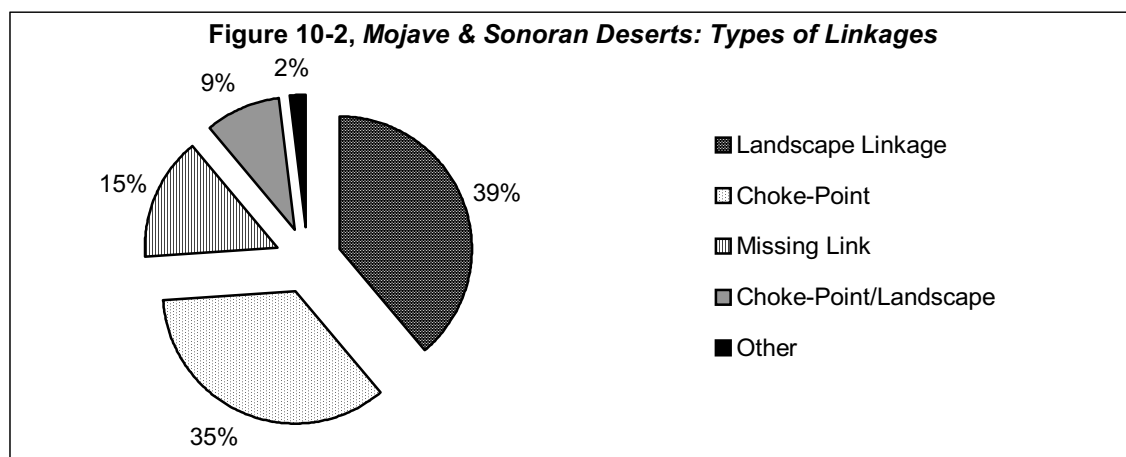


## 10.0 MOJAVE & SONORAN DESERT ECOREGION

The Mojave and Sonoran Desert ecoregion is roughly bound by the Sierra Nevada and Central Valley to the north, the Arizona and Nevada deserts to the east, the San Gabriel and San Bernardino Mountains to the west, with the Sonoran Desert continuing southward into Baja (Figure 1-1, *California Regions and Topography*). The primary vegetation types of the region are sand dunes, creosote bush scrub, saltbush scrub, mesquite, desert washes, desert riparian, palm oasis, ironwood and desert willow forest, Joshua tree woodland, chaparral, pinyon-pine juniper woodland, and pine-oak woodland.

The primary reason for the differences between the Mojave and Sonoran Deserts is elevation. The Mojave Desert is higher in elevation, and is therefore cooler, receiving more precipitation. This accounts for the differences in vegetation types; evergreen trees such as the Joshua tree (*Yucca brevifolia*) flourish in the Mojave but cannot persist in the Sonoran. At higher elevations in the Mojave Desert, juniper (*Juniperus* spp.) and pinyon pine (*Pinus quadrifolia*) are present with an understory of creosote bush (*Larrea tridentate*) and other shrubs and herbs. Creosote bush scrub, saltbush scrub, desert riparian, bajadas or desert washes, and sand dunes are characteristic habitats in the Sonoran Desert.



The majority of the region is publicly owned; however, there is considerable checkerboard ownership of private land interspersed. The Bureau of Land Management manages the greater part of the region. There are two National Monuments in the region; Joshua Tree and Death Valley. There are two State Parks, Anza-Borrego and Cuyamaca Rancho, and one National Park, Death Valley. The Salton Sea National Wildlife Refuge and Mojave National Preserve are other publicly owned lands. The military also has a significant presence in the region, including Fort Irwin, China Lake, Edwards Air Force Base, and the Chocolate Mountains Gunnery Range.

A total of 46 habitat linkages were identified for the region (Figure 10-1, *Mojave & Sonoran Deserts: Missing Linkages*). Of the linkages identified, 39% (18/46) were considered

Landscape Linkages<sup>1</sup>, 35% (16/46) were determined to be Choke-Points<sup>2</sup>, and 15% (7/46) were identified as Missing Links<sup>3</sup>. Participants identified some of the linkages as having multiple linkage types; 9% (4/46) were listed as Choke-Points<sup>2</sup> and Landscape Linkages<sup>1</sup>, and 2% (1/46) were named as Sand Source linkages (Figure 10-2, *Mojave & Sonoran Deserts: Types of Linkages*).

The key species used to identify the linkages belonged to many taxonomic groups. Mammals recognized as key species included the grizzly bear (*Ursus arctos*), black bear (*Ursus americanus*), mountain lion (*Felis concolor*), bobcat (*Lynx rufus*), coyote (*Canis latrans*), kit fox (*Vulpes macrotis*), bighorn sheep (*Ovis canadensis*), mule deer (*Odocoileus hemionus*), and Mohave ground squirrel (*Spermophilus mohavensis*). Reptiles and amphibians recognized as key species included desert tortoise (*Gopherus agassizii*), flat-tailed horned lizard (*Phrynosoma mcallii*), Colorado & Mojave desert fringe-toed lizards (*Uma* spp.), and arroyo southwestern toad (*Bufo microscaphus californicus*). Birds listed as key species included Peregrine falcon (*Falco peregrinus*), bald eagle (*Haliaeetus leucocephalus*), golden eagle (*Aquila chrysaetos*), southwestern willow flycatcher (*Empidonax traillii extimus*), least Bell's vireo (*Vireo bellii pusillus*), snowy plover (*Charadrius alexandrinus nivosus*), and other migratory birds. Both single and multiple key species were used in identifying the linkages; 57% (26/46) of the linkages recognized mammals as key species, 20% (9/46) used birds and 43% (20/46) used amphibians or reptiles. Mammalian carnivores were recognized as key species in 30% (14/46) of the linkages.

Existing features that facilitate animal movement varied. Some were listed as large contiguous parcels of intact habitat, others semi-contiguous, while some were merely strips of remnant habitat. Waterways, riparian corridors, broad alluvial fans and desert washes were listed as natural connectivity conduits; highway overpasses, underpasses, bridges and dirt roads were also recognized as facilitating wildlife passage.

The primary barriers to animal movement in the region also varied. Highways and roads were named as barriers in 72% (33/46) of the linkages; Highways 8, 10, 78, 58, 395, 40, 15, 14, and 127, and State Routes 1 and 2 were specifically mentioned as obstacles to movement. Military bases, urbanization, rural residential development, ranches, golf courses, resorts and their associated roads and fences were also identified as barriers. Extractive activities such as gold and gravel mining operations were also listed as obstacles for wildlife, as were grazing, agriculture, railroads, and aqueducts. The degradation of habitat due to off-road vehicles was also specifically named as an impediment to wildlife movement in the region.

Numerous threats to connectivity were identified for the ecoregion, including roads, military, mining, off-road vehicles, border patrol, grazing, urbanization, flood control, agriculture, wind turbines, power lines, human disturbance, habitat conversion, and invasive species

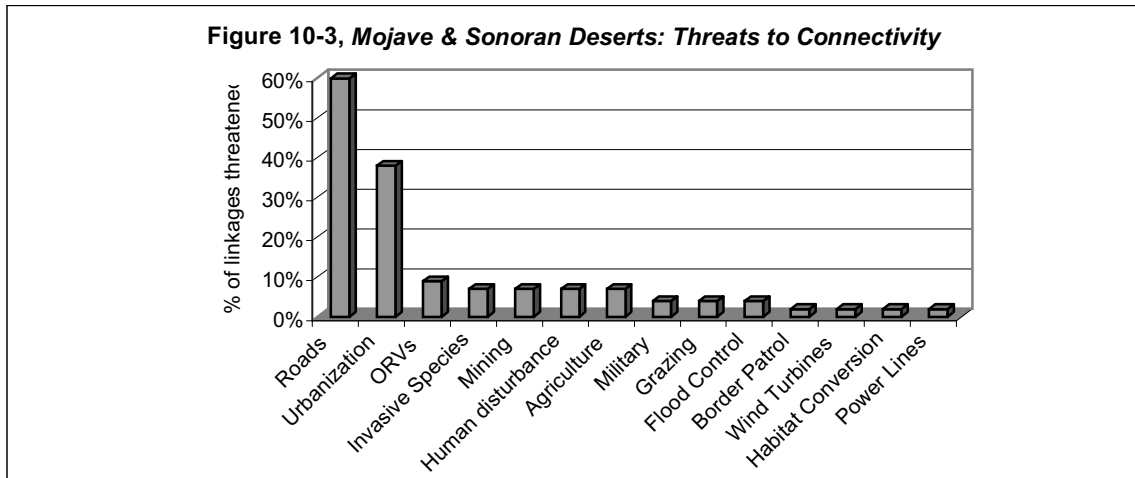
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<sup>1</sup> Landscape Linkage = Large, regional connections between habitat blocks ("core areas") meant to facilitate animal movements and other essential flows between different sections of the landscape.

<sup>2</sup> Choke-Point = A narrow, impacted, or otherwise tenuous habitat linkage connecting two or more habitat blocks ("core areas").

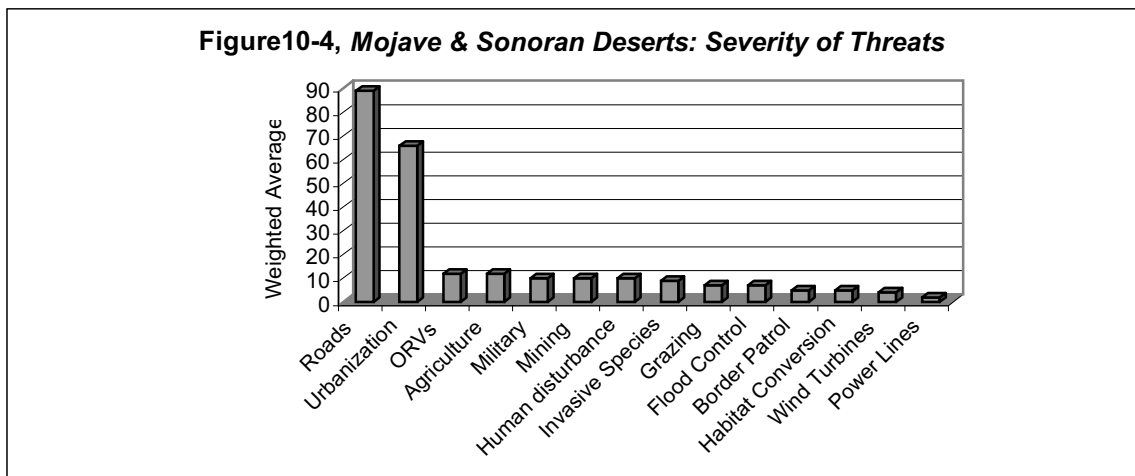
<sup>3</sup> Missing Link = A highly impacted area currently providing limited to no connectivity function (due to intervening development, roadways, etc.), but based on location one that is critical to restore connectivity function.

(Figure 10-3, *Mojave & Sonoran Deserts: Threats to Connectivity*). The primary threats were roads and urbanization. Of the linkages, 59% (27/46) were threatened to some degree by roads or highways, 52% (14/27) of which were ranked as severely threatened (rank = four or five). Urbanization jeopardized 37% (17/46) of the linkages, 71% (12/17) of which were ranked as severely threatened. Of the linkages, 9% (4/46) were listed as threatened, to varying degrees, by mining, agriculture, human



**Note:** The above graph depicts the percent of linkages affected by each threat identified for the ecoregion.

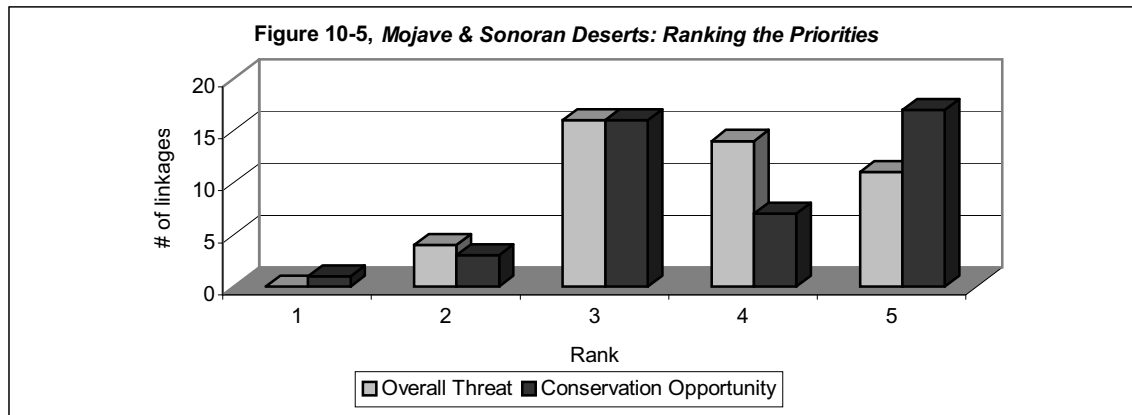
disturbance, and invasive species. In addition, 4% (2/46) are threatened, to some degree, by military, and flood control; wind turbines, power lines, border patrol and invasive species each put 2% (1/46) of the linkages at risk. A number of threats to habitat connectivity were identified for the region, though the average severity of the threat and the number of linkages affected varied. The weighted average (average rank  $\times$  number of linkages affected) was calculated for each threat identified to determine the severity of each threat in the region (Figure 10-4, *Mojave & Sonoran Deserts: Severity of Threats*). Figure 10-4, average severity of each threat among linkages, reveals similar trends as Figure 10-3, the number of linkages impacted by each threat.



**Note:** The above graph depicts the weighted average of each threat identified. Weighted average = average rank  $\times$  number of linkages affected. The severity of each threat was ranked from one to five (one = not severe, five = extremely severe).

Several types of restoration needs were identified to reestablish connectivity in the ecoregion.

Habitat types identified in need of restoration included desert washes, creosote bush scrub, wet meadows, desert riparian, Joshua tree, juniper, and pine-oak woodland. In some linkages, the eradication of invasive species was listed as the primary restoration need. In some linkages, prevention of off-road vehicle use was mentioned as a need to restore connectivity. Road closures and/or restricted-use of roads were listed as restoration needs for a few of the linkages. Establishing an east to west corridor with no grazing or fencing was also proposed. Protection of flood plains, management of water resources, and restoration of natural flood regimes were also named as restoration priorities. Other needs listed to restore connectivity in the region included restoring portions of agricultural land to native habitat and reclaiming an open-pit mine.



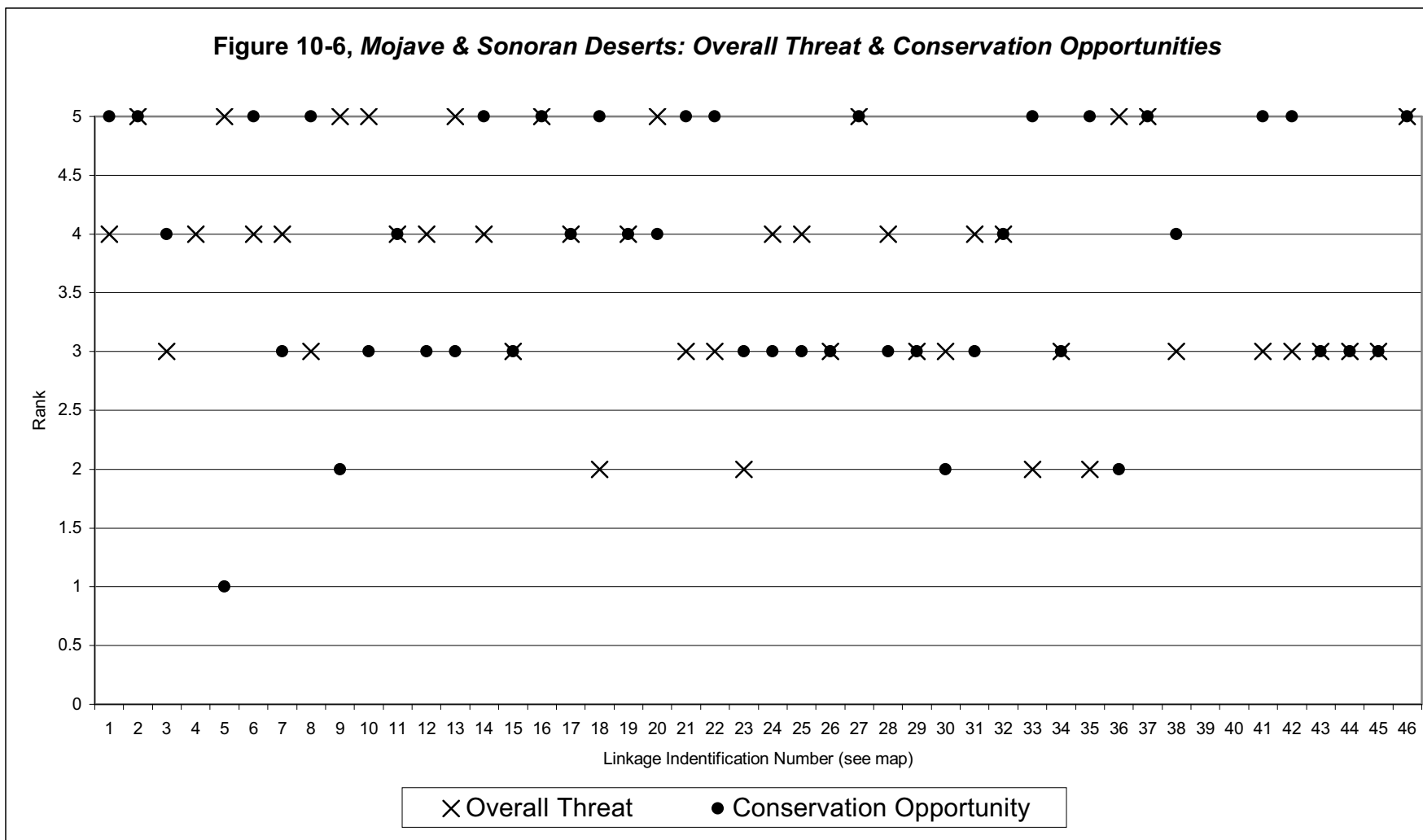
**Note:** Graph compares the number of linkages ranked for overall threat and conservation opportunity.

Conference participants scored the feasibility of conserving the linkage and ranked the overall degree of threat (Figure 10-5, *Mojave & Sonoran Deserts: Ranking the Priorities*). Scientists ranked 52% (24/46) of the linkages as high priorities with good opportunities for conservation (rank = four or five). Overall, 54% (25/46) of the linkages identified were ranked as severely threatened (rank = four or five). Of the linkages, 37% (17/46) were given the highest rank for conservation opportunity (rank = five). Eight of the top conservation opportunities were ranked as severely threatened (rank = four or five), five of which were ranked as in imminent danger (rank = five), Figure 10-1, *Mojave & Sonoran Deserts: Missing Linkages*, Map ID#s 2, 16, 27, 37, 46. These included three Landscape Linkages<sup>1</sup> (the Coachella Valley Preserve linkage Map ID# 2, Mojave River-Barstow-Camp Cady linkage Map ID# 16, and the Whitewater River linkage Map ID# 46), one Landscape Linkage<sup>1</sup> and connectivity Choke-Point<sup>2</sup> (the Joshua Tree linkage Map ID# 27), and one Missing Link<sup>3</sup> (the Owens Lake linkage Map ID# 37). Brief descriptions of the top ranked linkages (threat & conservation opportunity = five) are provided below. A comparison of how individual linkages were ranked is depicted in Figure 10-6, *Mojave & Sonoran Deserts: Degree of Threat and Conservation Opportunities*.

The Coachella Valley Preserve linkage (Figure 10-1, *Mojave & Sonoran Deserts: Missing Linkages*, Map ID# 2) was identified as a Landscape Linkage<sup>1</sup>. The key species listed for this linkage were bobcat and kit fox; this linkage was also identified as a critical sand source corridor. An intact broad alluvial fan consisting of creosote bush scrub, desert dunes and desert washes was listed as the primary linkage feature. Urbanization was named as the primary threat to connectivity and proposed development plans may create future barriers. Landownership in this linkage was listed as private; however, participants identified the

linkage as a key component of the Coachella Valley Multi-Species Habitat Conservation Plan, so potential exists for agency acquisition. Three studies have been conducted on sand source identification in the linkage and recent satellite imagery highlights sand movement. Please refer to the corresponding Linkage Description Log sheet for more specific information.

**Figure 10-6, Mojave & Sonoran Deserts: Overall Threat & Conservation Opportunities**



*Note: The above graph compares how each linkage was ranked for overall threat (one = no threat/secure, five = severe threat/loss imminent) and the feasibility of conserving the linkage (one = not feasible, five = good opportunity). Some linkages were not ranked for either category.*

The Mojave River/Barstow/Camp Cady linkage (Figure 10-1, *Mojave & Sonoran Deserts: Missing Linkages*, Map ID# 16) was identified as a Landscape Linkage<sup>1</sup>. This linkage was identified as providing connectivity for arroyo southwestern toad, least Bell's vireo, willow flycatcher, and other riparian birds. The linkage was also listed as a sand source corridor supplying sand to the Kelso Dunes. Riparian habitat was named as the primary linkage features, while lack of water was named as the most significant impediment to wildlife movement. The key threats identified for the linkage were urbanization, exotic plants, and flood control. The primary restoration needs listed were exotic plant removal (tamarisk & arundo), ensuring stream flow, and preventing encroachment into the flood plain. Landownership in the linkage was listed as both private and public, with the publicly owned land administered by the Bureau of Land Management and the California Department of Fish and Game. Participants indicated that this linkage was part of the West Mojave Conservation Plan and that potential exists for agency acquisition. Specific agencies mentioned included the Federal Emergency Management Agency, Flood Control District, CalTrans, and the California Department of Fish and Game. Please refer to the corresponding Linkage Description Log sheet for more specific information.

The Joshua Tree linkage (Figure 10-1, *Mojave & Sonoran Deserts: Missing Linkages*, Map ID# 27) was identified as a Landscape Linkage<sup>1</sup> and a connectivity Choke-Point<sup>2</sup>, linking the Bullion Mountains with the Sheep Hole Mountains to the north of Joshua Tree National Park. This linkage was recognized as an excellent wildflower and general wildlife corridor. Urbanization and roads were named as significant barriers to wildlife movement. Planning for urban build-in at 29 Palms and road decommissioning of non-essential dirt roads were both identified as opportunities for protecting and restoring habitat connectivity. Landownership in the linkage was listed as both public and private; the Bureau of Land Management administers the publicly owned land. Please refer to the corresponding Linkage Description Log sheet for more specific information.

The Owens Lake linkage (Figure 10-1, *Mojave & Sonoran Deserts: Missing Linkages*, Map ID# 37) was identified as a Missing Link<sup>3</sup> between the Sierra Nevada and the Inyo Mountains. This linkage was identified as a stopover for migratory bird species. In fact, an inland population of snowy plover breeds in this area. The primary threats identified were habitat conversion and lack of water. Participants explained that Owens Lake was historically a navigable waterway; after Los Angeles began exporting water, it became a shallow wetland; presently, it is an alkali sink. This linkage was listed as being owned by the State, managed by the Great Basin Unified Air Pollution Control District, and directed by a Los Angeles Department of Water and Power Environmental Impact Report on PM10 emissions. The motivation for dust abatement measures was primarily for human health concerns, but implementation is expected to indirectly benefit wildlife. Various dust control measures are currently being initiated, including shallow flood control, gravel cover, and revegetation plots. Please refer to the corresponding Linkage Description Log sheet for more specific information.

The Whitewater River linkage (Figure 10-1, *Mojave & Sonoran Deserts: Missing Linkages*, Map ID# 46) was identified as a Landscape Linkage<sup>1</sup>. This linkage was identified as providing connectivity for carnivores and birds; it was also identified as a sand movement corridor. The primary threat identified was suburban development blocking sand transport. Participants

indicated that there was local support for protecting this linkage and willing sellers. They also indicated that the linkage was part of the Coachella Valley Habitat Conservation Plan and that potential exists for agency acquisition. Please refer to the corresponding Linkage Description Log sheet for more specific information.

Scientific documentation or studies referenced for some of the linkages included (see Appendix C, *Connectivity References*, for complete citation, if provided):

- Coachella Valley Multi-Species Habitat Conservation Plan
- West Mojave Plan
- North East Mojave Plan
- The Recovery Plan for Bighorn of the Peninsular Ranges
- Desert Tortoise Recovery Plan
- Desert Bighorn of the Chocolate Mountains
- Bureau of Land Management Plans for Desert Tortoise and Bighorn
- Mojave River Forks Dam Biological Report
- Death Valley Natural Resource Management Plan
- Los Angeles Department of Water and Power Environmental Impact Report on PM10 Emissions
- Bureau of Land Management ACEC Plan
- Bighorn Meta-population model, California Department of Fish and Game
- Biology of the Kingston Range, University of California Santa Cruz publication

Ecoregional team members provided GIS-based maps and satellite images for some of the linkages. Bighorn sheep were recognized as a key species, indicative of habitat connectivity, in 41% (19/46) of the linkages identified for the region; 26% (5/19) of which (Figure 10-1, *Mojave & Sonoran Deserts: Missing Linkages*, Map ID#s 1, 6, 7, 9, & 10) coincide with areas depicted in Figure 10-7, *Peninsular Bighorn Sheep Essential Habitat and Physical Features*. Please refer to the corresponding Linkage Description Log sheets for more specific information.

The Peninsular-Borrego linkage (Figure 10-1, *Mojave & Sonoran Deserts: Missing Linkages*, Map ID# 6) is illustrated in Figure 10-8, *Corridors and Links: Anza-Borrego Desert State Park and Cuyamaca Rancho State Park*. California State Parks also provided four additional focus maps of properties identified in the map referenced above, which are available upon request. All five properties were listed as having willing sellers. Please refer to the corresponding Linkage Description Log sheet for more specific information.

Five of the linkages have willing sellers in all or a portion of the linkage (Figure 10-1, *Mojave & Sonoran Deserts: Missing Linkages*, Map ID#s 1,6,10, & 15), three of which were considered conservation priorities (Map ID#s 1, 6, 46). Potential exists for agency acquisition in 54% (25/46) of the linkages, 20% (5/25) of which were identified as having willing sellers. Of the linkages, 26% (12/46) were identified as part of formal conservation plans. Other opportunities identified to secure or restore connectivity function include developing landowner incentives for conservation easements, coordination with CalTrans on fencing and underpasses for future highway realignments, working with the military,

Environmental Protection Agency clean-up projects, working with federal and state agencies on management directives, and formal conservation plans.