecca-Orocopia hills, and in the canyons of Anza Borrego Desert State Park. With an **overstory** of desert fan palm trees, these communities provide unique islands of shade, moisture, and vegetation in an otherwise arid and sparse landscape. Fan palm oases host species found nowhere else in the desert, like the two-inch, blue-black, giant palm-boring beetle, which is **endemic** to this community, and the Western yellow bat, which is strongly associated with this habitat. The oases also allow a number of other species that are normally found in more **mesic** coastal and forest environments to live in the desert, including California mountain king snake, gopher snake, Western screech-owl, bobcat, and hooded oriole (Barrows 2005 pers. comm.).

The Bureau of Land Management (BLM) is the Colorado Desert region's largest land manager, with about 2.9 million acres, or 43.1 percent of the region. Department of Defense lands account for about 500,000 acres, or 7 percent, of the region. A number of other public landholdings occur around the Salton Sea, with the California Department of Parks and Recreation, the Department of Fish and Game, and the U.S. Fish and Wildlife Service managing lands along and under the sea. Joshua Tree National Park spans the transition from the Mojave to the Colorado Desert, with slightly less than half the park, about 340,000 acres, in the Colorado Desert. Anza Borrego Desert State Park encompasses over 600,000 acres, or nearly 9 percent, of the region, and the Santa Rosa Wildlife Area, which

includes Fish and Game, State Lands Commission, and BLM lands, encompasses about 100,000 acres. Together, Joshua Tree National Park, Anza Borrego Desert State Park, and the Santa Rosa Wildlife Area, along with other protected lands in the Mojave Desert, are part of the Mojave and Colorado Deserts Biosphere Reserve, designated by the United Nations as an important global site for preservation of the biological and cultural resources of these two desert regions.

Although the Colorado Desert remains one of the least-populous regions in California, human activities have had substantial impacts on the region's habitats and wildlife. Many unique communities, particularly aquatic and dune systems, are limited in distribution and separated by vast expanses of inhospitable, arid desert terrain. Even limited human disturbances can have markedly deleterious effects on the endemic and sensitive species supported by these unique regional systems.

Some of the greatest human-caused effects on the region have resulted from the water diversions and flood control measures along the Colorado River. These measures have dramatically altered the region's hydrology by redistributing the region's water supply to large expanses of irrigated agriculture and metropolitan coastal areas. The once-dynamic Salton Sea and Colorado River ecosystems are now controlled by human water management. Because of the scarcity of water resources in the desert environment, these alterations have had substantial impacts on regional wildlife and habitats. In addition, portions of the region are experiencing substantial growth and development pressures, most notably the Coachella Valley.

2. Species at Risk

The Plan development team updated vertebrate and invertebrate species information in the California Natural Diversity Database (CNDDDB) during 2004–2005. The following regional summary of numbers of wildlife species, endemic species, and **species at risk** is derived from the updated CNDDDB.

The diverse wildlife inhabiting the Colorado Desert include many species specially adapted to the unique desert habitats. There are 481 vertebrate species that inhabit the Colorado Desert region at some point in their life cycle, including 282 birds, 82 mammals, 66 reptiles, 16 amphibians, and 35 fish. Of the total vertebrate species that inhabit this region, 84 bird **taxa**, 34 mammalian taxa, 21 reptilian taxa, five amphibian taxa, and four fish taxa are included on the **Special Animals List**. Of these, four are endemic to the Colorado Desert region, and four other species found here are endemic to California but not restricted to this region (Table 8.1).

Table 8.1: Endemic Special Status Vertebrates of the Colorado Desert Region

	<i>Anniella pulchra pulchra</i>	Silvery legless lizard
*	<i>Batrachoseps major aridus</i>	Desert slender salamander
	<i>Lampropeltis zonata</i>	California mountain kingsnake (San Diego population)
	<i>Ovis canadensis nelsoni dps</i>	Peninsular bighorn sheep
*	<i>Perognathus longimembris bangsi</i>	Palm Springs pocket mouse
	<i>Spermophilus tereticaudus chlorus</i>	Palm Springs round-tailed ground squirrel
*	<i>Uma inornata</i>	Coachella Valley fringe-toed lizard
*	<i>Xantusia gracilis</i>	Sandstone night lizard
* denotes taxon is endemic to region		

The number of arthropod species is so great, and they are so poorly known taxonomically, that it is presently impossible to accurately estimate the total number of invertebrate species occurring in the state. In the Colorado Desert region, however, 15 invertebrate taxa are included on the Special Animals List, including 12 arthropod taxa and three mollusk taxa. Of these, eight are endemic to the Colorado Desert region, and five other taxa found here are endemic to California but not restricted to this region (Table 8.2).

Table 8.2: Endemic Special Status Invertebrates of the Colorado Desert Region

*	<i>Anomala carlsoni</i>	Carlson's dune beetle
*	<i>Anomala hardyorum</i>	Hardys' dune beetle
	<i>Calileptoneta oasa</i>	A leptonetid spider; no common name
*	<i>Ceratochrysis bradleyi</i>	Bradley's chrysidid wasp
*	<i>Dinacoma caseyi</i>	Casey's june beetle
*	<i>Eremarionta immaculata</i>	White desertsnailed
	<i>Eremarionta morongoana</i>	Morongo (=Colorado) desertsnailed
*	<i>Eremarionta rowelli mccoiana</i>	California McCoy snail
*	<i>Hedychridium argenteum</i>	A chrysidid wasp; no common name
	<i>Macrobaenetes valgum</i>	Coachella giant sand treader cricket
	<i>Parnopes borregoensis</i>	A chrysidid wasp; no common name
*	<i>Pseudocotalpa andrewsi</i>	Andrews' dune scarab beetle
	<i>Stenopelmatus cahuilansensis</i>	Coachella Valley Jerusalem cricket
* denotes taxon is endemic to region		

The Wildlife Species Matrix, including data on listing status, habitat association, and population trend for each vertebrate and invertebrate species included on the Special Animals List, is available on the Web at http://www.dfg.ca.gov/habitats/wdp/matrix_search.asp. For vertebrates, the matrix also

includes links to species-level range maps. Additionally, a link to the California Department of Fish and Game's online Field Survey Form is available to assist in reporting positive sightings of species on the Special Animals List to the California Natural Diversity Database (CNDDDB).

Two Species at Risk

Note: *The following discussion of two species at risk illustrates how stressors or threats affect species and highlights conservation challenges and opportunities. These species discussions are not intended to imply that conservation should have a single-species approach.*

Of the region's species at risk, many are dependent on habitats that have limited distribution. Threats from population growth and development are particularly acute for species that depend on restricted habitats, such as Peninsular bighorn sheep. The populations of many species associated with regional aquatic and wetland habitats have declined due to loss and alteration of these habitats. A number of species have also become dependent on habitats created by use and transport of water for irrigated agriculture. Desert pupfish, once widely distributed in the Colorado Basin but now restricted to a handful of locations associated with the Salton Sea, exemplify this pattern.

Peninsular Bighorn Sheep

Restricted to the Peninsular mountain ranges, Peninsular bighorn sheep are a distinct segment of the larger bighorn sheep population. They inhabit dry, rocky, low-elevation desert slopes, canyons, and alluvial fans from the San Jacinto and Santa Rosa Mountains near Palm Springs south into Baja California (CDFG 2005b).

Surveys in the early 1970s showed a population already limited by disease transmitted from livestock and domestic sheep. The highest recorded population estimate was 1,171 sheep in 1974 (CVAG 2004). Peninsular bighorn sheep were listed as threatened by the state in 1971 and as an endangered population segment under the federal Endangered Species Act in 1998. Between the 1970s and 2000, numbers steadily declined as a result of habitat loss and degradation, disease, and predation.

Connectivity between habitat areas is crucial for the long-term survival of Peninsular bighorn sheep. Bighorn sheep must be able to move on a daily and seasonal basis to make use of the limited water and sparse plant forage found in this dry desert environment. Additionally, they need to be able to move between subpopulations (or ewe groups) to allow genetic exchange and maintain a healthy population structure. Habitat fragmentation can result in genetic isolation and restrict the species' ability to recolonize if population numbers decline (Boyce 2005 pers. comm., USFWS 2000c).

Urban encroachment on Peninsular bighorn sheep habitat is particularly severe in the northern portion of their range. Residential and resort developments are expanding westward from the urban centers around Palm Springs into canyon mouths and up the lower mountain slopes of the San Jacinto

and Santa Rosa mountains. Besides habitat loss and fragmentation, bighorn sheep face numerous hazards at the urban-wildland interface. They have been poisoned by toxic ornamental plants, exposed to toxic pesticides and herbicides, drowned in swimming pools and concrete-lined agricultural canals, entangled in fences, harassed by domestic dogs, and killed on roads. A six-year study of sheep in the Coachella Valley area showed that urbanization accounted for 34 percent of adult bighorn mortalities (CDFG 2005b).

Degradation of habitat quality is also an issue for Peninsular bighorn sheep. Critical watering sources are threatened by human recreation, water development, and the spread of invasive plants. Human recreational use can discourage sheep from accessing watering areas around seeps and springs. Tamarisk, a non-native shrub, invades springs and consumes groundwater before it reaches the surface. Groundwater pumping for orchards, particularly near the northwestern corner of Anza Borrego State Park, also threatens the availability of spring water (Boyce 2005 pers. comm.).

In the 1990s, predation by mountain lions was found to be a major factor contributing to Peninsular bighorn sheep mortality. Although a healthy bighorn population can withstand predation, a population already reduced to low numbers can be substantially diminished (CDFG 2005b). Land management practices and resulting habitat alterations may be contributing to unusually high rates of mountain lion predation. Fire suppression results in thicker, brushier vegetation, which may make it more difficult for bighorn sheep to detect and avoid lions and may affect the distribution of lion's preferred prey, mule deer (Boyce 2005 pers. comm.).

In 2000, a federal recovery plan for Peninsular bighorn sheep was completed. The plan's primary provisions include protection of an adequate habitat base, effective management of conserved lands, establishment of adequate buffering zones along the urban interface, and prudent management of human activity within bighorn range. The Peninsular Bighorn Sheep Recovery Team—including representatives from the University of California, Fish and Game, and the Bureau of Land Management—advises the U.S. Fish and Wildlife Service on plan implementation. Efforts to protect bighorn sheep habitat and prevent conflicts between bighorns and humans have been instituted. For example, land acquisitions at the wildland-urban interface have allowed for the construction of barrier fencing along roadways to prevent road kill and limit bighorn sheep exposure to urban hazards (CDFG 2005b).

Monitoring indicates that these conservation efforts may be benefiting the sheep population. In 1994, the number of bighorn sheep in the Peninsular Ranges was estimated at 360 adults. Subsequent surveys have suggested an upward population trend. In 2002, the total number of sheep occupying the Peninsular Ranges was estimated to be 670. In 2003, the status of Peninsular bighorn sheep was characterized as increasing (CDFG 2005b).

Nonetheless, threats from disease outbreaks, predation, habitat loss, and recreational disturbance remain substantial. Ongoing habitat protection and management, as well as long-term monitoring to

provide information on sheep ecology—including the relationship between fire, vegetation communities, and predator-prey interactions; disease exposure; survival rates and causes of death; and the levels and effects of human recreation in sheep habitat—are needed to achieve conservation goals.

Desert Pupfish

Historically, desert pupfish occurred in the main channel of the lower Colorado River and in the backwaters and sloughs along the river from Needles downstream through the river delta habitats. Pupfish were also distributed through springs, seeps, and slow-moving streams of the Salton Basin (USFWS 1993a).

Pupfish require shallow, slow-moving, clear water with a moderate amount of aquatic vegetation and soft substrate. They are, however, well adapted to systems with cyclical flooding and drying, such as those that historically occurred in the Colorado River system, and can tolerate temperature extremes, high salinity, low oxygen levels, and desiccation of their eggs. In spite of this hardiness, desert pupfish have disappeared from much of their former range. In the Colorado Desert, pupfish occur only in two desert creeks that drain into the Salton Sea (Salt Creek and San Felipe Creek, with its associated San Sebastian marshlands), in shoreline pool habitats and irrigation canals along the Salton Sea, and in artificial **refugia**. Along the Colorado River, dams, water diversions, and channelization have sufficiently altered flow, temperature, and water quality to eliminate pupfish habitat. Many of the backwater channels they inhabited have been destroyed or are now inhabited by introduced predatory fish species (CDFG 2005b, USFWS 1993a).

Pupfish move along the edges of the Salton Sea between shoreline pools, agricultural drains, and creek habitats associated with the sea. This connectivity between populations maintains genetic diversity and allows for repopulation of areas where pupfish may be temporarily eliminated by changing environmental conditions. Biologists currently working on a regional habitat conservation plan note that it will be important to find ways to maintain this connectivity if changing water levels or salt concentrations restrict pupfish use of the Salton Sea (Crayon 2005 pers. comm.). Desert pupfish were listed as endangered by the state of California in 1980, and they were federally listed as endangered in 1987. The U.S. Fish and Wildlife Service issued a recovery plan in 1993. Its primary recovery measures include protection of existing populations; establishment of new populations through introductions into the best available unoccupied natural habitats; and establishment of refugia populations in artificial or semi-natural pools and ponds.

3. Stressors Affecting Wildlife and Habitats

- Water management conflicts and water transfer effects
- Inappropriate off-road vehicle use

- Loss and degradation of dune habitats
- Growth and development
- Invasive species

Water Management Conflicts and Water Transfer Impacts

The primary threats to aquatic habitats are the diversion of Colorado River water and the modification of its habitats, the decline of the Salton Sea, and the conversion or alteration of agricultural lands and canals.

Alteration of Colorado River Habitats

Water is a limited and precious resource in the arid Colorado Desert. The Colorado River is the region's largest perennial waterway, with aquatic species inhabiting the river's main stem and backwaters. Numerous bird species and other wildlife are dependent on the Colorado River riparian areas and the river delta at the Sea of Cortez.

The diversion of the Colorado River for agricultural and urban water uses substantially affects the region's wildlife and ecosystems. Urban demands for water are increasing. Locally, rapid urbanization in the Coachella Valley is increasing water-supply needs. Meanwhile, water districts of Southern California are ready to buy any available surplus irrigation water from the region.

More than a dozen large dams control, store, divert, and allow for the consumptive use of nearly all the water in the Colorado River (Pitt 2001). These dams, as well as channelization, flood control structures, and flow regulation practices have drastically altered the river's flows and sediment transport processes (Briggs and Cornelius 1998). Flows are much reduced and have less variation (Busch and Smith 1995, Cohen and Henges-Jeck 2001). The delta wetlands at the Sea of Cortez have been reduced to about one-tenth of their original 2 million acres (Pitt 2001). Additionally, water is not available to recharge the groundwater table. In many locations, groundwater levels in riparian areas along the Colorado River have receded from historical levels of less than 3 feet to more than 10 feet below the surface (Hayes 2004 pers. comm.).

Historically, sediment was deposited at the river delta or along the river's banks by flood events, creating deep floodplain soils (Busch and Smith 1995, Poff et al. 1997). Over-bank flooding also flushed the soils of built-up salts, creating more favorable conditions for vegetation. Today, however, sediment transport is blocked by dams, and natural flooding is prevented along most of the river's length.

This groundwater decline and decreased flooding have stressed native riparian cottonwood and willow habitat, favoring the establishment of invasive tamarisk, which can withstand drier conditions and saltier soils (Briggs and Cornelius 1998, Poff et al. 1997). Tamarisk provides inferior wildlife habitat compared to native vegetation and now dominates the Colorado River's riparian areas.

Decline of the Salton Sea

The Salton Sea is the most recent of a series of inland lakes that have historically occupied the Salton Basin. Sustained today by agricultural drainage water, the Salton Sea can be considered neither a natural nor an entirely artificial ecosystem. (See Conditions in the Salton Sea at the end of this chapter.) It is clear, however, that the sea provides critical resources for the region's wildlife, particularly for a great diversity of birdlife. More than 400 bird species have been recorded in the Salton Sea area, including approximately 100 locally breeding species.

The sea's importance stems from its status as the major remaining aquatic habitat of inland Southern California, from its location on the Pacific Flyway, and from the diverse array of habitat types it provides. The sea provides adjacent freshwater marshes and mud flats and offers deep waters that sustain fish populations and support fish-eating birds. The sea's proximity to the Imperial Valley's canals and fields creates a landscape mosaic uniquely able to fulfill multiple habitat requirements for nesting, foraging, and breeding.

The Salton Sea is vital to migratory, wintering, and breeding waterbirds (Shuford et al. 2002). Birds may number in the millions during the winter. In some years, eared grebe numbers alone have been as high as 3.5 million. Nineteen waterbirds of high conservation concern inhabit the sea, including brown pelican, American bittern, white-faced ibis, and ruddy duck. A significant portion of the North American populations of several sensitive species, including the eared grebe, American white pelican, and Yuma clapper rail, are supported by the sea. Threatened by a number of environmental problems, ranging from reduced freshwater inflows and increasing salinity to eutrophication, avian disease outbreaks, and the presence of toxic contaminants, the sea's health is declining, and birds that rely on the sea are at risk.

The sea's decline prompted local agencies in 1993 to establish the Salton Sea Authority (composed of Imperial Irrigation District, Coachella Valley Water District, Imperial County, Riverside County, and the Torres Martinez Tribe) to address both biological and economic recovery. Most recently, the state of California established a Salton Sea Restoration Fund and took on responsibility for selecting a method for its restoration.* At the federal level, the need to restore the sea was recognized with the enactment of the 1998 Salton Sea Reclamation Act, which charged the Department of the Interior and Bureau of Reclamation with responsibility for restoring the sea. Although both state and federal agencies recognize the importance of restoring the sea, they have not yet agreed on a plan for restoration that both agencies will support.

Aquatic and Terrestrial Habitats of Agricultural Lands

With the natural aquatic and wetland systems of the Colorado River dramatically altered and diminished, wildlife species in the region depend on the features of irrigated agricultural lands. The once-arid landscape is now transected by a network of water delivery and drainage canals. Imperial Valley's 475,000 irrigated acres and Coachella Valley's 75,000 acres receive 3.2 million acre feet of Colorado

*The state took on responsibility for the restoration of the Salton Sea through the passage in 2003 of SB 654. Along with SB 277 and 317, it requires the state to provide to the legislature by December 31, 2006, a preferred alternative for restoration of the Salton Sea and establishment of a Salton Sea Restoration Fund.)

River water annually (Cohn 2000, Cohen et al. 1999). Orchards and date palm plantations in the Coachella Valley and fields of cotton, alfalfa, Sudan grass, lettuce, sugar beets, onions, and melons in the Imperial Valley have replaced native desert communities. The New and Alamo rivers, created when the Colorado River formed the Salton Sea, are now fed principally by agricultural drainage water and provide isolated pools, marshlands, and mudflats used by shorebirds. The drains and canals used to transport water now support wetland vegetation communities and a number of sensitive species, including California black rail, Western burrowing owl, and desert pupfish. Agricultural fields also provide wintering habitat for mountain plover, long-billed curlew, and sandhill crane (Wunder and Knopf 2003).

Water Transfer Effects

In recent years, a number of regional agreements have been negotiated to transfer water from agricultural use to meet growing urban needs in other parts of the state. These water transfers will help the state to reduce its use of Colorado River water to its federal apportionment of 4.4 million acre-feet/year.

In 2003, the Quantification Settlement Agreement (QSA) and related agreements allowed the transfer of 300,000 acre-feet/year of Colorado River water from the Imperial Irrigation District to urban areas, primarily in coastal Southern California. The parties to these agreements included the Imperial Irrigation District, San Diego County Water Authority, the Metropolitan Water District of Southern California, U.S. Bureau of Reclamation, and the state of California. Ultimately, water conservation through irrigation efficiency measures and lining canals with concrete (to prevent water loss through seepage) will supply the water for the transfer. Initially, however, large-scale fallowing of agricultural fields will provide surplus water for transfer.

In addition to the water transfers covered by the QSA agreements, other changes in the management of Colorado River water are planned in California and in the lower Colorado River basin states. These changes include additional agriculture-to-urban water transfers, increased water-transport efficiency, and changes in diversion points and dam release schedules to meet water supply and power generation needs. The environmental effects of these changes will be addressed by the 2005 Lower Colorado River Multi-Species Conservation Program (Lower Colorado River Program). (The federal Lower Colorado Program allows changes in diversion points and dam release schedules on the Colorado River by water and power agencies in California, Arizona, and Nevada, as well as by the U.S. Bureau of Reclamation and sovereign Native American tribes. The program allows total water transfers of up to 1.574 million acre-feet of Colorado River water per year.) In California, the program will allow up to 800,000 acre-feet of Colorado River water to be transferred annually. These include transfers to urban areas, including some areas in Coachella Valley, from the Imperial Irrigation District, the Palo Verde Irrigation District, and the Bard Water District.*

* California's permittees under the Lower Colorado Program are the Bard Water District, City of Needles, Coachella Water District, Colorado River Board of California, Imperial Irrigation District, Palo Verde Irrigation District, San Diego County Water Authority, Southern California Public Power Authority, the Metropolitan Water District of Southern California, Southern California Edison Company, and the City of Los Angeles Department of Water and Power.

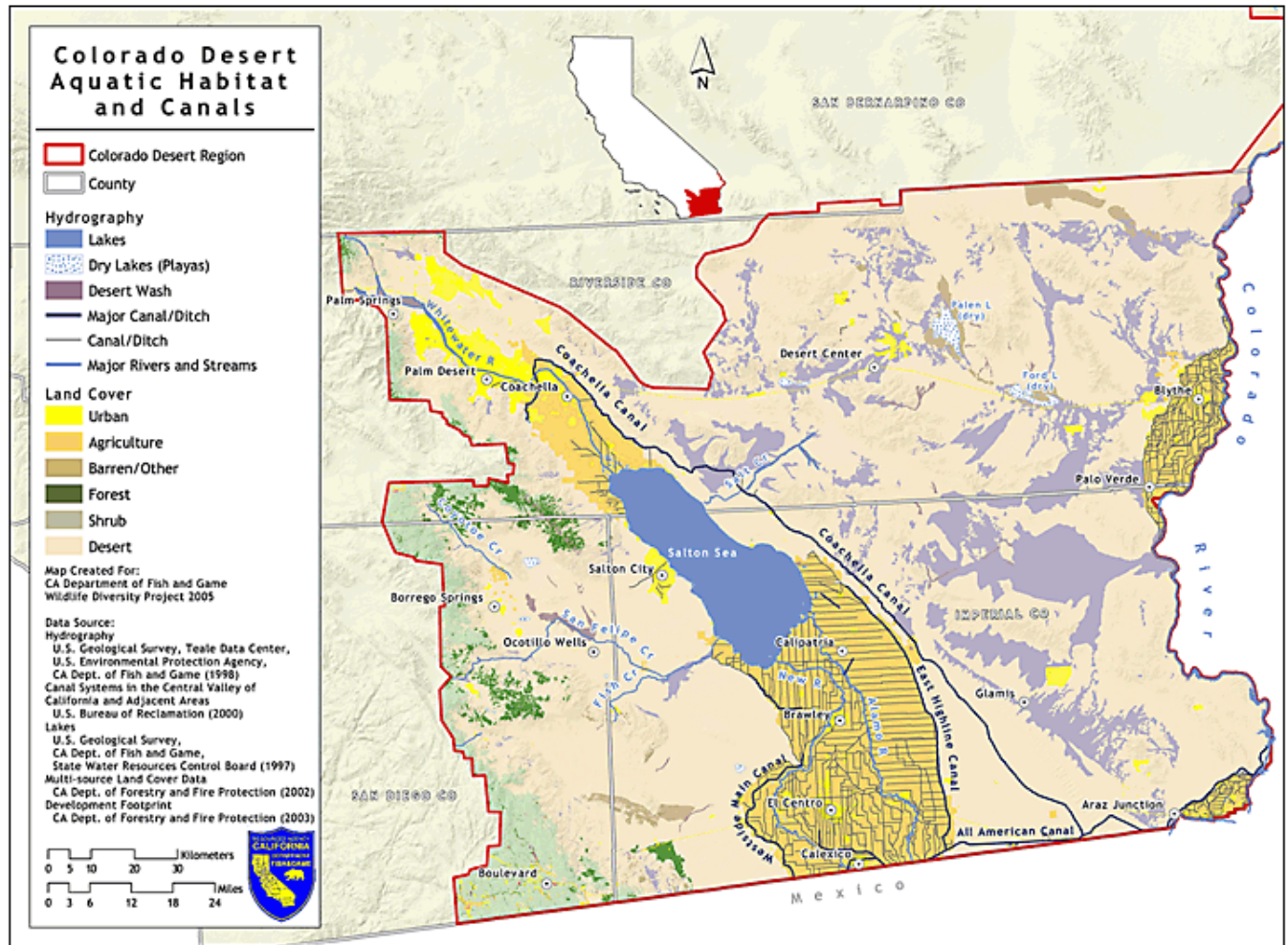


Fig. 8.1: Colorado Desert Aquatic Habitat and Canals

Water management activities have dramatically altered the region's aquatic and wetland habitats. Colorado River water is diverted to an extensive irrigation canal system, transforming large portions of the desert from arid landscapes to agricultural fields and orchards. Agricultural runoff water sustains the Salton Sea and the New and Alamo rivers.

If unmitigated, these water transfers would have substantial effects on the region's aquatic habitats and the wildlife species that depend on them. With less water applied to agricultural fields, less **tail-water** will flow through drains and be available to sustain the Salton Sea. Canal, drain, and irrigation-fed river habitats would be reduced. Lining canals with concrete will prevent groundwater recharge, reducing the amount of water that feeds seeps and springs as well as the Salton Sea. At the sea, lower water levels will affect shoreline habitat, and salinity will increase more rapidly with less incoming fresh water. Additionally, changes in water diversion points and in the timing of dam releases in the upper Colorado River basin will affect flows, habitats, and species in the lower Colorado River.

To address these effects, parties to the QSA and the Lower Colorado River Program committed to a number of conservation measures to mitigate for the water transfers. Permits issued in conjunction

with these agreements will allow for the **take** of protected species under the California and federal Endangered Species Acts that results from the water management activities covered by these agreements. The QSA also includes commitments to work toward restoration of the Salton Sea. (See the QSA and Lower Colorado River Program Commitments at the end of this chapter.)

Inappropriate off-road vehicle use

Off-road vehicles have the potential to harm both plants and animals directly, as well as to modify desert ecosystems, making them less habitable (Hall 1980). These vehicles may crush plants, cover them with soil, and expose their roots. They can also run over wildlife, collapse burrows, and damage seasonal pools. Soil compaction reduces water availability and affects plants' ability to root and germinate and animals' ability to burrow. Off-road vehicles may also carry in seeds of invasive plant species. Any of these alterations can have cascading effects on the larger community. Changes in vegetation composition also affect available habitats for invertebrates, thus changing the prey base for other desert wildlife. (The effects of off-road vehicle use on desert habitats are discussed in greater detail in Chapter 7, Mojave Desert Region.)

In the Colorado Desert region, some of the greatest levels of off-road vehicle use occur in sand dune habitats. As discussed below, these communities are particularly susceptible to degradation by heavy recreational use. Off-road vehicle use and trespass also has substantial effects on areas along the U.S.–Mexico border in Anza Borrego Desert State Park, and in stream beds and washes surrounding the Salton Sea.

Loss and Degradation of Dune Habitats

Desert sand dune ecosystems support some of the most diverse communities of plants and animals in the deserts of the southwestern United States. Although dune habitats account for only about 7 percent of California's desert landscape, many rare and sensitive species depend on these unique ecosystems.

Dunes are dynamic systems, dependent on movement of sand by wind and water. Active dune systems require sources of sand, as well as landscape features and corridors that allow sand transport and dune migration. Harsh, extreme conditions characterize dune environments, including frequent disturbance of the shifting sandy soils, low nutrients, hot and dry climates, limited water availability, and sparse vegetation for forage or cover.

The flora and fauna that live on dunes frequently have adaptations that enable them to survive in these unusual and challenging conditions. For example, many dune plants are covered with fine white hairs to protect against strong sun, and others have very small leaves to reduce the amount of water that evaporates through the leaves' pores. Fringe-toed lizard species have elongated scales ("fringes") on their hind feet that provide traction, a shovel-shaped head that facilitates burrowing, ear-covering scales to keep out sand, and an internal nostril structure to allow breathing below sand.

Functioning as isolated “sand-islands,” dune habitats foster the evolution of unique species. In California, there are three species of fringe-toed lizards (genus *Uma*), each restricted to a separate dune system: in the Algodones dunes, *Uma notata* (listed as a Fish and Game species of concern); in the Coachella Valley, *Uma inornata* (state listed as threatened, federally listed as endangered); and in the Mojave dunes, *Uma scoparia* (listed as a Fish and Game species of concern).

The three primary threats to desert dune systems are the disruption of sand source and sand transport processes, invasive plant species, and off-road vehicle use.

To ensure their continued existence, sand dunes need replenishing. Roads and buildings can cut dunes off from sand sources, blocking and fragmenting corridors for sand movement. Dunes also migrate, and construction and development can destroy their destinations along with their sources of sand. Residential development adjacent to dune areas is often followed by public demand to control naturally blowing sand, resulting in the construction of sand fences that prevent sand from moving through these areas.

Colonization by invasive plant species that either stabilize dunes with extensive root systems or block sand movement prevents natural migration and shifting. These invasives often spread from adjacent development or along road corridors. Principle species of concern include Russian thistle, Saharan mustard, annual grasses of the genus *Schismus*, and planted tamarisk.

Off-road vehicles are particularly problematic in dune environments because compaction can inhibit the sand movement that is vital to dune replenishment and migration. Sand compaction may also negatively affect fringe-toed lizards, which can only burrow in fine, loose sand.

In the Colorado Desert, the most significant dune systems are the Algodones Dunes, also known as Imperial Dunes (approximately 160,000 acres), the Superstition Hills, also known as West Mesa (approximately 100,000 acres), and the Coachella Valley dunes (once approximately 64,000 acres, with fewer than 8,000 acres remaining).

These dune systems face different threats, depending on land ownership, intended land use, and surrounding land uses. The Algodones Dunes and Superstition Hills are in remote areas without significant population or development pressures. Both areas are largely in federal ownership. BLM manages portions of both of these systems as off-road vehicle recreation areas. The use of these vehicles in the Superstition Hills, where less than 15 percent of the dunes is open to vehicles, is far less contentious than in the Algodones Dunes, where up to 85 percent of the dunes has historically been open to varying levels of vehicle use. The remaining Coachella Valley dunes are threatened by development that impedes natural sand movement and dune replenishment and by off-road-vehicle trespass on preserve lands.

It is critical for public land managers to find ways to provide opportunities for recreational access and off-road-vehicle use while adequately protecting biologically sensitive areas and important wildlife habitats.

Algodones Dunes

Stretching 40-plus miles northward from the U.S.–Mexico border, and ranging from 6 to 10 miles across, the Algodones Dunes are the United States' largest dune system. One hundred sixty plant and animal species inhabit the Algodones Dunes, many of which are rare or endemic. Sensitive wildlife include the flat-tailed horned lizard, Colorado Desert fringe-toed lizard, and Couch's spadefoot toad (all three of which are Fish and Game species of concern), and at least four endemic beetle species, including the Andrews' dune scarab beetle. Plants that are found only in active dune habitats include Algodones dunes sunflower, Wiggins' croton, giant Spanish needle, sand food, desert eriogonum, and Peirson's milkvetch, which is federally listed as threatened and occurs only in a band of habitat across the central portion of the Algodones dunes.

The North Algodones Dune Wilderness Area (approximately 30,000 acres) is off-limits to off-road vehicles. Additional protected acreage may be necessary to ensure the survival of the dunes' rare and endemic species. Some of the best habitat for these species is located in areas designated as open to vehicle use, and in recent years user numbers have reached more than 200,000 on peak weekends.

In 1998, BLM initiated a monitoring program to evaluate the effects of off-road vehicle use on six special-status plant species, including Peirson's milkvetch. The results showed that significant impacts occur around the vehicles' staging areas, with areas immediately surrounding staging areas almost entirely devoid of plant life. However, impacts decrease with distance away from these access points. At distances of 1 to 2 miles away from staging areas, trails are very limited, and populations of all the plant species persist (Knauf 2004 pers. comm.).

In 2000, a court settlement between nongovernmental conservation organizations and off-road vehicle advocacy groups resulted in interim closures of 19,000 additional acres (for a total of approximately 49,000 protected acres), leaving roughly half the dunes open to vehicle use. In 2003, BLM released a new management plan proposing to reopen many of the closed areas. BLM maintains that the plan will safeguard sensitive species populations through adaptive management, such as stipulations to limit vehicle use if visitation exceeds certain levels or if populations of Peirson's milkvetch drop below certain levels. The plan also includes monitoring of the fringe-toed lizard, flat-tailed horned lizard, bird species, and microphyll woodlands. In January 2005, the U.S. Fish and Wildlife Service issued a Biological Opinion approving the management plan, which will allow BLM to put the plan into effect and to lift the interim off-road-vehicle closures.

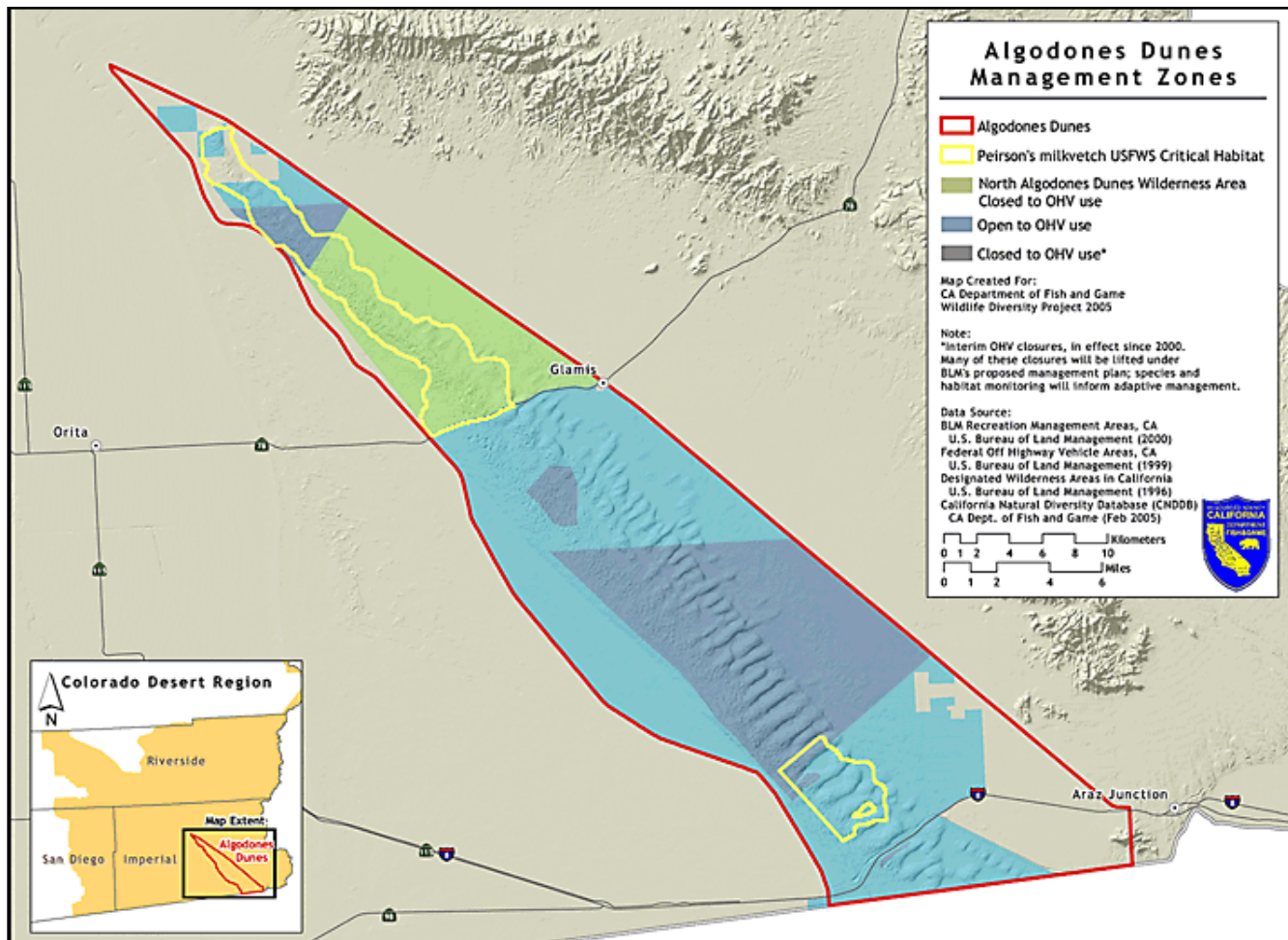


Fig. 7.2: Algodones Dunes

The Algodones Dunes harbor a number of endemic and sensitive species like Peirson's milkvetch. The North Algodones Dunes Wilderness Area is permanently closed to off-highway-vehicle use. A new BLM management plan for the dunes may repeal the additional closures instated in 2000 while concurrently instituting adaptive management measures to track off-highway-vehicle effects on sensitive dune species.

Coachella Valley Dunes

The primary threat to sand dune habitats in the Coachella Valley is the expansion of residential and resort development surrounding Palm Springs in the northwestern areas of the valley. The vital sand movement processes that keep dunes alive are increasingly blocked and fragmented. Currently, the majority of remaining viable dune habitat (which constitutes only between 5 percent and 10 percent of the dunes' original extent) is encompassed in a system of preserves owned by state and federal resources agencies. Some of these preserve lands are threatened by illegal off-road vehicle use.

One hundred eighty plant and animal species inhabit the Coachella Valley preserve. Sensitive wildlife that are endemic to the dunes include the Palm Springs pocket mouse and Coachella round-tailed ground squirrel (both of which are Fish and Game species of concern), Coachella giant sand treader cricket, Coachella Valley Jerusalem cricket, Barrows' dune beetle, giant red velvet mite, and the

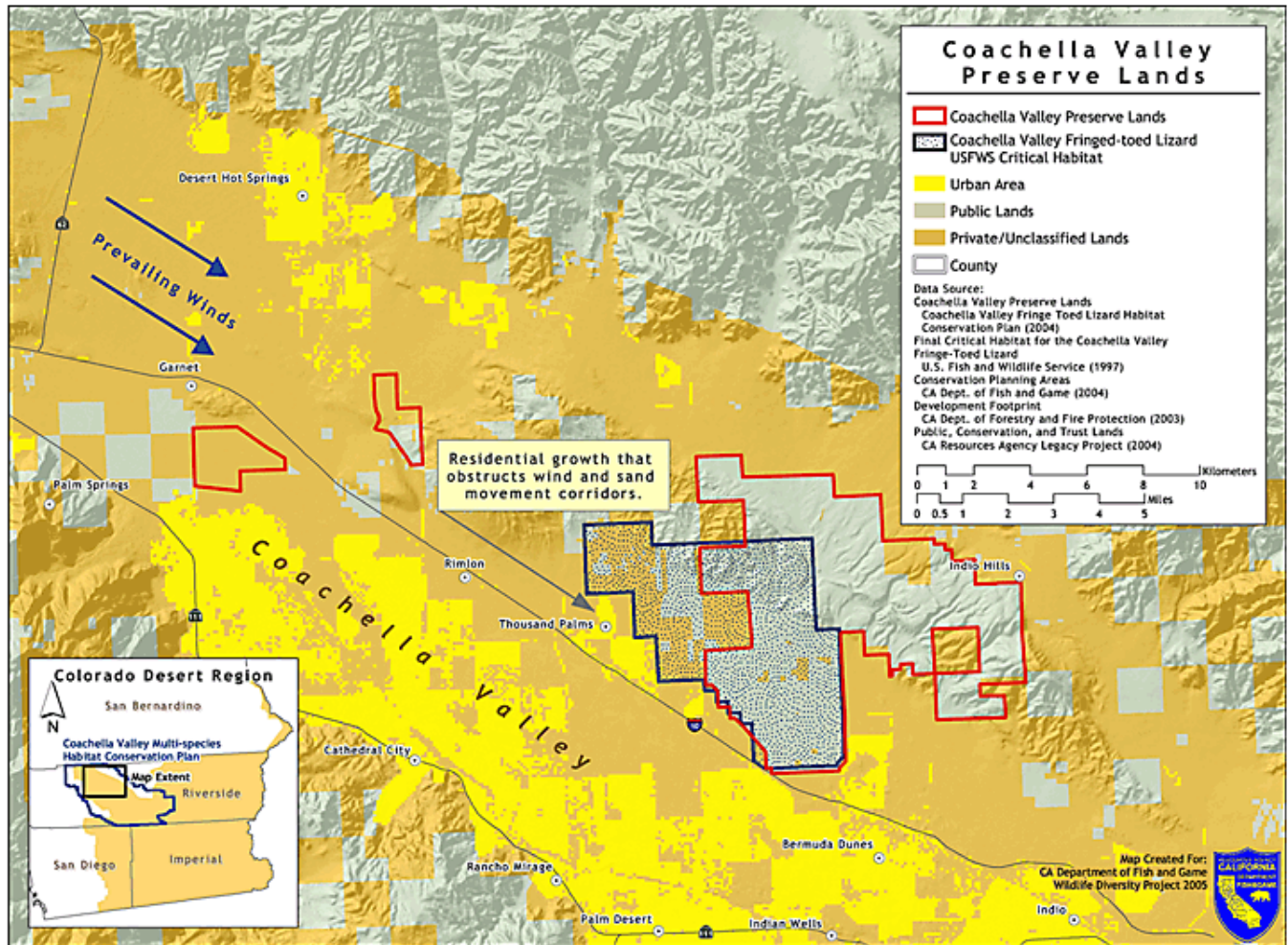


Fig. 7.3: Preserve Lands in the Coachella Valley

The Coachella Valley Dunes, which have been reduced to less than 10 percent of their original extent, harbor endemic and sensitive species like the Coachella Valley fringe-toed lizard. Although the majority of remaining dunes are protected, portions of the wind- and sand-movement corridors needed to sustain the dunes are still in need of protection.

Coachella Valley fringe-toed lizard (federally listed as threatened, state listed as endangered). Plants that characterize Coachella Valley's dune habitats include sand verbena, dune evening primrose, spectacle pod, bugseed, and the endemic Coachella Valley milkvetch (federally listed as endangered).

The Coachella Valley preserve system was first established in 1986 to protect the threatened Coachella Valley fringe-toed lizard. While the goal of the preserve was to protect dune habitats, an ecological model showed that wind and sand movement corridors, as well as sand source locations, also need to be protected to preserve the dunes. The preserve system's design includes three separate units, each with separate sand sources, to ensure that dune habitats will be protected even if major unforeseen impacts occur at any one site. Reevaluation of the ecological model in 1993 indicated that the primary sand source for one of the units was not adequately protected. Fortunately, the sand source

and the path to the preserve had not been severely affected by development, so options for correcting the preserve design were still available. Since then, about half of the desired lands have been acquired.

With continuing population growth in the Coachella Valley, off-road vehicle trespass is becoming an increasingly serious problem on Coachella Valley preserve lands. Particularly on recently acquired lands that were previously private and open to their use, there is some difficulty in enforcing and educating the vehicles' users about new preserve boundaries.

Growth and Development

As a whole, the Colorado Desert region does not face the level of population and development pressure experienced across most of California, and it remains the state's second-least populous region (CERES 2004). However, some areas of the Colorado Desert have seen significant growth in recent decades and are facing the resulting challenges to regional wildlife. The two most notable examples are the Coachella Valley and southern Imperial County near the U.S.–Mexico border cities of Calexico and Mexicali.

Coachella Valley is home to a series of fast-growing communities stretching from Palm Springs eastward to Indio and including outlying communities of Mecca, Coachella, Thermal, and North Shore in the southeast (BLM 2002a). For example, Cathedral City grew by 42 percent between 1990 and 2000; Palm Desert grew by 77 percent (CDOF 2004). New residential development, resort complexes, and golf courses have expanded steadily over recent decades, moving further up the canyons onto the lower slopes of the Peninsular Mountain Range and spreading across the natural communities and agricultural areas of the valley floor. Population in the valley's nine cities and surrounding unincorporated areas is projected to increase from approximately 330,000 in 2000 to between 475,000 and 518,000 residents in 2020 (CVAG 2004).

The Coachella Valley's unique and diverse habitats host a number of sensitive, rare, and endemic species. Conflicts between these species and the rapid pace of development are at the forefront of wildlife agencies' concerns. Since the passage of the California Desert Conservation Act in 1980, 10 Coachella Valley species have been listed as federally protected. Federal, state, and local agencies, along with conservation organizations, are attempting to address these issues through the development of a regional habitat conservation plan, the Coachella Valley Multi-Species Habitat Conservation Plan. (See Coachella Valley Multi-Species Habitat Conservation Plan.)

Growth is also noteworthy in southern Imperial County, near the border cities of El Centro and Calexico on the U.S. side and Mexicali on the Mexico side. Some residents, drawn from coastal areas by affordable housing, commute up to two hours to the San Diego area. El Centro grew by 21 percent to 37,835 residents between 1990 and 2000; Calexico grew by 46 percent to a population of 27,000 (CDOF 2004). Conversion of agricultural fields to residential development presents a major threat to wildlife. As previously described, irrigated agricultural fields are a critical component of the habitat

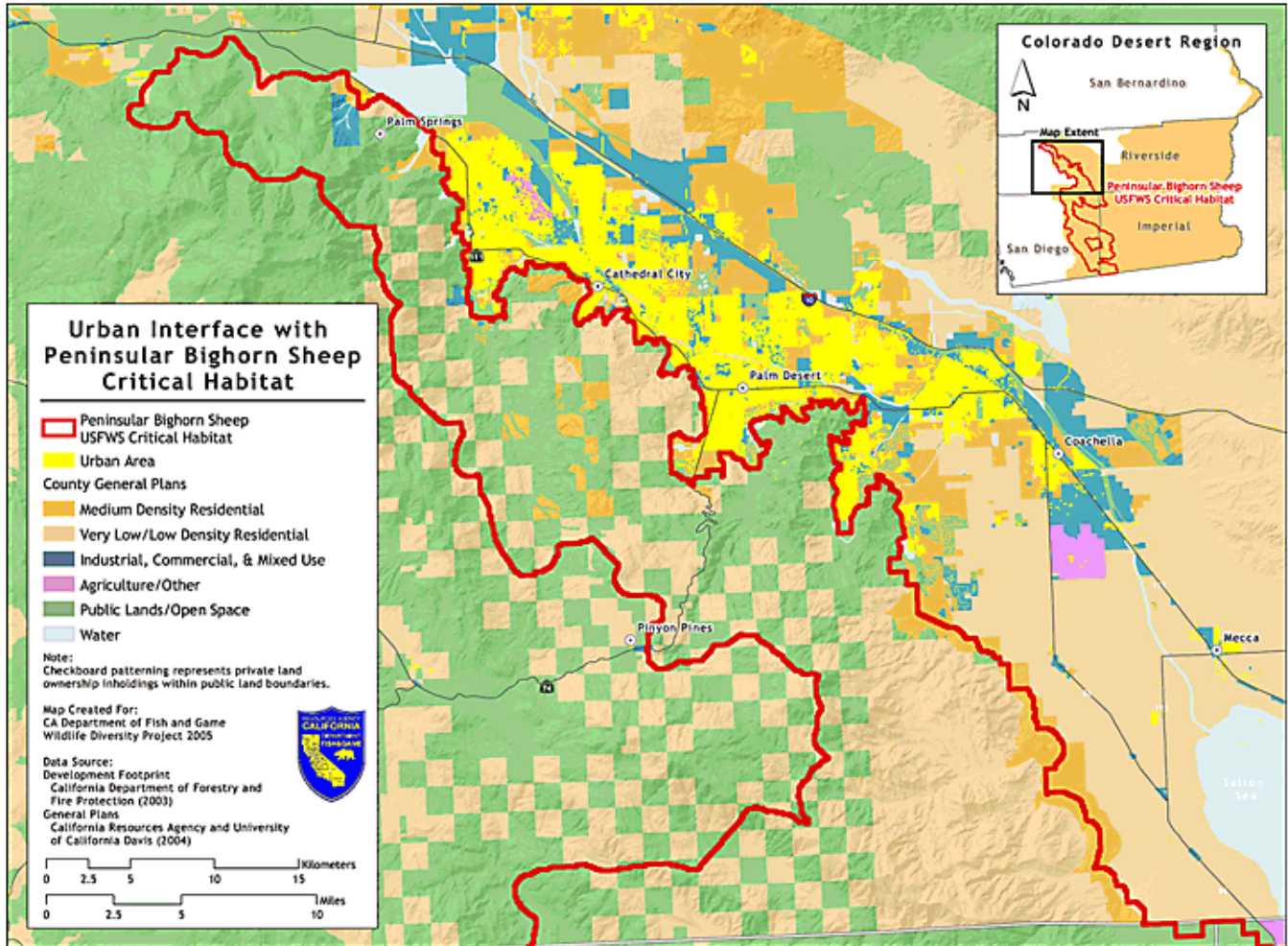


Fig. 7.4: Peninsular Bighorn Sheep Critical Habitat Along Urban Edge

In the northwestern portion of the Coachella Valley, urban development is expanding immediately adjacent to portions of the Peninsular Range that have been designated by the U.S. Fish and Wildlife Service as critical habitat for Peninsular bighorn sheep.

mosaic that sustains the great diversity and number of birds in this region. Among the species most reliant upon the Imperial Valley's agricultural fields are mountain plover and western burrowing owl (each a Fish and Game species of concern and a federal species of special concern), California black rail (state listed as threatened and a federal species of concern), and sandhill crane (state listed as threatened).

Expanding communities also increase the need for infrastructure, including roads, powerlines, and water supply. As in other areas of the state, threats to wildlife include direct destruction of habitat, pollution, fragmentation of habitats, blockage of migratory corridors, and introduction of non-native and potentially invasive species. Population growth in neighboring regions, especially along the South Coast and across the larger Sonoran Desert, also puts demands on the resources of the Colorado Desert. Utility corridors that traverse the desert—including electric lines, gas and oil pipelines, aqueducts, and supporting service roads—are continually expanded; increasing amounts of Colorado River

water are directed to growing urban areas; and visitors seek recreation opportunities in the desert's open landscapes.

Wind power development and renewed gold mining are also growing concerns. BLM and county planners are receiving large numbers of applications for windmill development, many of which are located in remote parts of the region, raising concerns over the possible negative environmental effects associated with construction, maintenance, and access. Wind power expansion is a particular concern for birds and bats, because poorly designed or sited windmills and transmission lines can interfere with flight corridors and cause local mortality (Jones 2005 pers. comm.). Expanding gold mining operations also disturb desert habitats. Toxic contaminants from these operations present hazards to wildlife, and important roosting and foraging sites for bats have been lost and degraded (Bolster 2005 pers. comm.).

Waste management is also an issue in the region. There are currently plans to build two large landfill facilities for the disposal of wastes from desert communities and imported from the South Coast; one of these is to be built adjacent to Joshua Tree National Park. The introduction of nutrients and pollutants, possible contamination of air and water quality, and increased numbers of nuisance species like common ravens could harm desert wildlife if such facilities are not operated in an environmentally responsible manner.

Invasive Species

Plants

In the Colorado Desert region, non-native saltcedar, or tamarisk, presents the greatest challenge. Tamarisk is virtually ubiquitous in riparian areas along the Colorado River. Alteration of the river's natural flow regime favors invasive tamarisk over native vegetation, in part because some native species are adapted to the historical seasonal flooding regime for dispersal and germination. Decreased flooding frequency results in salt buildup in riparian soils, and native species are less salt-tolerant than tamarisk. Tamarisk can also withstand reduced sediment deposition and lowered groundwater levels. In many places, tamarisk has completely replaced native cottonwood, willow, and mesquite and grows in dense mono-species stands. Even where native riparian trees remain, tamarisk usually grows among them (Glenn et al. 2001). It can also be found along most of the region's other waterways and aquatic habitats, including irrigation canals and drains and some springs. Tamarisk provides lower-quality habitat than native trees for nesting birds and other wildlife (including the southwestern willow flycatcher) and uses larger quantities of water than native vegetation, lowering groundwater levels and drying up desert springs while raising soil salinity.

In dune habitats, non-native species block sand movement or stabilize dunes with their roots. As noted in the section on dune habitats, these species include tamarisk (which blocks sand), Russian thistle, Saharan mustard, and introduced annual grasses. These species tend to spread from adjacent developments or can be distributed by off-road vehicles.

Animals

Non-native burros were introduced to the Colorado Desert more than a century ago and now range throughout the region. They can be particularly damaging to riparian areas and at springs. Along the Colorado River and around springs in the Chocolate Mountains where they congregate, burros consume available forage, increase sediment runoff, and compete with bighorn sheep and other native wildlife for access to drinking water. Under the BLM North Eastern Colorado Desert Plan, target limits were set for burro herd size. Because of the requirement under the Wild Horse and Burro Act that burros be managed through capture and relocation, herd control is time-consuming, labor-intensive, and costly. Burros have high reproduction rates. Thus, even where target herd-size limits have been set, herd sizes exceed target numbers.

Brown-headed cowbirds thrive in many human-altered habitats, including fragmented landscapes like suburban developments and golf courses, as well as in agricultural and grazing lands, where they are attracted to livestock droppings and feed. With the expansion of these land uses over the last century, cowbird populations have increased substantially in the Colorado Desert region, particularly in the Imperial and Coachella valleys. Brown-headed cowbirds lay eggs in flycatcher nests, and the flycatcher parent birds may desert the nest or raise the cowbird young at the expense of their own. In California, brown-headed cowbirds have been reported using from 50 percent to 80 percent of flycatcher nests (CVAG 2004). Parasitism of southwestern willow flycatcher nests by brown-headed cowbirds has been identified as a major cause of the flycatcher's decline (USFWS 2002d).

Another regionally sensitive species threatened by exotic species is the desert pupfish, state and federally listed as endangered. Competition, disturbance, and predation by introduced fish species, particularly sailfin molly, mosquito fish, and tilapia and crayfish species, threaten desert pupfish populations (CDFG 2005b).

4. Conservation Actions to Restore and Conserve Wildlife

In addition to the recommended regional actions described below, see the recommended statewide conservation actions as given in Chapter 4.

a. Federal, state, and local agencies, along with nongovernmental conservation organizations, should work together to reach agreement upon and fund a restoration plan for the Salton Sea.

- **The Salton Sea ecosystem should be maintained and restored in a form that provides vitally important aquatic habitats.** The restoration plan should ensure that the sea's current habitat values will be provided by the new restored form of the sea or adequately met elsewhere in the region. Important habitats include deep water to support fish production, freshwater marshes, shoreline, shallow water, and mudflats (Levin and Cooper 2003). Restoration solutions should be designed to avoid degrading existing habitats.

- **Ecosystem restoration goals for bird species should be set by reviewing habitat needs on a species-by-species basis.** Consideration should be given to which species are represented only at the sea, which ones have the capability to fly longer distances to other sites, and which species use each habitat type. This information can determine the required size and character of habitats needed to maintain wildlife diversity. Appropriate nongovernmental organizations and research institutions should assist government agencies with conducting research and reviewing the avian life-history information needed to set these goals.
- **The water quality of inflows to the sea should be improved by addressing both the quality of the agricultural drainage water and water quality in the Alamo and New rivers, the sea's main tributaries.** Agricultural practices that protect environmental quality, such as reducing the use of fertilizers and pesticides and constructing tailwater wetland systems, should be implemented. Government agencies and nongovernmental organizations should continue to research the feasibility and effectiveness of using created wetland projects to filter aquatic contaminants and improve water quality. Wetlands projects created by Wildlife Unlimited on the New and Alamo rivers have been cost efficient and have shown promising results in improving water quality; they are available on the Web at <http://www.newriverwetlands.com>. Additional research is needed to determine the ultimate fate of selenium sequestered in remediation wetlands.

The Regional Water Quality Control Board should work to finalize **Total Maximum Daily Load** (TMDL) standards for tributaries to the sea. The federal Clean Water Act requires TMDL standards to set limits on pollutant levels allowed to enter currently impaired waterways and then to allocate the emissions amount that is allowable by each of the sources of the pollutant. Adequate TMDL standards should be established for all pollutants entering the sea, with particular focus on nutrients like phosphorous. Recent modeling efforts for the Salton Sea have shown that reducing phosphorus inputs could substantially decrease the occurrence of algae blooms and large fish kill events (Anderson and Amrhein 2002).

b. Federal and state wildlife agencies should work to ensure that environmental impacts resulting from water transfers (both those permitted under the Quantification Settlement Agreement [QSA] and any future transfers) are mitigated.

All commitments in the Salton Sea and Imperial Valley Habitat Conservation Plan and the related Biological Opinion should be carried out. (See the QSA and Lower Colorado River Plan Commitments at the end of this chapter.)

It is unlikely that the \$133 million funding cap on implementation costs agreed to by the water agencies will be able to cover the full costs of carrying out the Salton Sea and Imperial Valley Habitat Conservation Plan and the related Biological Opinion. Therefore, it will also be important for the state to help secure funding to complete all components of the plan.

All commitments in the Lower Colorado River Multi-Species Conservation Plan should be carried out. (See the QSA and Lower Colorado River Program Commitments.)

As the Multi-Species Conservation Plan is implemented and developed into site-specific plans, adequate staff and funding resources for active management should be ensured, both until the created and restored wetland and riparian habitats are established and for long-term management needs like invasive species control. Efforts should also be made to protect and augment existing patches and areas of native vegetation along the Colorado River and delta. Where native fish-stocking programs are employed, resources should be invested in programs to restore and improve instream and backwater habitats and to control invasive aquatic wildlife species.

c. Federal and state wildlife agencies, water management agencies, and nongovernmental conservation organizations should develop and invest in restoration and protection efforts for the Salton Sea, the Colorado River delta, and other regional wildlife habitats.

In managing the Salton Sea, Colorado River, and regional agricultural habitats, these systems must be considered as part of the larger combined Colorado Basin ecosystem. Restoration and preservation actions at any of these habitats can benefit many of the same species. State legislation passed as a part of the QSA process says the QSA mitigation funds may be applied to Colorado River delta restoration. Restoring a portion of the Colorado River delta would enhance the region's ability to sustain wildlife.

The Audubon Society and other nongovernmental conservation groups should continue to work with private landowners and land managers in Imperial County to institute wildlife-friendly management practices on agricultural lands, to establish conservation easements on agricultural lands that can be managed to provide important wildlife habitat, and to work with willing sellers to bring some habitat areas into conservation ownership.

Increased Colorado River flows and occasional flood flows are needed to restore the delta. The Colorado River Board of California, working with California's Colorado River users, California Department of Water Resources, Fish and Game, U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service, and U.S. International Boundary and Water Commission should work together and with their Mexican counterparts to develop and implement a plan to acquire water for dedicated instream flows for the Colorado River and delta.

d. Wildlife agency staff developing the Imperial Valley Habitat Conservation Plan, working with Imperial County planners and nongovernmental conservation organizations, should identify and protect critical avian habitats in southern Imperial County.

Vital habitats for birds need to be identified and adequately protected in areas where development and urbanization are transforming the agricultural fields of southern Imperial County. New development should set aside protected areas for bird habitat. Initial surveys of avian habitats in and around Imperial

Valley agricultural fields were undertaken in 1999 and can provide guidance for further research (Shuford et al. 2002). Additional studies to determine the most important crops and agricultural management practices for wildlife should be a research priority. As rapid development continues near border cities, local, county, and General Plans should take these vital habits into account.

Before allowing large acreages of crops for water conservation efforts, consideration should be given to the agricultural habitats that would be lost. Even in cases where agricultural water leases could be purchased for ecosystem restoration uses, such as increased Colorado River flows, the habitat values that would be gained by returning water to the river must be balanced against the agricultural habitats that would be lost if large acreages of crops are taken out of production.

e. The Bureau of Land Management, working with state and federal wildlife agencies and nongovernmental conservation organizations, should protect and restore biologically significant habitats in the Algodones Dunes.

- **Ongoing monitoring of Algodones Dunes' habitats and endemic and sensitive species is needed to determine appropriate off-road vehicle restrictions.** The U.S. Fish and Wildlife Service and BLM, with the input of regional biologists (including representatives of the California Native Plant Society), should continue to cooperate to develop and implement monitoring programs to assess the effects of off-road-vehicle use on dune species and habitats. As monitoring protocols are revised and developed, they should receive peer review to ensure they are scientifically rigorous and designed appropriately to identify changes caused by vehicle activity. Future monitoring protocols should be designed to assess community-level ecological effects (rather than focusing exclusively on listed species) by evaluating indicators of community health, such as arthropod diversity and numbers, soil compaction, and reproductive success of both plant and animal species (Barrows et al. 2005). In order for the BLM to implement the community-level components of their 2003 management plan, such as monitoring of plant communities and bird species, additional staff and funding will be needed.
- **If the interim closures in the southern sections of the dunes (instituted in 2000) are lifted, careful monitoring should be used to track effects on the dunes' sensitive biological resources.** If negative effects are documented, BLM should consider reinstating the interim closures and making them permanent through a wilderness designation.
- **Dune protection requires greater management and enforcement resources.** Law enforcement in the Algodones Dunes recreation areas is provided primarily by nine BLM patrol rangers, giving each officer responsibility for approximately 20,000 acres. On peak visitation weekends, up to 50 additional staff from local sheriff's offices and border patrol offices are employed to maintain public safety. It is important that large staff deployments on peak weekends not only address crowd control but also enforce vehicle-use restrictions designed to protect the dune's resources. Fish and Game enforcement officers should be used to bolster patrol efforts on peak visitation days. Additionally, as called for in the Draft Imperial Sand Dunes Recreation and

Management Plan, increased law enforcement is also needed on a regular basis to perform normal patrols for dumping, vegetation destruction, and trespass violations (BLM 2003b).

- f. State and federal agencies and nongovernmental partners should collaborate to develop a comprehensive Southern California Outdoor Recreation Program (for the South Coast and Colorado Desert regions) to provide recreational opportunities and access that do not conflict with wildlife habitat needs. Areas for intensive recreational access and off-road vehicle use should be developed on the least-sensitive public lands in order to direct pressures away from sensitive habitats.**

See off-highway vehicle workshop discussion results, <http://www.dfg.ca.gov/habitats/wdp/ohv.pdf>.

- g. Federal, state, and local agencies and nongovernmental conservation organizations should work to protect and restore biologically significant habitats in the Coachella Valley.**

Wildlife agencies and local governments should finalize the Coachella Valley Multiple Species Habitat Conservation Plan (Coachella Plan) in order to secure funding for continuing acquisition of lands in the proposed reserve system. Once the Coachella Plan is completed, all parties should work to implement their commitments under the plan.

In addition to the provisions in the Coachella Plan, long-term protection of the preserve system requires restriction of off-road vehicle use. As the valley's population continues to grow, demands for vehicle recreation areas will increase. Currently, the closest large, open off-road vehicle area is in Mecca Hills, approximately 45 minutes away from the valley's population centers. Establishing a closer open area could reduce pressures on protected dune areas.

- h. Nongovernmental conservation organizations should continue to work to protect important wildlife habitat areas.**

Regionally active citizen-supported groups, such as the Friends of the Desert Mountains, the Wildlands Conservancy, the Mojave Desert Land Trust, the Anza Borrego Foundation, and others, should continue to identify opportunities for habitat conservation, including the use of land acquisitions from willing sellers and conservation easements to protect biologically significant areas and private inholdings within public lands.

Priority areas for protection include inholdings in Anza Borrego Desert State Park, the margins of Joshua Tree National Park, especially where there are strong growth and development pressures, the sand-movement corridors and sand sources needed to sustain the Coachella Valley Dunes Preserve System, important avian habitats in Imperial County, remaining native riparian communities along the lower Colorado River, and others.

i. Permitting agencies, county and local planners, and land management agencies should work to ensure that infrastructure development projects are designed and sited to avoid harmful effects on sensitive species and habitats.

As demands for roads, power, water, and waste disposal sites grow, efforts should be made to update and upgrade existing infrastructure to meet those needs. For example, rather than developing additional wind farms, existing wind farms can be updated to produce more electricity per windmill, and transmission lines can be upgraded to higher voltage lines to avoid the need for new utility corridors across undeveloped lands.

Wherever possible, infrastructure development projects should be sited near existing urban areas and development corridors and away from areas that are relatively undeveloped or with significant biological resources.

If new landfill facilities are built in the region, permitting agencies should work with project developers to ensure that all possible measures are taken to prevent environmental impacts, such as using closed-top landfill pits and reliably sealed liners to prevent water and soil contamination.

j. Federal, state, and local agencies should work with nongovernmental organizations to provide greater resources to control and limit introductions of invasive species in the region.

Agencies should increase research and monitoring of exotic species that compete with, predate, or parasitize sensitive native species or degrade important habitats. Watchlists of highly invasive species and maps of major invasive species' occurrences should be continually updated and publicized.

Working in cooperation with pest control councils, coordinated weed management areas, and conservation organizations, agencies should develop and implement eradication and control programs for invasive species. These programs must include adaptive management approaches, integrated pest management, participation by many different organizations, and planning at a landscape-scale. Public education about the threats presented by invasive species and support for and publicity about the efforts of citizen task-force groups working to control invasive species should be included as part of these programs.

Agencies should increase efforts to remove invasive tamarisk and restore native vegetation in riparian areas and springs and should support task-force groups focused on tamarisk control. Where possible, consider restoration of natural flow and flood regimes that favor native riparian species. Headwaters, areas that support sensitive species, and areas with light infestations are priority candidates for tamarisk control.

Working in cooperation with local planners and nongovernmental conservation groups, agencies should encourage planting of native plant species (and control of invasives) in urban edge and wilderness interface zones, particularly along the Peninsular Range, Coachella Valley Dunes, Anza Borrego Desert

State Park, and Joshua Tree National Park. Known invasive species should not be used for landscaping new developments in the area. Native species should be used in all restoration and habitat enhancement work and in critical habitat zones. This is particularly important for Colorado River riparian restoration projects, in Salton Sea–associated wetlands that are managed as wildlife refuges, and in the large-scale managed marsh that will be created in Imperial County as a Quantification Settlement Agreement mitigation measure.

Conditions in the Salton Sea

The Salton Sea is 35 miles long, about 12 miles wide, approximately 36 feet deep, and spans the border of Imperial and Riverside counties. The current sea formed in 1905 when Colorado River floodwaters broke through irrigation barriers. For almost two years, until engineers could reroute the flow, nearly all of the river's water flowed into the Salton basin (Cohn 2000, Cooper 2003). Although the sea resulted from this irrigation accident, a number of naturally formed water bodies have occupied the low-lying Salton basin in the past. Thousands of years ago, an arm of the Sea of Cortez extended into the basin, providing a delta fishery for Native Americans (Cooper 2003). Before the Colorado River was controlled by impoundments and channelization, the river's natural meanderings and winter floods would sporadically flow into the Salton basin, and, until 300 years ago, a water body larger than the Salton Sea (known as Lake Cahuilla) intermittently covered the area. Between 1824 and 1904, Colorado River flows spilled into the basin eight times, creating freshwater lakes that gradually evaporated (USBOR 2003).

The current Salton Sea has not evaporated because it is sustained by agricultural drainage water that feeds the sea's major tributaries, the New and Alamo rivers. Approximately 1.35 million acre feet of water enter the sea annually, more than 75 percent of which is U.S. agricultural drainage water. Ten percent of inflows to the sea originates in Mexico; 75 percent of this also is agricultural drainage, and 25 percent is municipal and industrial effluents (Cohen et al. 1999). Today, the amount of agricultural water feeding the sea is decreasing because water conservation measures and water-transfers to urban areas are reducing agricultural water use.

The sea's water quality is determined by the quality of these inflows. Water quality problems include high salinity, nutrient loading, and toxic contamination. The problems presented by these inputs are magnified because the sea is a closed basin with no natural outflows. Water exits the sea only by evaporation, thus concentrating the salts, nutrients, and contaminants. The sea is now 30 percent saltier than ocean water. Salinity increases at approximately 1 percent per year (RWQCB 2003), threatening invertebrate and fish populations and the food chain that supports the sea's fish-eating birds (Shuford et al. 2002).

Besides salts, agricultural drainage water contains fertilizers, pesticide residues, and naturally occurring elements, such as selenium, that can be toxic at high concentrations (Cohn 2000, Kaiser 1999). Nitrogen and phosphorous also enter in sewage wastewater, primarily via the New River (Kaiser 1999). High nutrient levels create a eutrophic system, characterized by algal blooms and subsequent die-offs, which result in low dissolved oxygen, high ammonia and hydrogen sulfate levels, and fish kills (RWQCB 2003). Eutrophic conditions may also foster the spread of avian disease (Cohen et al. 1999). The toxic contaminants of greatest concern are selenium and DDT and its derivatives. Although current contaminant levels are too low to cause direct toxicity, concerns remain about the potential for **bioaccumulation**, about recent detections of DDT (in spite of long-time bans), and about the exposure of contaminated sediments as sea levels decline, which could present an air quality hazard if those sediments become airborne dust. The sea's water quality problems could be exacerbated by planned water conservation measures for regional irrigated agriculture. Decreasing the volume of drainage water entering the sea will lessen the dilution rate of salts and contaminants in the sea (Cohen et al. 1999).

Restoration of the sea is a complex issue. Currently, biologists are attempting to identify which of the sea's habitats and resources are vital to wildlife and bird populations. Figuring out how to preserve these aspects while establishing a healthy ecosystem will be the key to restoration efforts.

The Colorado River Quantification Settlement Agreement (QSA) and Lower Colorado Program Commitments

Under the QSA and associated state and federal Endangered Species Act permits, commitments to mitigate for water transfer impacts to the Salton Sea and Imperial Valley agricultural lands and drains include:

1) The San Diego County Water Authority, Coachella Valley Water District, and Imperial Irrigation District agreed to complete an Imperial Irrigation District Habitat Conservation Plan/Natural Community Conservation Plan by 2006 to mitigate for activities in the Imperial Valley that will result from the water transfer. These water agencies are responsible for plan-implementation costs of up to \$133 million. Through cost-sharing agreements, the Southern California Metropolitan Water District and the U.S. Bureau of Reclamation are also responsible for funding portions of various mitigation measures. The state of California has assumed financial responsibility for any costs that exceed the capped amounts agreed to by parties to the QSA (QSA JPA 2003a, SB 654 2003).

The Imperial Irrigation District Habitat Conservation Plan (QSA JPA 2003b) is anticipated to:

- a. Include up to 96 species and provide conservation strategies for the five primary habitat types used by those species: drains, tamarisk scrub,* agricultural fields, desert, and the Salton Sea. Species-specific conservation measures will be included for the burrowing owl, desert pupfish, and razorback sucker.
- b. Require the Imperial Irrigation District to discharge enough mitigation water (conserved through fallowing) to the Salton Sea to ensure that inflows will not decrease over the next 15 years. (A State Water Resources Control Board Order also mandates this inflow requirement, along with salinity and elevation monitoring.)
- c. Create a managed marsh as habitat for Yuma clapper rails, California black rails, and other wetland-associated species to mitigate operation and maintenance activities and selenium impacts in Imperial Valley drains and canals.
- d. Maintain drain habitat suitable for the desert pupfish. If Salton Sea salinity increases to the point where desert pupfish can no longer travel between drains by traversing the sea, the agricultural drains will be extended and linked, so that pupfish populations will remain connected for genetic exchange. Additionally, the results of ongoing research on selenium concentrations in drainwater and effects on pupfish will be incorporated through adaptive management.
- e. Require Imperial Irrigation District to hire a full-time biologist/project manager to oversee implementation of the plan.

2) The Imperial Irrigation District, San Diego County Water Authority, and Coachella Valley Water District are responsible for installing oceanic roosts on the Southern California coast to serve brown pelicans that now depend on deepwater fishery habitats at the Salton Sea. Two roosts with the capacity to support at least 1,200 pelicans will be constructed by 2018 (State of California 2004).

* Where tamarisk has replaced native riparian vegetation, it is utilized by wildlife. Loss of riparian tamarisk habitat must be mitigated by the creation of native riparian habitats suitable for use by willow flycatchers or other target species.

The Lower Colorado River Program

Under the federal Lower Colorado River Multi-Species Conservation Program and associated California Endangered Species Act permits, commitments to mitigate for water transfer impacts to the lower Colorado River include:

California's permittees* under the Lower Colorado River Program are responsible for funding implementation costs for the plan, up to \$156.5 million. The U.S. Bureau of Reclamation has assumed responsibility for any costs that exceed the capped amounts agreed to by other program permittees. In addition to the federal requirements, California's permittees are also responsible for funding the management of some of the mitigation lands in perpetuity in order to meet standards for permits under the California Endangered Species Act (State of California 2005, US DOI 2005, USFWS 2005).

The Lower Colorado Program will:

- a. Cover 26 species. Species that figured most prominently in the planning process were the Yuma clapper rail, California black rail, yellow-billed cuckoo, southwestern willow flycatcher, razorback sucker, and bonytail.
- b. Create and manage more than 8,000 acres of native wetlands and riparian habitat along the Colorado River (of which at least 3,000 acres will be in California), including a total of more than 5,000 acres of cottonwood-willow riparian habitat to benefit the southwestern willow flycatcher, more than 1,000 acres of marsh, and more than 1,000 acres of open backwaters. Restoration projects will include restoration of agricultural lands to native cottonwood, willow, and mesquite habitat and improvement of existing protected lands by removing tamarisk and planting native trees.
- c. Augment populations of razorback suckers, bonytail, and flannelmouth suckers in the Colorado River.

* California's permittees under the Lower Colorado Program are the Bard Water District, City of Needles, Coachella Water District, Colorado River Board of California, Imperial Irrigation District, Palo Verde Irrigation District, San Diego County Water Authority, Southern California Public Power Authority, the Metropolitan Water District of Southern California, Southern California Edison Company, and the City of Los Angeles Department of Water and Power.

The Draft Coachella Valley Multiple Species Habitat Conservation Plan

Some of the Colorado Desert region's most important wildlife habitats are found in the Coachella Valley. A variety of land forms and accompanying differences in temperature, water availability, and other environmental conditions contribute to the area's high biological diversity. Elevations range from 150 feet below sea level at the desert floor to 10,000 feet in the surrounding mountains. The area's unique communities include ephemeral streams, riparian areas, alluvial fans, palm oases, and a sand dune system created by strong winds that funnel through the San Geronio Pass.

The intersection of sensitive species' habitat and suburban development is at the crux of conservation planning in the Coachella Valley. For example, expanding developments overlap with Peninsular bighorn sheep habitat where the valley floor meets the low elevation slopes and canyon mouths of the Peninsular Range. Along this interface, there are currently five golf courses and residential developments under construction or approved to be built. (See Fig. 7.4.)

The major challenges resulting from development pressures identified by the Draft Coachella Valley Multiple Species Habitat Conservation Plan (the Coachella Plan) are habitat loss; impacts of exotic species; unauthorized off-road vehicle use; disturbance from dumping; compromised sand process dynamics; blocked wildlife movement corridors; and groundwater overdraft and changes in water availability (CVAG 2004).

Through the establishment of a roughly 730,000-acre preserve system and implementation of improved land management practices, the Coachella Plan aims to maintain or restore populations of all species included in the plan (five plants, two insects, one fish, one amphibian, three reptiles, 11 birds, and four mammals), and to preserve examples of the valley's 27 natural communities. The Coachella Plan also emphasizes the importance of sustaining ecological and evolutionary processes and adapting preserve management to changing conditions.

Among the natural-community types identified in the Coachella Plan, sand-dependent communities and alluvial fan habitats face the greatest threats. These habitats once covered most of the valley floor but are now restricted to a small fraction of their former range. Alluvial fan communities are vulnerable because they form along the base of the mountain range, a desirable location for housing and recreational facilities. Alluvial fans are important aquatic features after rains, especially for amphibians like Woodhouse's toad. The plan targets these communities for protection and builds upon the existing Coachella Valley Preserve system by identifying linkages and sand transport corridors that are not yet protected.

Another important management issue addressed in the Coachella Plan is regulation of recreational trails in Peninsular bighorn sheep habitat. The draft Coachella Plan recognizes the potential adverse impacts of trail use on bighorn sheep access to foraging areas and water sources (particularly during critical periods such as lambing season) and includes an adaptive management and monitoring program to address these issues. Construction of new, lower-elevation trails around the base of the mountain range will also reduce the volume of use of higher elevation trails and serve as a buffer zone and barrier between sheep habitat and the urban edge.

The projected timeline for the Coachella Plan calls for preserve system acquisitions to be complete in 30 years and for management and monitoring programs to be funded in perpetuity.