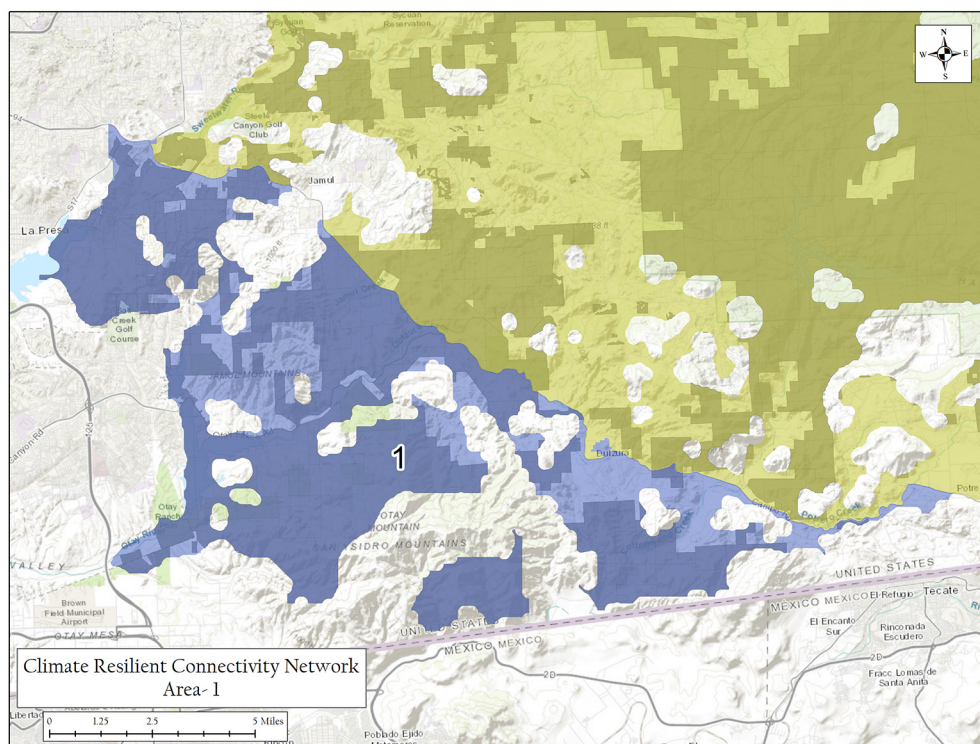# APPENDIX A: DETAILED LINKAGE DESCRIPTIONS

Area: 1

Southwest San Diego County

Acres: 46,230

75.4% **Conserved**

**(**Conserved areas shown in darker color on map)

Climate Resilient Connectivity Network
Area- 1

Land Cover	Vegetation Composition	
1.9% Urban	95.3% Vegetation	
0.4% Agriculture	*32.7% Chaparral*	*43.5% Coastal Sage Scrub*
2.4% Water or Wetlands	*2.6% Conifers*	*13.7% Grasslands*
0.0% Barren	*2.9% Hardwood*	*0.0% Desert Sage Scrub*
4 **Focal Species**: Big-eared woodrat, Bobcat, Western toad, Wrentit		
Majority Land Owners: BLM, USFWS, CDFW		

Description:

Area 1 is located in southwestern San Diego County and encompasses lands that make up the San Diego National Wildlife Refuge (USFWS), Rancho Jamul Ecological Reserve (CDFW), and Otay Mountain (BLM). This zone is bordered by SR-125 to the west, Campo Road (SR-94) to the east, and the U.S.-Mexico border to the south. It serves as an important connection between natural lands in Baja California, Mexico and the contiguous open space in the Cleveland National Forest to the east. Although a large proportion of land in this area is in conservation status, encroaching development from the dense urban areas to the west as well as frequent fires may fragment or degrade habitat in the area. Sections of border fence to the south and SR-94 to the north pose constraints to wildlife connectivity in and out of the area and should be considered for wildlife road crossing improvements.

Area: 2

### Southeast San Diego County

Acres: 205,266

55.3% Conserved

(Conserved areas shown in darker color on map)

Climate Resilient Connectivity Network
Area- 2
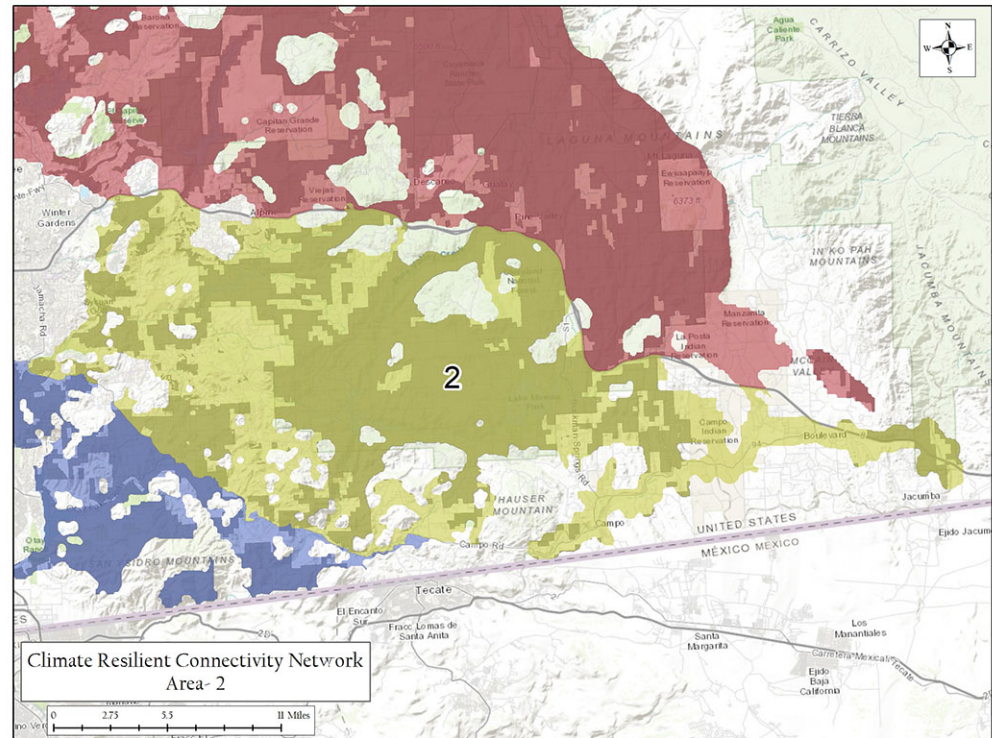
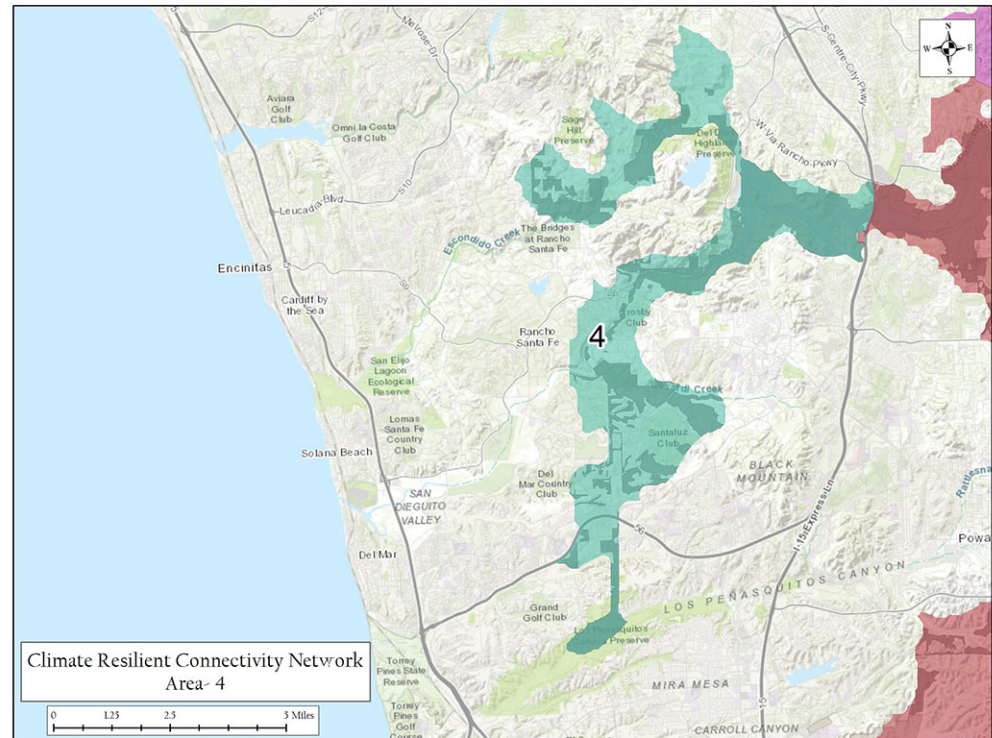| Land Cover	Vegetation Composition	
4.8% Urban	92.5% Vegetation	
1.3% Agriculture	*64.1% Chaparral*	*16.6% Coastal Sage Scrub*
1.0% Water or Wetlands	*0.1% Conifers*	*5.5% Grasslands*
0.4% Barren	*5.4% Hardwood*	*0.7% Desert Sage Scrub*
4 **Focal Species**: Big-eared woodrat, Bobcat, Western toad, Wrentit		
Majority Land Owners: Cleveland National Forest, CDFW, BLM		

Description:

Area 2 is located in southeastern San Diego County and encompasses the southernmost region of the Cleveland National Forest as well as the Sycuan and Campo Indian Reservations. This zone is bordered by Jamacha Road and Campo Road (SR-94) to the east and is bounded by Interstate 8 to the south and west until it terminates in the vicinity of the Jacumba Mountains, west of the desert escarpment. The area serves as an important north-south connection between Baja California, Mexico and the Peninsular Mountains. Although a much of the land in this area is in conservation status, expanding urban edges from the cities of El Cajon and Alpine may fragment the western half of the linkage zone. Sections of border fence to the south, SR-94 to the west, and I-8 to the north all pose constraints to wildlife connectivity in and out of the area and should be considered for wildlife road crossing improvements.

Area: 3

Eastern San Diego County

Acres: 346,649

56.3% Conserved

(Conserved areas shown in darker color on map)

Climate Resilient Connectivity Network
Area- 3
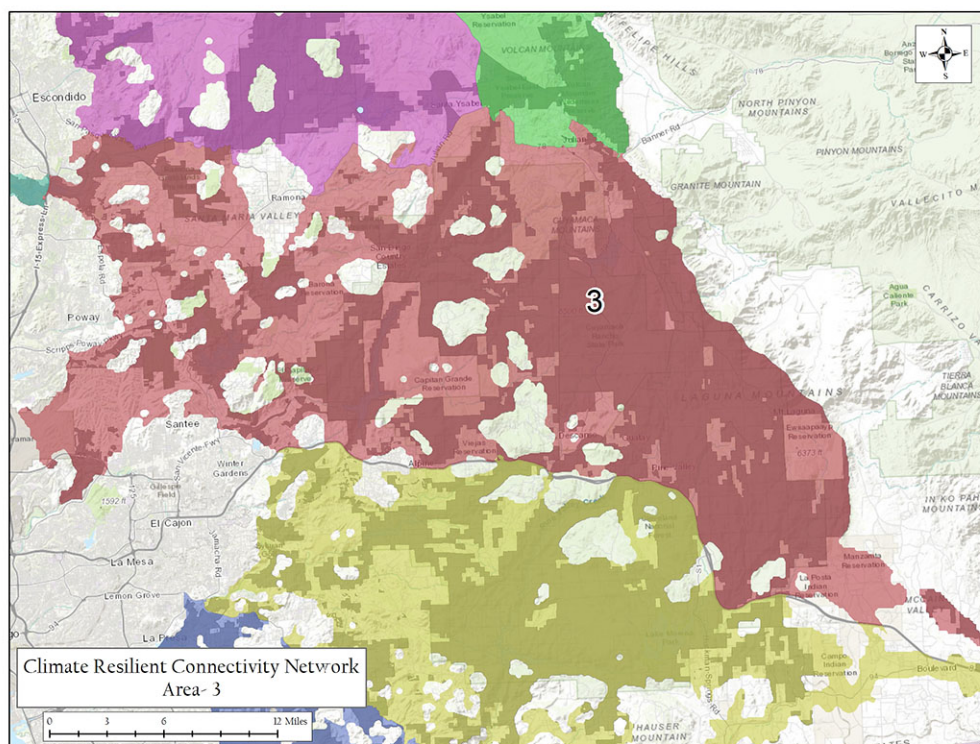
Land Cover	Vegetation Composition	
5.3% Urban	91.3% Vegetation	
2.0% Agriculture	*57.2% Chaparral*	*13.3% Coastal Sage Scrub*
1.1% Water or Wetlands	*3.6% Conifers*	*7.2% Grasslands*
0.3% Barren	*9.8% Hardwood*	*0.1% Desert Sage Scrub*
5 Focal Species: Big-eared woodrat, Bobcat, California spotted owl, Western toad, Wrentit		
Majority Land Owners: Cleveland National Forest, State Parks, City of San Diego		

Description:

Area 3 is located in eastern San Diego County and encompasses Mount Laguna (USFS) and the Cuyamaca Mountains (State Parks) in the southern portion of the U.S. extent of the Peninsular Range. The zone stretches between SR-78 to the north and Interstate 8 to the south and is bounded by the Anza Borrego desert to the east and development surrounding Interstate 15 to the west. It serves as an important connection between smaller tracts of protected lands in the west that are part of the San Diego Multiple Species Conservation Plan preserve network, managed by the City of San Diego, County of San Diego, and State of California, to the contiguous open space and mountains the east, where the linkage overlaps with two California Essential Habitats Connectivity (CEHC) linkage zones. The area is also critical for connecting montane regions north-south along the Peninsular Range and as such, was also identified as a key linkage in the South Coast Missing Linkages assessment (Peninsular-Borrego Linkage). Development pressure to from the west near the towns of Santee, Poway, Ramona, and Escondido may fragment the western edge of this zone. Frequent fires along the San Diego River watershed also pose a threat to vegetation and habitats in this area. I-8 to the south, SR-78 to the northeast, SR-67 in the west, and a number of smaller roadways all pose constraints to wildlife connectivity in and out of the area and should be considered for wildlife road crossing improvements.

Area: 4

North Western San Diego County

Acres: 15,497

43.0% **Conserved**

(Conserved areas shown in darker color on map)

Climate Resilient Connectivity Network
Area- 4

Land Cover	Vegetation Composition	
23.4% Urban	65.9% Vegetation	
1.9% Agriculture	*20.4% Chaparral*	*21.5% Coastal Sage Scrub*
5.8% Water or Wetlands	*0.0% Conifers*	*18.0% Grasslands*
2.9% Barren	*6.0% Hardwood*	*0.0% Desert Sage Scrub*
4 **Focal Species**: Big-eared woodrat, Bobcat, Western toad, Wrentit		
Majority Land Owners: City of San Diego, County of San Diego, Escondido Creek Conservancy		

Description:

Area 4 is located in the coastal area of central San Diego County and encompasses Lake Hodges and several riparian corridors (*i.e.*, Escondido, Lusardi, and Penasquitos Creeks) managed by the City of San Diego and County of San Diego that are part of the San Diego Multiple Species Conservation Plan preserve network. This zone is bordered by Interstate 15 to the east, Interstate 5 to the west, the cities of San Marcos and Escondido to the north and the Mira Mesa neighborhood of San Diego to the south. The area serves as an important north-south connection among the conserved lands in the highly fragmented coastal plain. Connectivity among these riparian preserves may also support movement between constrained lands to the west to larger blocks of contiguous open space to the east. This zone is threatened by expanding development along the SR-56 corridor, Carmel Valley, and in the City of San Marcos. SR-56 to the south, SR-78 to the north, and I-15 to the east, as well as numerous secondary roads (*e.g.,* Carmel Valley Road, Black Mountain Road) pose constraints to wildlife connectivity in and out of the area and should be considered for wildlife road crossing improvements.

Area: 5

## Palomar/Agua Tibia Mountains

Acres: 341,038

38.6% **Conserved**

(Conserved areas shown in darker color on map)

Climate Resilient Connectivity Network
Area- 5
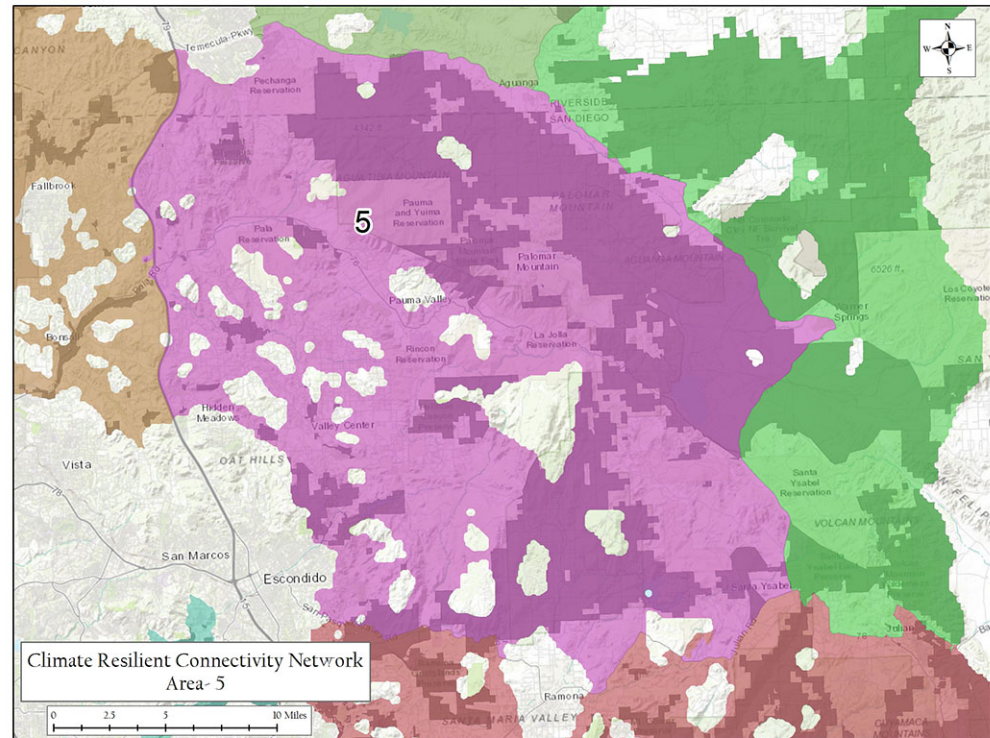
Land Cover	Vegetation Composition	
4.5% Urban	82.8% Vegetation	
10.7% Agriculture	*43.6% Chaparral*	*9.3% Coastal Sage Scrub*
1.6% Water or Wetlands	*2.8% Conifers*	*11.4% Grasslands*
0.4% Barren	*15.5% Hardwood*	*0.1% Desert Sage Scrub*

5 Focal Species: California spotted owl, Big-eared woodrat, Bobcat, Western toad, Wrentit

Majority Land Owners: Cleveland National Forest, Vista Irrigation District, County of San Diego

Description:

Area 5 is located in northern San Diego and southern Riverside Counties and encompasses the inland valleys east of Interstate 15 up to Palomar Mountain in the Peninsular Range, including lands in the managed by the U.S. Forest Service, County of San Diego, Vista Irrigation District, and Cities of San Diego and Escondido. This zone is bordered by Interstate 15 to the west, the desert in the east, SR-78 to the south, and SR-79 to the north. Conserved lands in this zone are primarily in the east whereas the western half includes agricultural lands, rural communities, and lands proposed for conservation under the Draft North County Multiple Species Conservation Plan. Tribal lands for the Pechanga, Pala, La Jolla, San Pasqual, and Mesa Grande tribes are also located in this zone. The northern segment of this linkage includes the eastern half of the critically important linkage between Palomar Mountain and the Santa Ana Mountains, which has been previously identified in the CEHC and SCML modeling efforts. This area is at risk from expanding low- and medium-density developments and the increased fire frequency. Numerous rural roadways constrain wildlife connectivity within this area, and Interstate 15 at the San Diego-Riverside County boundary is a major barrier to wildlife movement that should be considered for wildlife crossing improvements.

Area: 6

Eastern Peninsular Mountains

Acres: 208,556

63.1% **Conserved**

(Conserved areas shown in darker color on map)

Climate Resilient Connectivity Network Area- 6
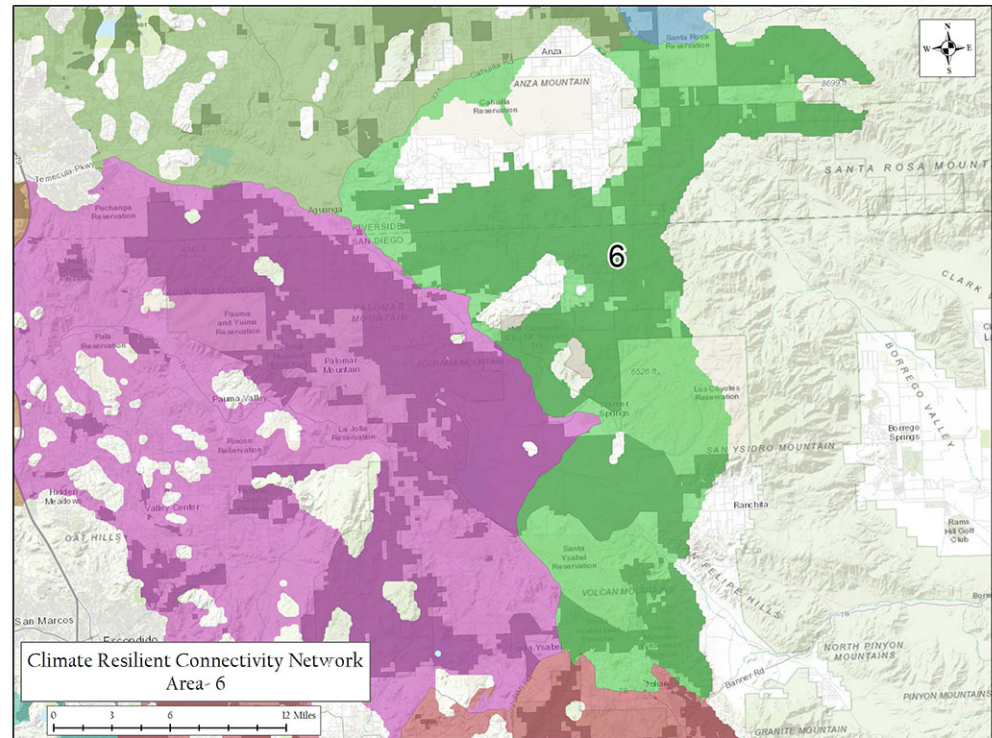
Land Cover	Vegetation Composition	
1.0% Urban	97.6% Vegetation	
0.9% Agriculture	*69.4% Chaparral*	*4.1% Coastal Sage Scrub*
0.5% Water or Wetlands	*4.1% Conifers*	*7.4% Grasslands*
0.1% Barren	*10.6% Hardwood*	*1.9% Desert Sage Scrub*
5 Focal Species: Big-eared woodrat, Bobcat, California spotted owl, Western toad, Wrentit		
Majority Land Owners: San Bernardino/Cleveland National Forests, BLM, Vista Irrigation District		

Description:

Area six is located in northeastern San Diego County and southern Riverside County and encompasses the dry, eastern slopes of the Peninsular Range (including Volcan, Hot Springs, Beauty, and Santa Rosa Mountains) and the western edge of the Anza Borrego desert from the town of Julian to Aguanga, including lands managed by the Bureau of Land Management, State Parks, U.S. Forest Service, County of San Diego, and CDFW. Portions of the Mesa Grande, Los Coyotes, Cahuilla and Santa Rosa reserverations are also part of this linkage. This zone is bordered by SR-79 to the west, the Anza Borrego desert to the east, SR-371 to the north, and SR-78 to the south. The area serves as an important connection north-south along the Peninsular Range and east-west between the desert and mountains with areas in this linkage being previously identified in the SCML project as important for the Peninsular-Borrego and Palomar-San Jacinto-Santa Rosa linkages. This zone is threatened by expanding development in Riverside County near the towns of Aguanga and Anza. Rural highways such as SR-78, SR-79, and SR-371 pose constraints to wildlife movement in and out of this area and should be considered for wildlife road crossing improvements.

Area: 7

Orange County Coastal Ranges

Acres: 330,267

44.4% Conserved

(Conserved areas shown in darker color on map)

Climate Resilient Connectivity Network
Area- 7
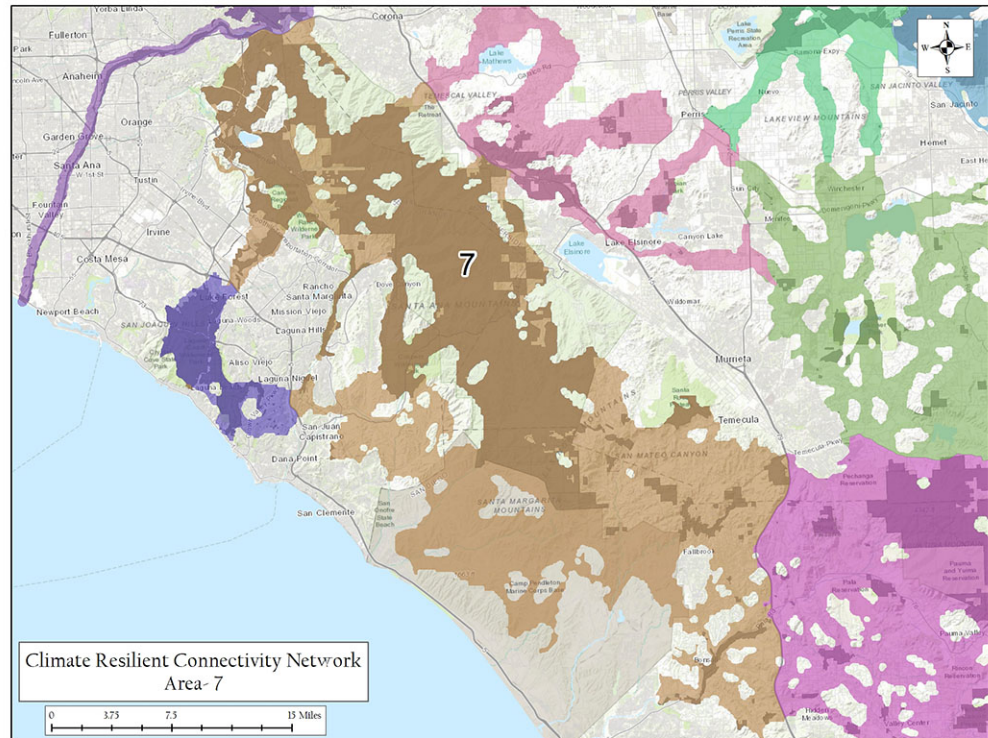
Land Cover	Vegetation Composition	
5.2% Urban	85.4% Vegetation	
8.3% Agriculture	*43.6% Chaparral*	*19.7% Coastal Sage Scrub*
0.2% Water or Wetlands	*0.9% Conifers*	*11.7% Grasslands*
0.8% Barren	*9.3% Hardwood*	*0.3% Desert Sage Scrub*
5 Focal Species: Big-eared woodrat, Bobcat, California spotted owl, Western toad, Wrentit		
Majority Land Owners: Cleveland National Forest, County of Orange, BLM		

Description:

Area 7 is located in northern San Diego, western Riverside, and Orange Counties and encompasses the Santa Ana Mountains as well as the lands along the coastal plain west of Interstate 15 that connect the Santa Ana Mountains to Palomar Mountain. Within this area, conserved lands include the Cleveland National Forest along the steep, rugged mountains, and coastal preserves that are part of the Nature Reserve of Orange County such as the Irvine Ranch Open Space and Coal Canyon Preserve, as well as Caspers Wilderness Park and Audubon Starr Ranch. Portions of Marine Corps Base Camp Pendleton in the northwest corner of San Diego County are also included in this linkage. This zone is bordered by I-15 to the east, I-405 to the west, SR-91 to the north, and SR-78 to the south. This area serves as an important connection between the Santa Ana Mountains and surrounding open spaces, which are becoming increasingly isolated by urbanization in both Orange and Riverside Counties. This zone includes the western half of the linkage between the Santa Ana Mountains and northern San Diego County that was previously identified by the CEHC and SCML projects. The dense urbanization and heavily traveled roadways that surround and intersect this linkage pose constraints to wildlife movement within and among adjacent areas. Where possible, wildlife road crossing improvements should be considered to mitigate this impacts.

Area: 8

Laguna Coast

Acres: 21,590

58.1% Conserved

(Conserved areas shown in darker color on map)

Climate Resilient Connectivity Network
Area- 8
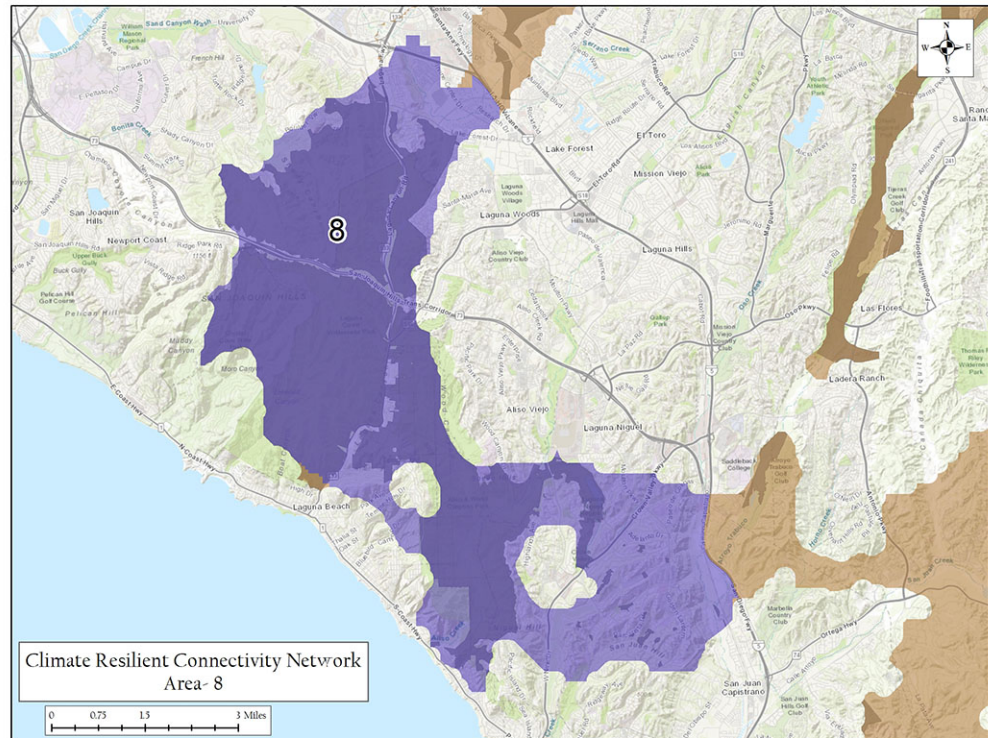
Land Cover	Vegetation Composition	
25.7% Urban	72.0% Vegetation	
0.4% Agriculture	*6.3% Chaparral*	*45.8% Coastal Sage Scrub*
0.3% Water or Wetlands	*0.0% Conifers*	*17.4% Grasslands*
1.6% Barren	*2.4% Hardwood*	*0.1% Desert Sage Scrub*
4 **Focal Species**: Big-eared woodrat, Bobcat, Western toad, Wrentit		
Majority Land Owners: County of Orange, City of Irvine, State Parks		

Description:

Area 8 is located in coastal Orange County and encompasses coastal preserves that are part of the Nature Reserve of Orange County such as Crystal Cove State Park, Laguna Coast Wilderness Park, and Aliso and Wood Canyons Wilderness Park. This zone is bordered by I-5 to the east, the Pacific Ocean to the west, and the town of Costa Mesa to the north and Dana Point to the south. The area serves as an important connection east-west between the highly constrained coastal preserves surrounded by development, surface streets, and freeways and the Santa Ana Mountains to the east. This zone is threatened by the impact of the existing development and heavily trafficked roads and requires linkages to be completed to the northeast and southeast to ensure full protection. Local highways such as SR-73 and SR-133 pose a threat to connectivity within this area while I-5 constraints to wildlife movement in and out of the area. All of these roads should be considered for wildlife road crossing improvements.

Area: 9

San Jacinto Foothills

Acres: 225,205

30.1% **Conserved**

(Conserved areas shown in darker color on map)

Climate Resilient Connectivity Network
Area- 19
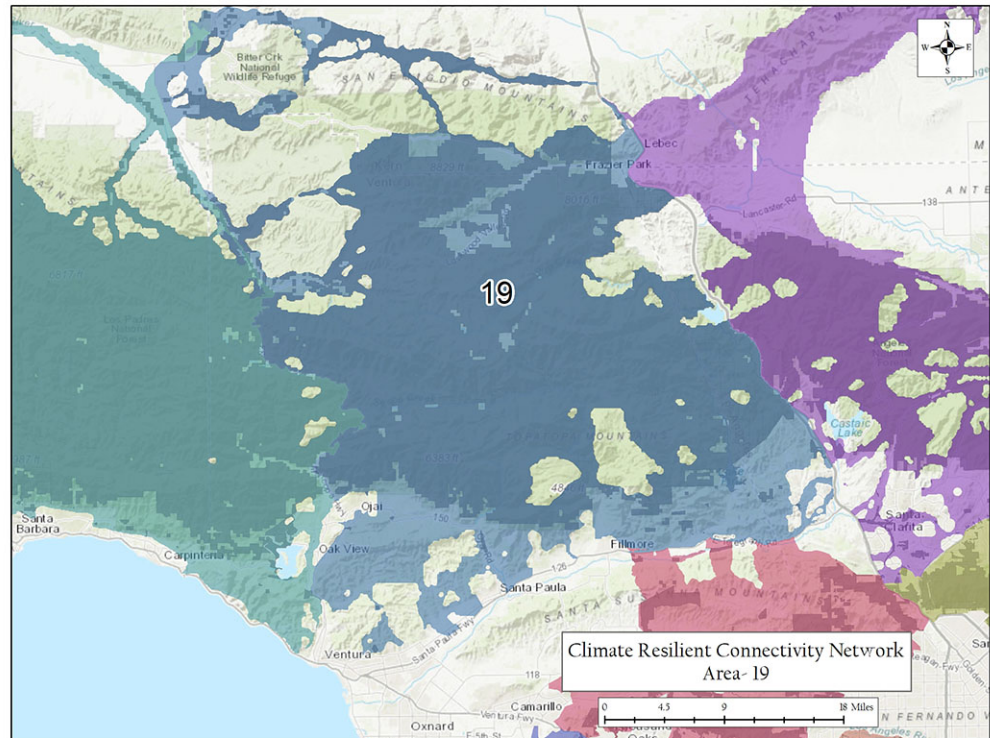
Land Cover	Vegetation Composition	
10.3% Urban	73.6% Vegetation	
13.0% Agriculture	*43.4% Chaparral*	*18.8% Coastal Sage Scrub*
3.0% Water or Wetlands	*2.5% Conifers*	*5.5% Grasslands*
0.0% Barren	*3.5% Hardwood*	*0.0% Desert Sage Scrub*
5 Focal Species: Big-eared woodrat, Bobcat, California spotted owl, Western toad, Wrentit		
Majority Land Owners: USFS (San Bernardino National Forest), BLM, Riverside County		

Description:

Area 9 is located in southwestern Riverside County and encompasses the inland valleys and foothills of Mount San Jacinto within the Western Riverside Multiple Species Habitat Conservation Plan (MSHCP) such as Lake Skinner Park and Diamond Valley reservoir, as well as the west slope of the mountain, in the San Bernardino National Forest. This area is also home to the Ramona and portions of the Cahuilla reservations. This zone is bordered by SR-79 and SR-371 to the south, SR-74 to the north and east, and I-215 to the west. The area serves as an important connection east-west between Mount San Jacinto, Santa Rosa Mountain, and Palomar Mountain, and was previously identified as an important linkage area under both the CEHC and SCML projects. This area is threatened by the ongoing development and associated roadway traffic and expansion in southwestern Riverside County in the rapidly growing cities of Temecula, Murrieta, and Hemet. Increasing fire frequency around these developments also poses a risk to vegetation and habitat supporting connectivity. Heavily trafficked surface streets such as Sage Road and Domenigoni Parkway as well as SR-79, SR-74, and I-215 likely constrain wildlife movement and should be considered for wildlife road crossing improvements.

Area: 10

San Jacinto Mountains

Acres: 160,854

63.1% **Conserved**

(Conserved areas shown in darker color on map)

Climate Resilient Connectivity Network Area- 10
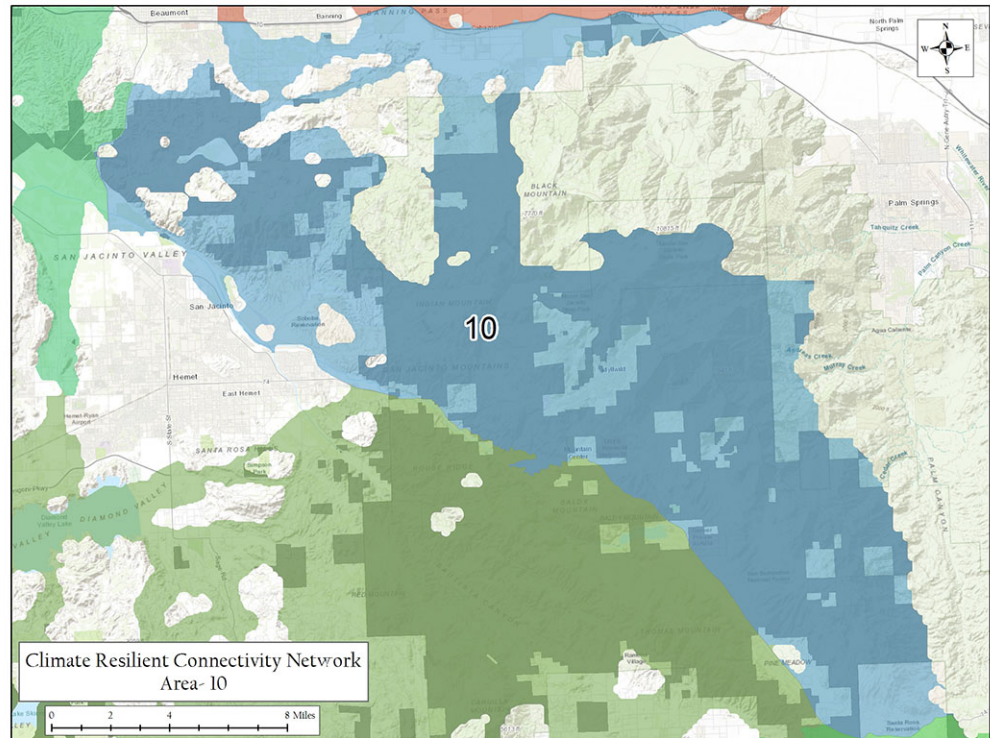
Land Cover	Vegetation Composition	
3.0% Urban	94.1% Vegetation	
1.4% Agriculture	*48.0% Chaparral*	*12.7% Coastal Sage Scrub*
0.4% Water or Wetlands	*20.2% Conifers*	*4.8% Grasslands*
1.0% Barren	*4.3% Hardwood*	*4.1% Desert Sage Scrub*
5 Focal Species: Big-eared woodrat, Bobcat, California spotted owl, Western toad, Wrentit		
Majority Land Owners: San Bernardino National Forest, BLM, State Parks		

Description:

Area 10 is located in the mountains of Riverside County and encompasses Mount San Jacinto within the San Bernardino Forest, Mount San Jacinto State Park, and the San Jacinto Wildlife Area. The area also includes tribal lands on the Soboba and Agua Caliente reservations. This zone is bordered by SR-74 to the south and west, SR-79 to the northwest, Interstate 10 to the north, and desert escarpment to the east. The area serves as an important connection between Mount San Jacinto, Santa Rosa Mountain, Palomar Mountain, and the San Bernardino Mountains, and was previously identified as an important linkage area under both the CEHC and SCML projects. The northwestern portion of this linkage is threatened by the impacts of development and increasing fire frequency along the I-10. Local highways such as SR-243, SR-75, and SR-79, as well as I-10 likely constrain wildlife movement and should be considered for wildlife road crossing improvements.

Area: 11

Perris Plain
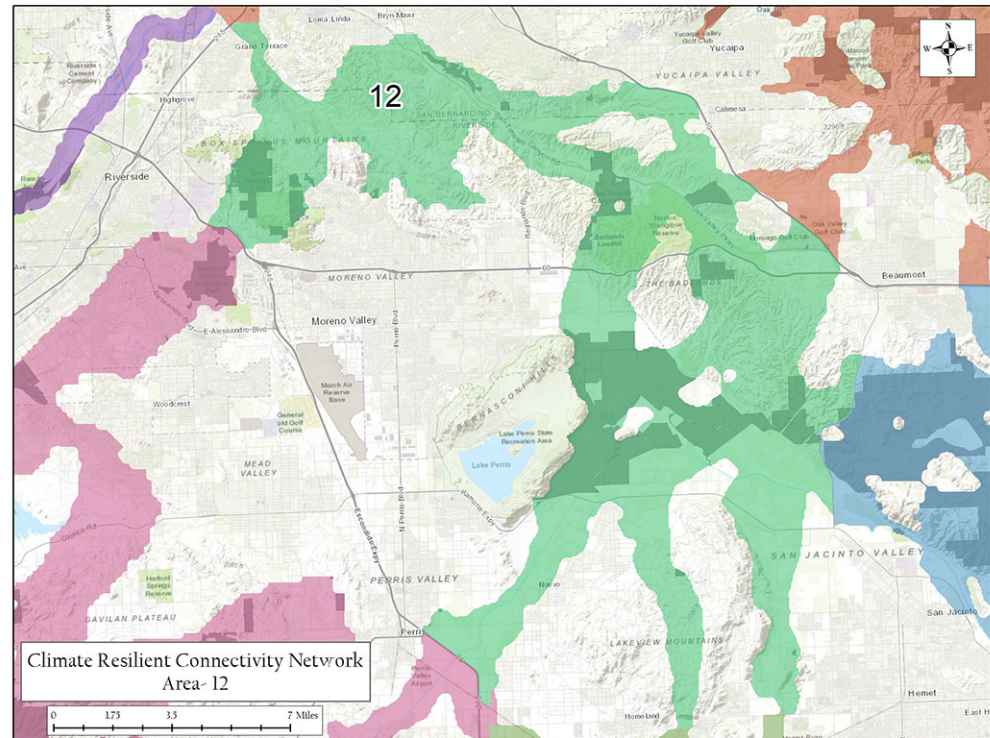
Acres: 72,641

15.5% Conserved

(Conserved areas shown in darker color on map)

Climate Resilient Connectivity Network
Area- 11
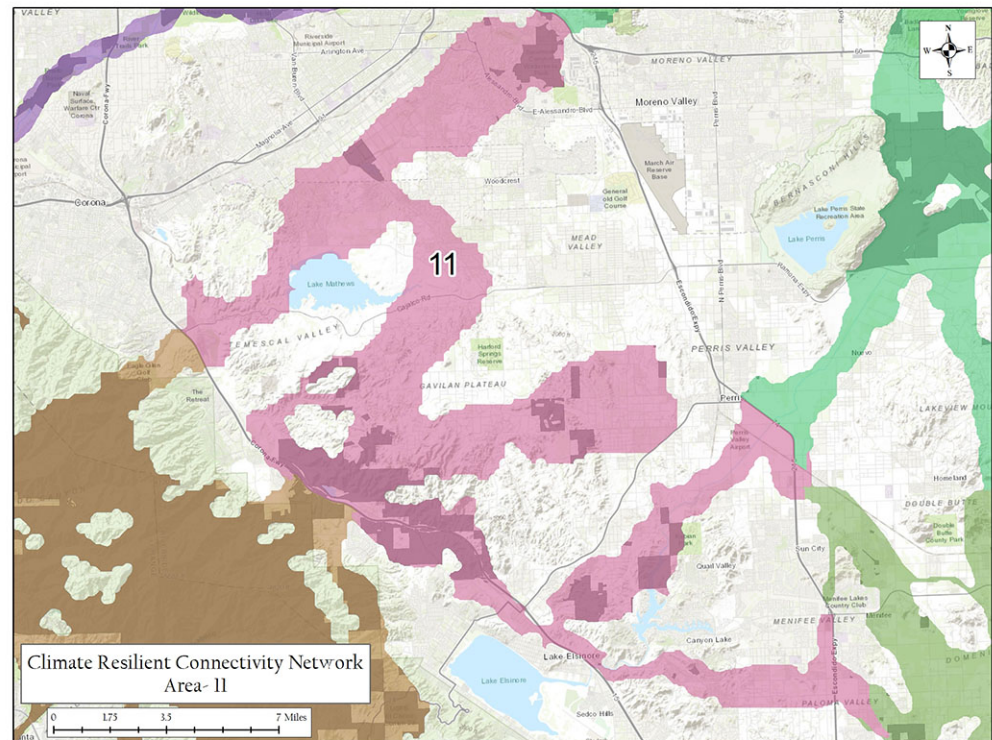
Land Cover	Vegetation Composition	
32.9% Urban	54.4% Vegetation	
12.1% Agriculture	*3.4% Chaparral*	*37.6% Coastal Sage Scrub*
0.6% Water or Wetlands	*0.9% Conifers*	*7.9% Grasslands*
0.0% Barren	*4.6% Hardwood*	*0.0% Desert Sage Scrub*
4 **Focal Species**: Big-eared woodrat, Bobcat, Western toad, Wrentit		
Majority Land Owners: Riverside County, BLM, City of Riverside		

Description:

Area 11 is located in northwestern Riverside County in the triangle formed by Interstates 15, 215 and SR-91 and encompasses Temescal Valley and the Elsinore Trough. This linkage segment is largely unconserved, but falls within the Western Riverside MSHCP with many areas in the linkage targeted for preservation under the MSHCP. Notably, this area has a significant percentage of Riversidian sage scrub in an area that has seen increasing development pressure. The area serves as an important connection between the Santa Ana Mountains and the mountains and deserts to the east and a portion of this linkage was previously identified in CEHC modeling. Growing development in the Inland Empire and heavily traveled roadways threaten connectivity in this area and increasing fire frequency also poses a risk to vegetation and habitat supporting connectivity. Local highways such as SR-74, I-15, and I-215 as well as surface streets such as Cajalco Road and Santa Rosa Road constrain wildlife movement and should be considered for wildlife road crossing improvements.

Area: 12

Moreno, Perris & San Jacinto Valleys

Acres: 79,757

**16.3% Conserved**

(Conserved areas shown in darker color on map)

Climate Resilient Connectivity Network
Area- 12

Land Cover	Vegetation Composition	
8.2% Urban	59.1% Vegetation	
28.6% Agriculture	*11.6% Chaparral*	*26.6% Coastal Sage Scrub*
3.6% Water or Wetlands	*0.0% Conifers*	*18.4% Grasslands*
0.5% Barren	*2.4% Hardwood*	*0.1% Desert Sage Scrub*
4 **Focal Species**: Big-eared woodrat, Bobcat, Western toad, Wrentit		
Majority Land Owners: CDFW, County of Riverside, Western Riverside County Regional Conservation Authority		

Description:

Area 12 is located in northern Riverside County and a small portion of San Bernardino County, and encompasses important agricultural lands as well as open spaces west of Riverside and Moreno Valley such as Box Springs Mountain Park, Lake Perris State Recreation Area, and the San Jacinto Wildlife Area. This zone is bordered by I-215 to the west, SR-79 to the east, I-10 to the north and east, and SR-74 to the south. The area serves as an important north-south connection between the San Jacinto and San Bernardino Mountains as well as an east-west connection between the Santa Ana Mountains and San Jacinto through the valleys of Riverside and Perris and overlaps with linkages previously identified by the CEHC and SCML projects. Numerous local highways pose constraints to wildlife connectivity within this area, and I-10, I-215, SR-74 and SR-79 pose a threat to movement in and out of this linkage and should be considered for wildlife road crossing improvements.

Area: 13

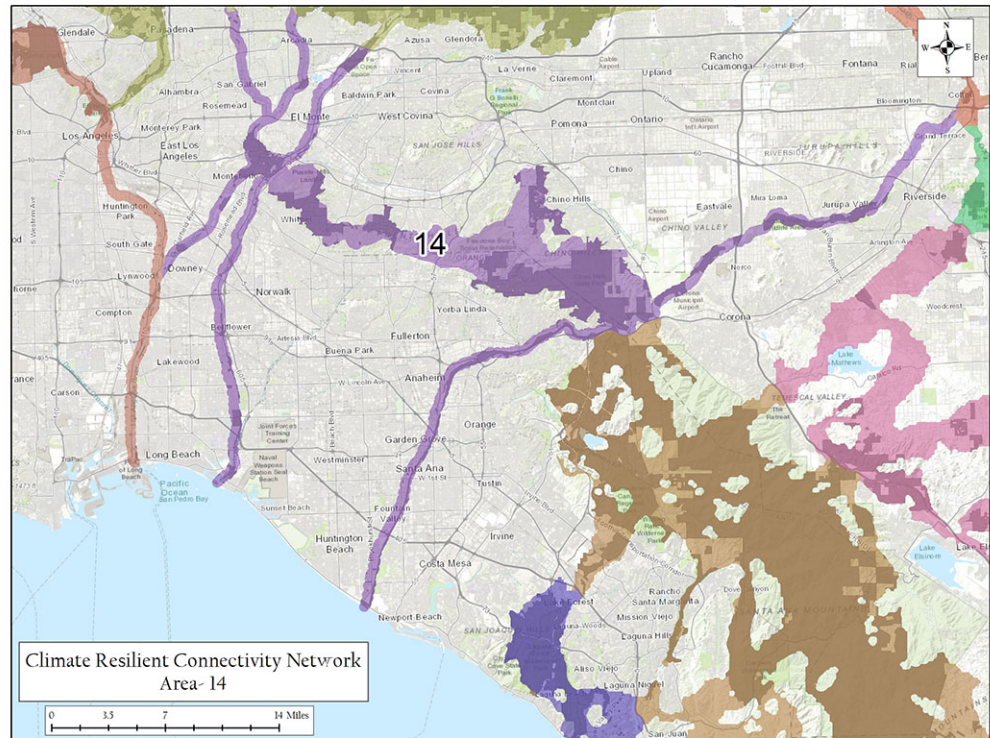## San Bernardino Mountains

Acres: 415,475

67.4% Conserved

(Conserved areas shown in darker color on map)

Climate Resilient Connectivity Network
Area- 13
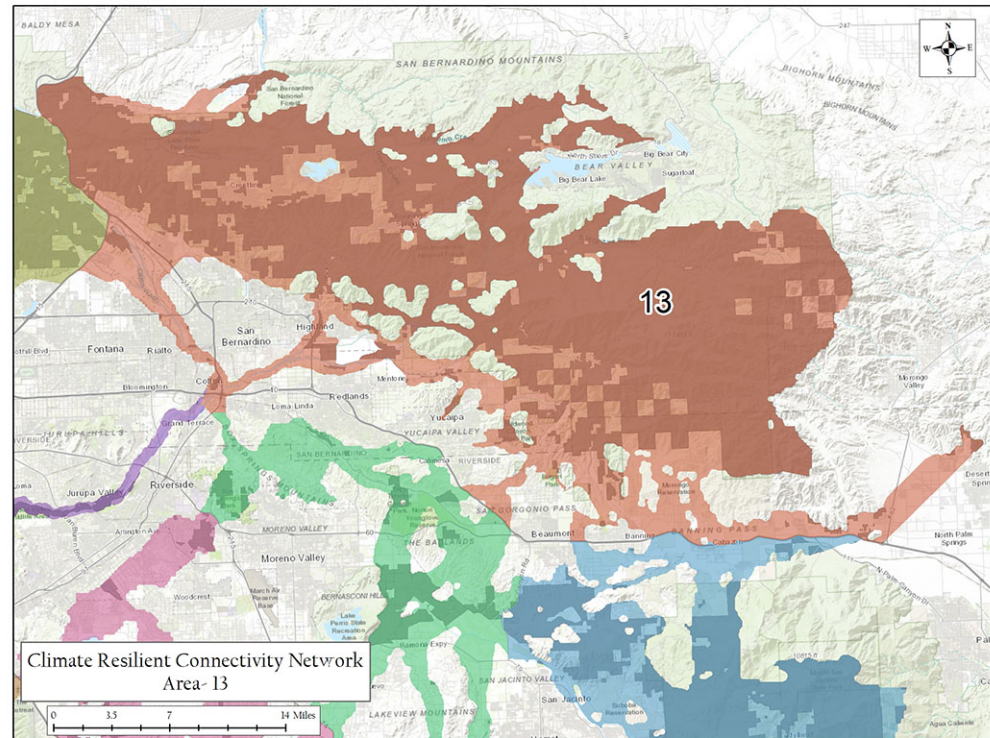
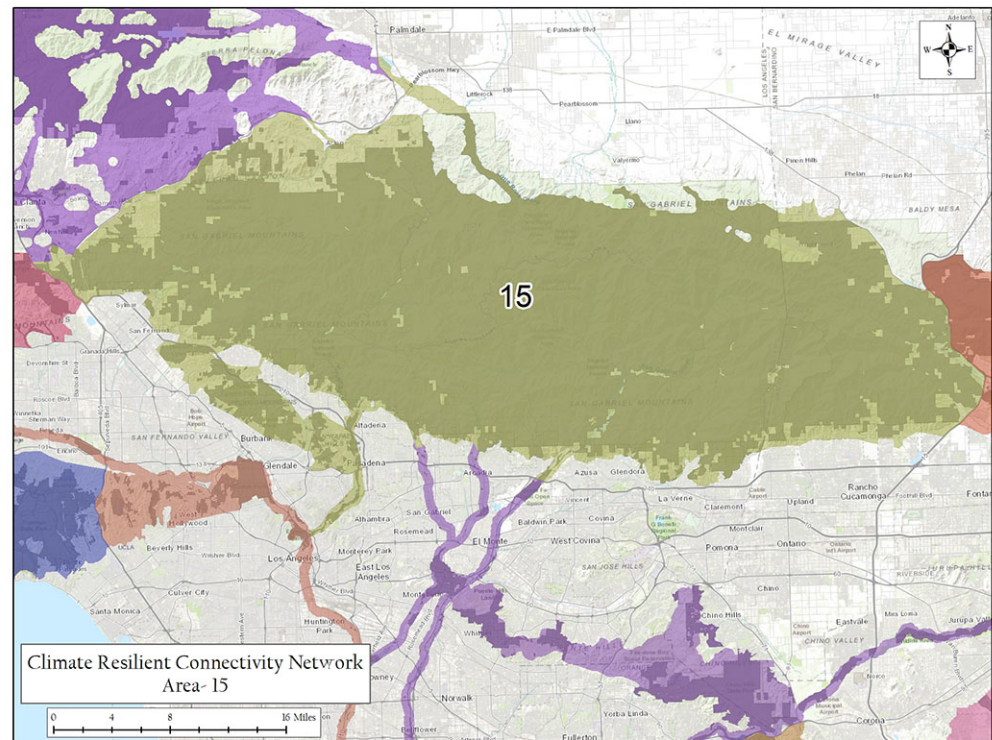| Land Cover	Vegetation Composition	
5.1% Urban	91.3% Vegetation	
0.8% Agriculture	*41.0% Chaparral*	*2.5% Coastal Sage Scrub*
1.0% Water or Wetlands	*25.9% Conifers*	*2.7% Grasslands*
1.8% Barren	*13.0% Hardwood*	*6.1% Desert Sage Scrub*
5 Focal Species: Big-eared woodrat, Bobcat, California spotted owl, Western toad, Wrentit		
Majority Land Owners: San Bernardino National Forest, BLM, The Wildlands Conservancy		

Description:

Area 13 is located in southern San Bernardino County and into northern Riverside County and encompasses a large segment of the San Bernardino Mountains within the San Bernardino National Forest as well as important linkage connections along the Santa Ana River and the Cajon Wash portion of Lytle Creek. This zone is bordered by I-10 to the south, I-215 and I-15 to the west, the Mojave desert to the north and east. The area serves as an important connection between fragmented habitats in the valleys of Riverside County and the conserved lands along the Transverse Range and also provide an important link between the San Gabriel Mountains to the west and the Little San Bernardino Mountains to the east. This area was previously identified as an important linkage in both the CEHC and SCML projects. Intense development in the foothills to the south of the mountains and heavily traveled roadways threaten connectivity in this area. High fire frequency along I-15 through the Cajon Pass also poses a risk to vegetation and habitat supporting connectivity. Wildlife road crossing improvements along mountain highways such as SR-330, SR-38, and SR-18 should be considered to support connectivity within this linkage, and improvements to roadways such as I-10, I-15, SR-62 and SR-210 could enhance connectivity to surrounding areas.

Area: 14

Chino/Puente Hills

Acres: 96,935

34.0% Conserved

(**Conserved areas shown in darker color on map**)

Climate Resilient Connectivity Network
Area- 14

Land Cover	Vegetation Composition	
42.1% Urban	52.5% Vegetation	
0.9% Agriculture	*7.0% Chaparral*	*6.0% Coastal Sage Scrub*
2.5% Water or Wetlands	*0.0% Conifers*	*25.1% Grasslands*
1.8% Barren	*13.5% Hardwood*	*0.7% Desert Sage Scrub*

5 Focal Species: California spotted owl, Big-eared woodrat, Bobcat, Western toad, Wrentit
Majority Land Owners: State Parks, US Army Corps of Engineers, County of Orange

Description:
Area 14 is located in Riverside, San Bernardino, Orange, and Los Angeles Counties, and encompasses the Chino and Puente Hills areas with fingers following riparian corridors along the Santa Ana and San Gabriel Rivers (including Eaton and Santa Anita Washes), as well as the Rio Hondo. San Bernardino National Forests and the Pacific Ocean. These riparian linkages were included based on prior conservation planning efforts including the Emerald Necklace Vision Plan, the Santa Ana River Parkway and Open Space Plan, and the Upper Santa Ana Habitat Conservation Plan. This zone is bordered by I-710 to the west, SR-210 to the north, I-215 to the east, and SR-91 to the south. The area serves as an important connection between the Santa Ana, San Bernardino, and San Gabriel Mountains through the intense development of the Los Angeles basin and the Inland Empire. This existing development, encroachment on and hardening of waterways, and continued expansion in the east threaten connectivity in this linkage as do the heavily traveled roadways in the area. SR-91 and SR-71 are among those where wildlife road crossing improvements can enhance wildlife connectivity.

Area: 15

San Gabriel Mountains

Acres: 642,164

83.3% Conserved
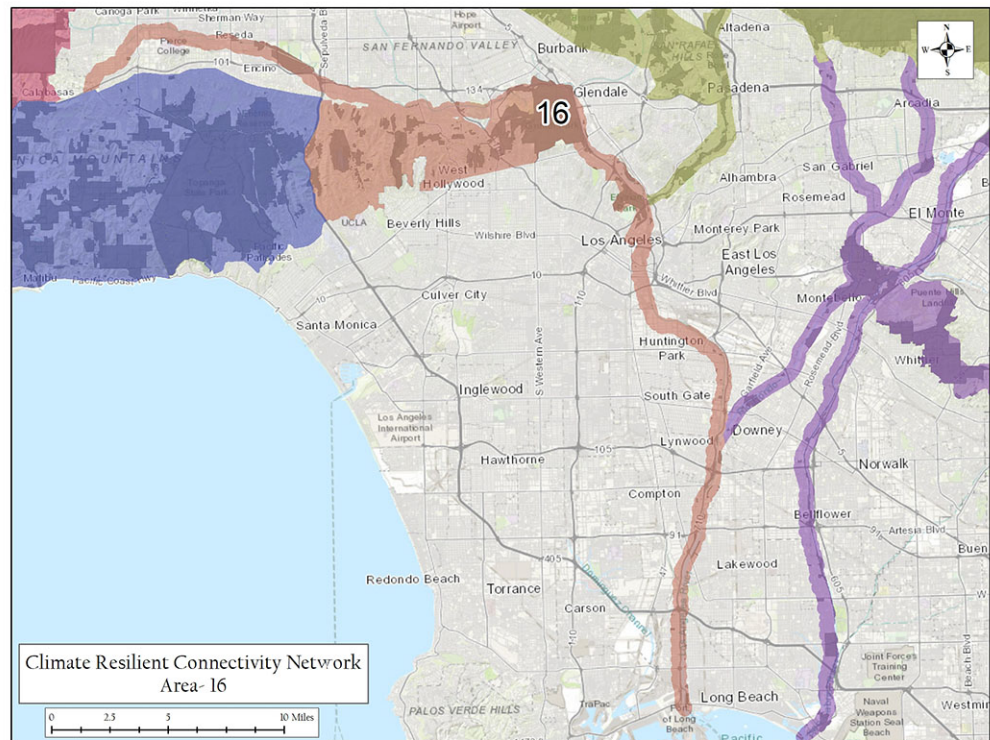
(Conserved areas shown in darker color on map)

Climate Resilient Connectivity Network
Area- 15

Land Cover	Vegetation Composition	
4.1% Urban	93.5% Vegetation	
0.0% Agriculture	*58.8% Chaparral*	*5.3% Coastal Sage Scrub*
0.5% Water or Wetlands	*16.0% Conifers*	*0.9% Grasslands*
1.9% Barren	*10.4% Hardwood*	*2.0% Desert Sage Scrub*
5 Focal Species: California spotted owl, Big-eared woodrat, Bobcat, Western toad, Wrentit		
Majority Land Owners: Angeles National Forest, City of Glendale, City of Santa Clarita		

Description:

Area 15 is located in Los Angeles and San Bernardino Counties and encompasses the San Gabriel Mountains in the Angeles National Forest as well as the Verdugo Mountains, San Rafael Hills, and the Arroyo Seco linkage to the Los Angeles River. This zone is bordered by SR-210 to the south, SR-14 to the west, and I-15 to the east. The full extent of this linkage was amended to reflect the boundary of the Rim of the Valley plan for expanding the conserved lands in and around the Santa Monica Mountains National Recreation Area. The area serves as an important connection to the San Bernardino Mountains to the east, the Simi Hills and Santa Monica Mountains to the west, and northward toward the Tehachapi Mountains. These connections were also identified in CEHC and SCML modeling. Development pressure along the foothills of the San Gabriel Mountains and in the San Fernando Valley threaten connectivity as has the associated increase in fire frequency in the area. Wildlife road crossing improvements to roadways such as SR-210 and SR-14 should be considered to enhance connectivity to surrounding areas.

Area: 16

Hollywood Hills

Acres: 45,268

20.5% Conserved

(Conserved areas shown in darker color on map)

Land Cover	Vegetation Composition	
73.7% Urban	23.2% Vegetation	
0.1% Agriculture	6.8% Chaparral	8.4% Coastal Sage Scrub
1.8% Water or Wetlands	0.0% Conifers	1.2% Grasslands
1.1% Barren	6.8% Hardwood	0.0% Desert Sage Scrub
4 **Focal Species**: Big-eared woodrat, Bobcat, Western toad, Wrentit		
Majority Land Owners: City of Los Angeles, Santa Monica Mountains Conservancy		

Description:

Area 16 is located in Los Angeles County and encompasses the Hollywood Hills, Griffith Park, and the Santa Monica Mountains east of I-405 as well as a riparian corridor along the Los Angeles River that runs from the north end of the Santa Monica Mountains, around Griffith Park, and to the Port of Long Beach. The full extent of this linkage was amended to include the Los Angeles River corridor identified for conservation in the Emerald Necklace Vision Plan and to reflect the boundary of the Rim of the Valley plan for expanding the conserved lands in and around the Santa Monica Mountains National Recreation Area. This zone is bounded by I-405 to the west, the San Fernando Valley to the north, and the City of Los Angeles to the south and east. The area serves as an important connection between the Santa Monica Mountains and the San Gabriel Mountains and the L.A. River provides an urban linkage through the dense development of the L.A. Basin. The intense development and roadways threaten connectivity in and habitat quality in this area. Wildlife road crossing improvements to roadways such as I-405 and US-101 should be considered to enhance connectivity to surrounding areas.

Area: 17

### Santa Monica Mountains

Acres: 184,363

44.7% Conserved

(Conserved areas shown in darker color on map)

Climate Resilient Connectivity Network
Area- 17
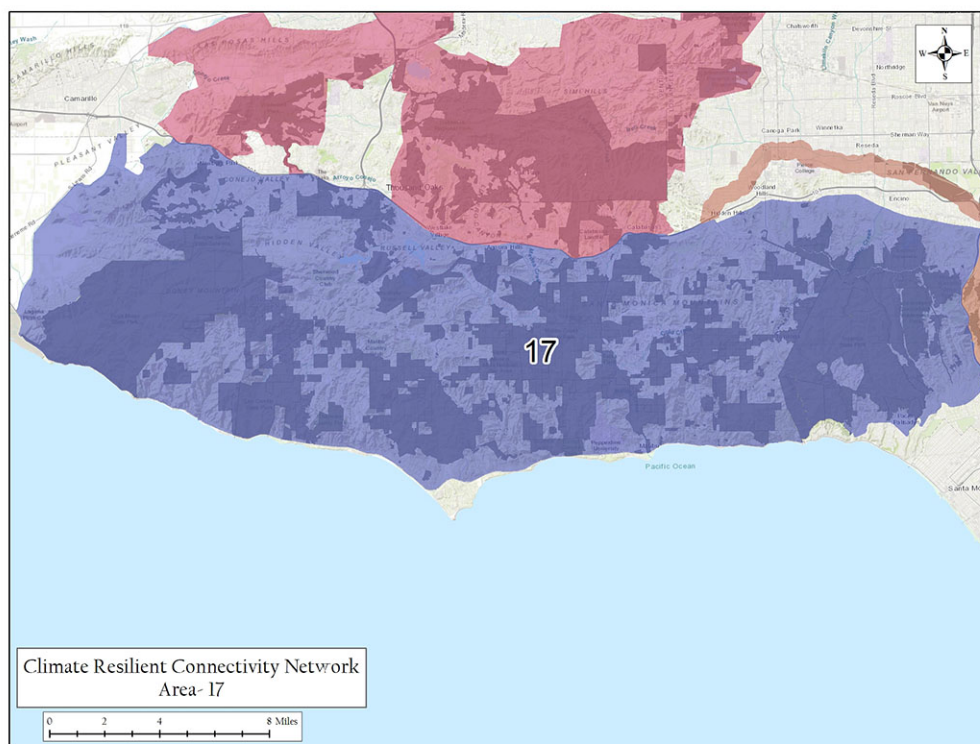
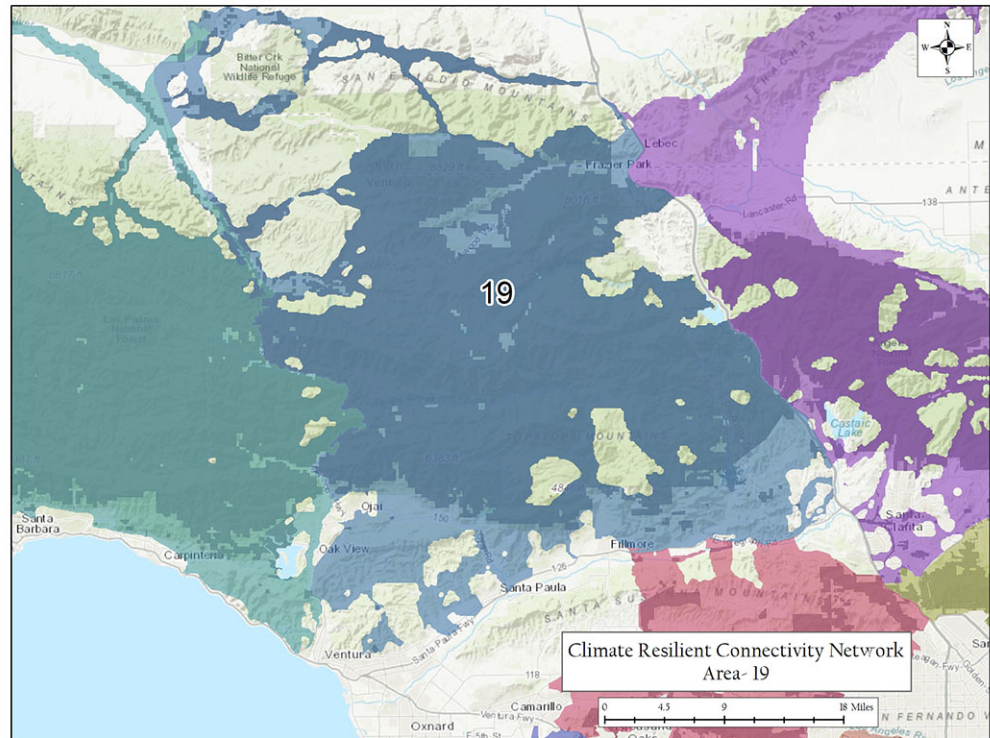| Land Cover	Vegetation Composition	
20.6% Urban	75.4% Vegetation	
2.6% Agriculture	*38.7% Chaparral*	*25.0% Coastal Sage Scrub*
0.4% Water or Wetlands	*0.0% Conifers*	*3.9% Grasslands*
1.0% Barren	*7.8% Hardwood*	*0.0% Desert Sage Scrub*
4 **Focal Species**: Big-eared woodrat, Bobcat, Western toad, Wrentit		
Majority Land Owners: State Parks, NPS, Mountain Recreation and Conservation Authority		

Description:

Area 17 is located in Los Angeles and Ventura Counties and encompasses the Santa Monica Mountains, including lands managed in the Santa Monica Mountains National Recreation Area, Point Mugu State Park, Topanga State Park, and Malibu Creek State Park. This zone is bounded by the Pacific Ocean to the south, US-101 to the north, I-405 to the east, and development around the town of Oxnard to the west. The full extent of this linkage was amended to reflect the boundary of the Rim of the Valley plan for expanding the conserved lands in and around the Santa Monica Mountains National Recreation Area. The area serves as an important east-west connection between the Santa Monica Mountains and the San Gabriel Mountains and north-south from the coast through the Simi Hills to the Sierra Madre. Linkages in this area were previously identified by both the CECH and SCML projects. Development pressure around the mountains threatens connectivity as has an increase in fire frequency in the area. Wildlife road crossing improvements to roadways such as I-405 and US-101 should be considered to enhance connectivity to surrounding areas.

Area: 18

Santa Susanna Mountains/Simi Hills

Acres: 167,477

27.5% **Conserved**

(Conserved areas shown in darker color on map)

Climate Resilient Connectivity Network
Area- 18
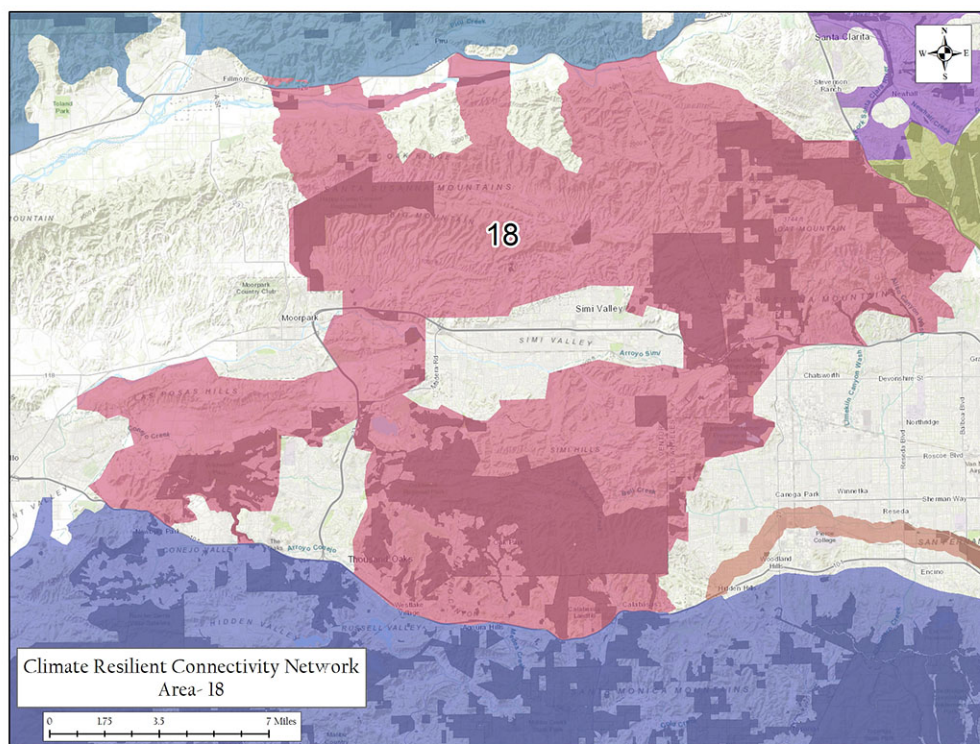
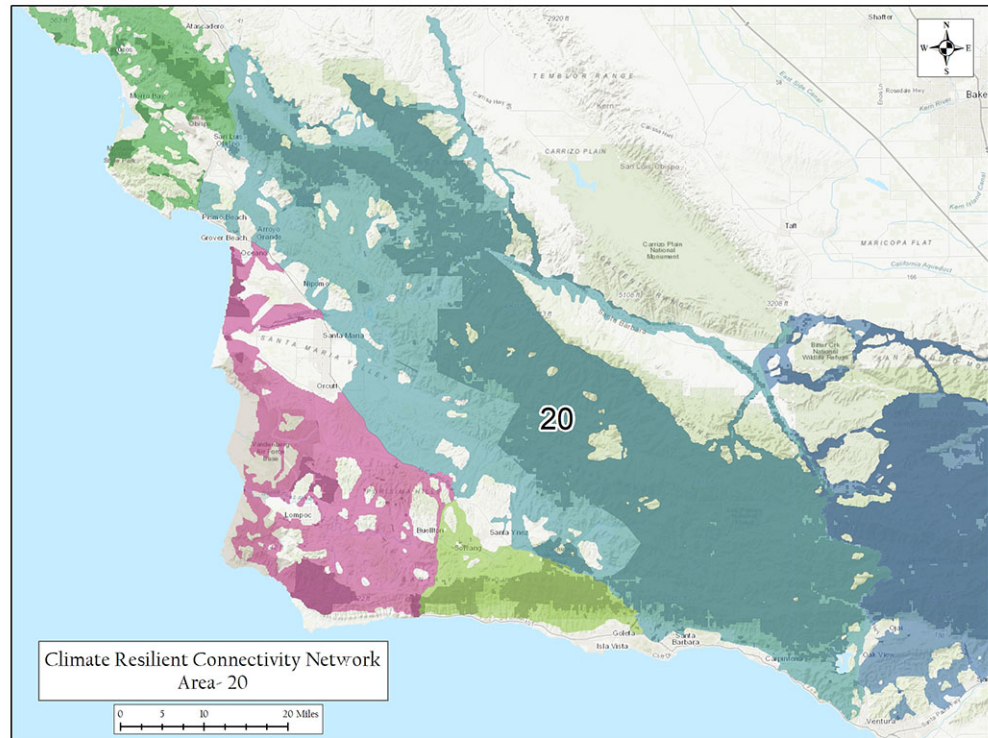| Land Cover	Vegetation Composition	
14.2% Urban	78.5% Vegetation	
4.1% Agriculture	*20.3% Chaparral*	*31.7% Coastal Sage Scrub*
0.4% Water or Wetlands	*0.4% Conifers*	*16.9% Grasslands*
2.8% Barren	*9.2% Hardwood*	*0.0% Desert Sage Scrub*
4 Focal Species: Big-eared woodrat, Bobcat, Western toad, Wrentit		
Majority Land Owners: Mountains Recreation and Conservation Authority, Santa Monica Mountains Conservancy, NPS		

Description:

Area 18 is located in Los Angeles and Ventura Counties and encompasses the Santa Susana Mountains and Agoura and Simi Hills, including several open space parks and canyon preserves managed by the National Park Service, City of Thousand Oaks, and the Mountains Recreation and Conservation Authority. This zone is bounded by Interstate 5 to the east, US-101 to the south, and SR-126 to the north. The full extent of this linkage was amended to reflect the boundary of the Rim of the Valley plan for expanding the conserved lands in and around the Santa Monica Mountains National Recreation Area. The area serves as an important east-west connection between the Santa Monica Mountains and the San Gabriel Mountains and north-south from the Santa Monica Mountains to the Sierra Madre. Linkages in this area were previously identified by both the CECH and SCML projects. Development pressure threatens connectivity as has an increase in fire frequency in the area. Wildlife road crossing improvements to roadways such as SR-118 could improve connectivity within this linkage and improvements to I-405 and US-101 should be considered to enhance connectivity to surrounding areas.

Area: 19

Topatopa Mountains

Acres: 644,295

72.6% **Conserved**

(Conserved areas shown in darker color on map)

Climate Resilient Connectivity Network Area- 19

Land Cover	Vegetation Composition	
1.3% Urban	93.7% Vegetation	
2.0% Agriculture	*45.6% Chaparral*	*10.8% Coastal Sage Scrub*
0.4% Water or Wetlands	*20.7% Conifers*	*9.1% Grasslands*
2.6% Barren	*7.3% Hardwood*	*0.2% Desert Sage Scrub*

5 Focal Species: Big-eared woodrat, Bobcat, California spotted owl, Western toad, Wrentit

Majority Land Owners: Angeles and Los Padres National Forests

Description:

Area 19 is located primarily in Ventura County, extending to Los Angeles and Kern Counties, and encompasses Lake Piru, the Topatopa and Sespe Mountains, and Frazier Park in the southeastern portion of the Los Padres National Forest. This zone is bounded by Interstate 5 to the east, SR-126 to the south, SR-33 to the west, and the Central Valley to the north. The area serves as an important east-west connection between the San Gabriel and Tehachapi Mountains to the east and the Coast Range to the west. It also provides an important linkage out of the isolated Santa Monica Mountains and Simi Hills to the large, contiguous open spaces in the Los Padres National Forest. Overlapping linkages were previously identified by both the CEHC and SCML projects. This area is rugged and largely isolated from the impacts of development, but increasing fire frequency at the wildland urban interface to the south poses a risk to vegetation and habitat supporting connectivity. Wildlife road crossing improvements along mountain highways such as SR-150, Lockwood Valley Road, and SR-95 should be considered to support connectivity within this linkage, and improvements to roadways such as SR-33, SR-126, and I-5 could enhance connectivity to surrounding areas.

Area: 20

Los Padres National Forest

Acres: 1,378,386

56.6% Conserved

(Conserved areas shown in darker color on map)

Climate Resilient Connectivity Network
Area- 20

Land Cover	Vegetation Composition	
0.6% Urban	95.0% Vegetation	
3.0% Agriculture	*48.2% Chaparral*	*11.4% Coastal Sage Scrub*
0.5% Water or Wetlands	*1.5% Conifers*	*13.1% Grasslands*
0.8% Barren	*20.6% Hardwood*	*0.2% Desert Sage Scrub*
5 Focal Species: Big-eared woodrat, Bobcat, California spotted owl, Western toad, Wrentit		
Majority Land Owners: Los Padres National Forest, BLM		

Description:

Area 20 is located in Santa Barbara, San Luis Obispo, and Ventura Counties and encompasses the San Rafael Range and the Sierra Madre Mountains in the Los Padres National Forest as well as riparian linkages following the Cuyama River and its drainages. This zone is bounded by SR-33 to the east, the City of Santa Barbara to the south, and SR-154 and US-101 to the west. The area serves as an important linkage along the south central coast providing north-south connectivity and overlaps with linkages identified in the CEHC assessment. This area is rugged and largely isolated from the impacts of development, except for areas to the west at the interface of towns such as Santa Ynez, Santa Maria, and San Luis Obispo. Increasing fire frequency at the wildland urban interface to the south also poses a risk to vegetation and habitat supporting connectivity. Wildlife road crossing improvements along mountain highways such as SR-166 should be considered to support connectivity within this linkage, and improvements to roadways such as SR-154 and US-101 could enhance connectivity to surrounding areas.

Area: 21

Santa Ynez Mountains

Acres: 120,646

36.6% **Conserved**
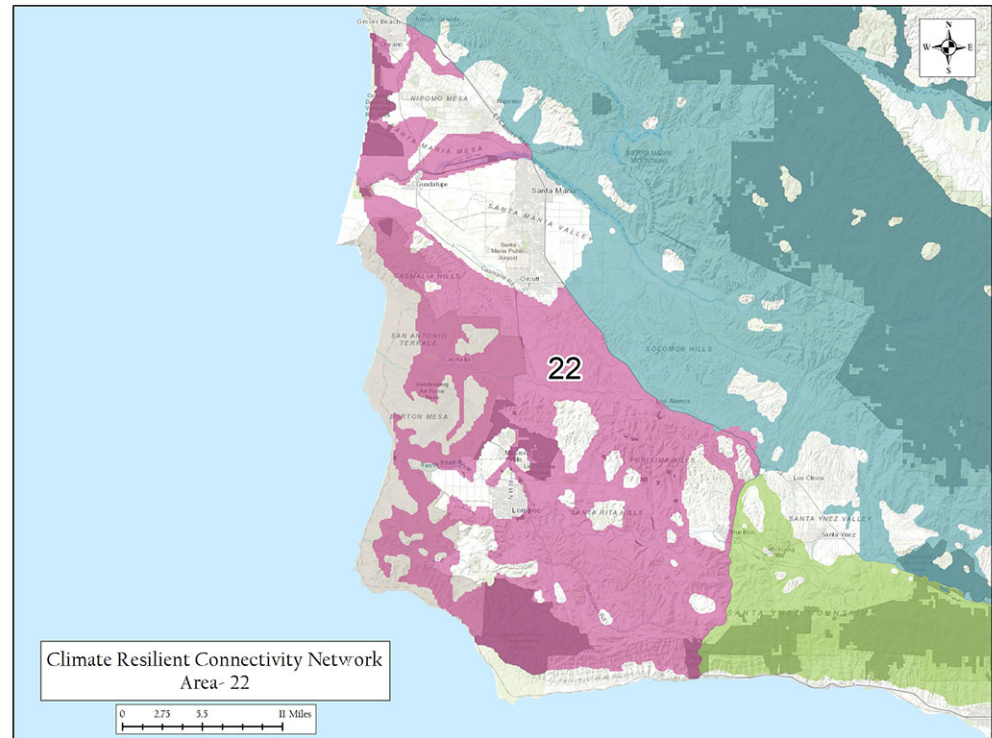
(Conserved areas shown in darker color on map)

Climate Resilient Connectivity Network
Area- 21
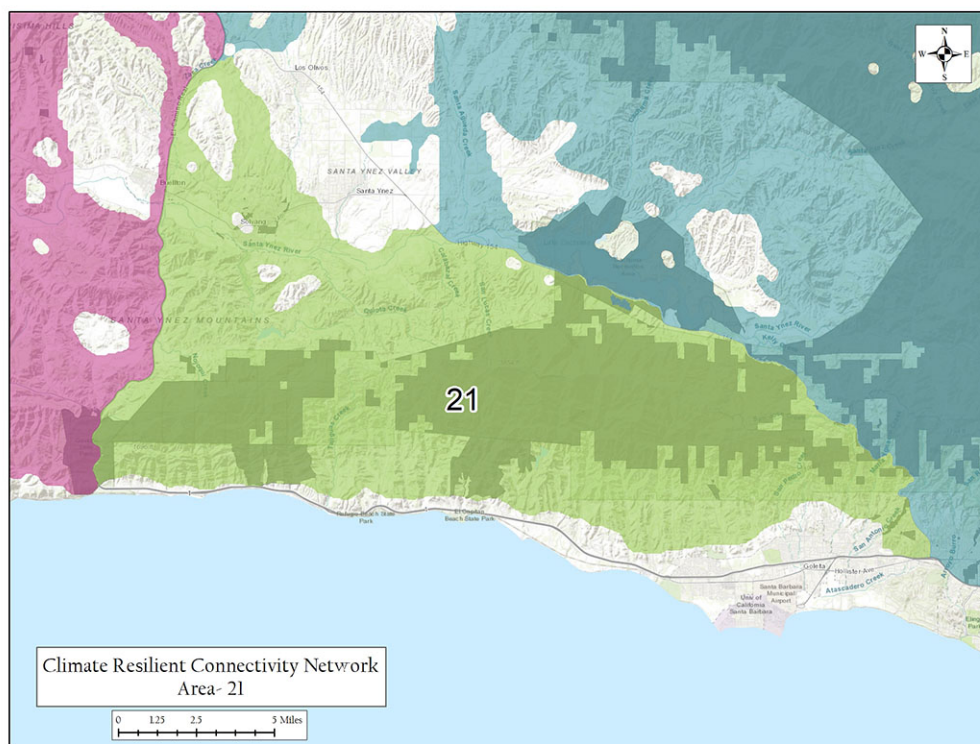
Land Cover	Vegetation Composition	
2.2% Urban	88.9% Vegetation	
7.8% Agriculture	*42.4% Chaparral*	*8.2% Coastal Sage Scrub*
0.2% Water or Wetlands	*0.0% Conifers*	*14.2% Grasslands*
0.9% Barren	*24.1% Hardwood*	*0.0% Desert Sage Scrub*
4 **Focal Species**: Big-eared woodrat, Bobcat, Western toad, Wrentit		
Majority Land Owners: Los Padres National Forest, State Parks		

Description:

Area 21 is located in Santa Barbara County and encompasses the Santa Ynez Mountains in the Los Padres National Forest and includes a portion of Gaviota State Park and Baron Ranch as well as agricultural lands in the Santa Ynez Valley. This zone is bounded by SR-154 to the east, US-101 to the west, and development on the coast from Goleta west along US-101/SR-1. The area serves as an important linkage connecting the interior mountains to those immediately along the coast. The rugged mountains are somewhat isolated from the impacts of development, but connectivity could be affected by development and activity in and around the towns of Goleta, Solvang, and in the Santa Ynez Valley. Wildlife road crossing improvements along SR-246 could enhance connectivity within this linkage, and improvements to SR-154 and US-101 could support connectivity to/from surrounding areas.

Area: 22

Central Coast

Acres: 297,336

11.2% Conserved

(Conserved areas shown in darker color on map)

Climate Resilient Connectivity Network
Area- 22

Land Cover	Vegetation Composition	
1.4% Urban	89.3% Vegetation	
5.6% Agriculture	*3.8% Chaparral*	*29.6% Coastal Sage Scrub*
0.3% Water or Wetlands	*0.6% Conifers*	*36.1% Grasslands*
3.4% Barren	*19.4% Hardwood*	*0.0% Desert Sage Scrub*
4 **Focal Species**: Big-eared woodrat, Bobcat, Western toad, Wrentit		
Majority Land Owners: Department of Defense (Vandenberg Airforce Base), Jack and Laura Dangermond Preserve (TNC), State Parks		

Description:

Area 22 is located in Santa Barbara and San Luis Obispo Counties and encompasses important agricultural lands in the Santa Maria Valley, the Purisima and Santa Rita Hills, Burton Mesa, as well as portions of the Santa Ynez River. This area includes Vandenburg Air Force Base, the Jack and Laura Dangermond Preserve, a 24,000-acre nature preserve that includes lands surrounding Point Conception, and a portion of Gaviota State Park. This zone is bounded by the coast to the south and west, and US-101 to the north and east. The area serves as an important linkage connecting the interior mountains to those immediately along the coast. Although its location along the rugged coast provides some protection for this linkage area, some impacts of development near Lompoc and agricultural activities in the valley may affect connectivity. Wildlife road crossing improvements along secondary roads could enhance connectivity within this linkage, and improvements to US-101 could support connectivity to/from surrounding areas.

Area: 23

Morro Bay

Acres: 377,303

## 21.2% Conserved

(Conserved areas shown in darker color on map)

Climate Resilient Connectivity Network
Area- 23
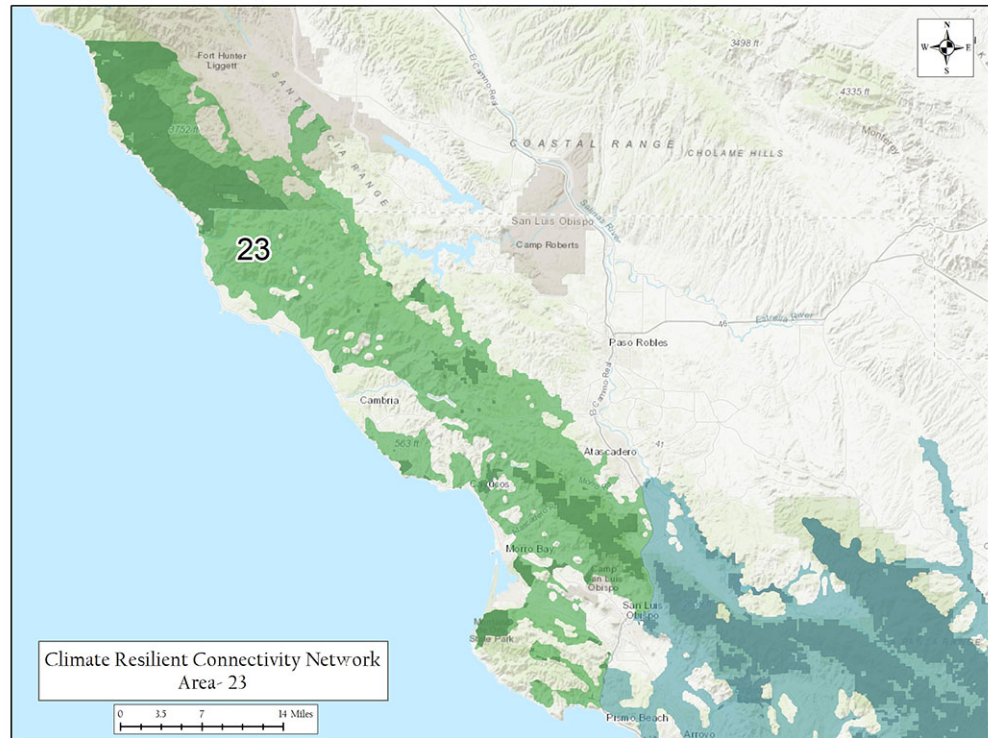
Land Cover	Vegetation Composition	
0.2% Urban	97.9% Vegetation	
1.3% Agriculture	*25.3% Chaparral*	*9.7% Coastal Sage Scrub*
0.3% Water or Wetlands	*3.5% Conifers*	*26.9% Grasslands*
0.2% Barren	*32.5% Hardwood*	*0.0% Desert Sage Scrub*
4 **Focal Species**: Big-eared woodrat, Bobcat, Western toad, Wrentit		
Majority Land Owners: Los Padres National Forest, State Parks, BLM		

Description:

Area 23 is located along the coast in San Luis Obispo and Monterey Counties, encompassing agricultural lands as well as portions of the Santa Lucia Range on the Los Padres National Forest, Montana de Oro, Morro Bay, and San Simeon State Parks, as well as the western edge of Fort Hunter Liggett. This zone is bounded by the coast to the west and US-101 to the southeast. The area serves as an important linkage along the central coast, particularly for species that prefer the oak woodland vegetation that is the dominant vegetation type, and was also previously identified in the CEHC analysis. Rural roads and increased fire frequency may threaten connectivity in this linkage. Wildlife road crossing improvements along secondary roads could enhance connectivity within the linkage, and improvements to US-101 could support connectivity to/from surrounding areas.

Area: 24

Tehachapi

Acres: 411,055

**35.8% Conserved**

(Conserved areas shown in darker color on map)

Climate Resilient Connectivity Network
Area- 24
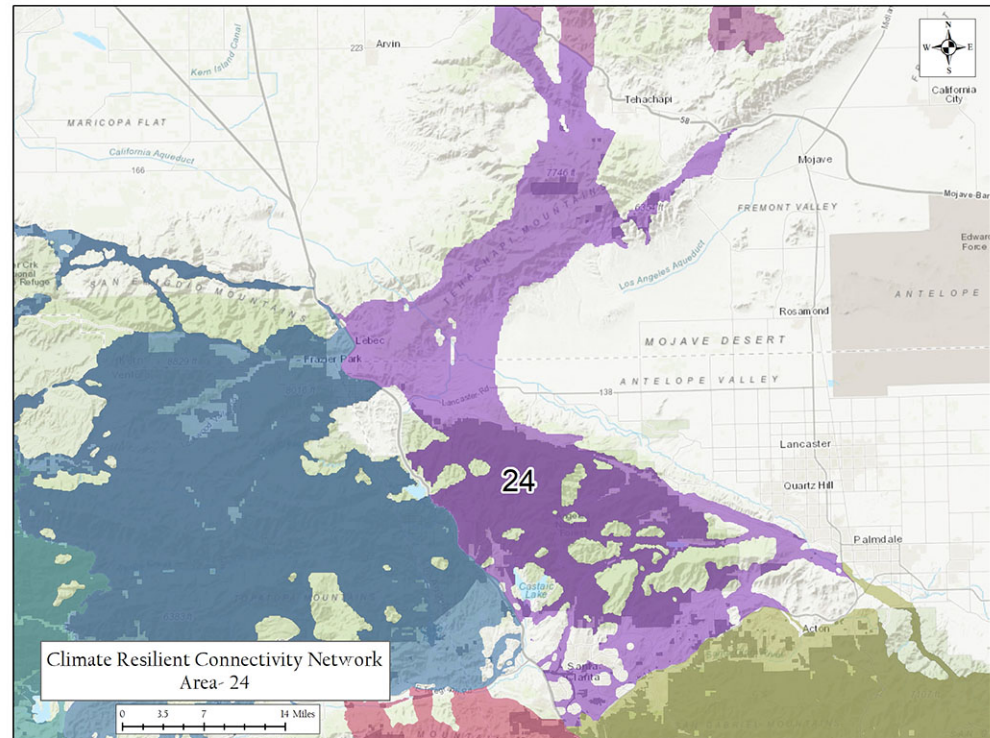
Land Cover	Vegetation Composition	
4.3% Urban	93.5% Vegetation	
0.3% Agriculture	*45.2% Chaparral*	*5.9% Coastal Sage Scrub*
0.8% Water or Wetlands	*5.2% Conifers*	*18.9% Grasslands*
1.1% Barren	*16.5% Hardwood*	*1.8% Desert Sage Scrub*
4 **Focal Species**: Big-eared woodrat, Bobcat, Western toad, Wrentit		
Majority Land Owners: Angeles National Forest, BLM, California Dept. of Water Resources		

Description:

Area 24 is located in Los Angeles and Kern Counties, encompassing lands along the Santa Clara River and the mountains between Antelope Valley and Castaic Lake on the Angeles National Forest up through the Tehachapi Mountains, including the lands within Tejon Ranch. Some of this land in this area is used for cattle grazing and other agricultural activities. This zone is bounded by Interstate 5 to the west, SR-58 to the north, SR-14 to the south, and the Mojave Desert and Antelope Valley to the east. The area serves as a critical linkage between the southern California Transverse and coastal mountains to the southern Sierra Nevada, which was previously identified in both the CEHC and SCML analyses. Development in Santa Clarita, Tehachapi and the Antelope Valley as well as increasing fire frequency along the I-5 corridor pose a threat to connectivity within this linkage. Wildlife road crossing improvements along SR-138 and other secondary roads could enhance connectivity within the linkage, and improvements to I-5, SR-58, and SR-14 could support connectivity to/from surrounding areas.

Area: 25

Lower Sequoia

Acres: 702,734

73.8% **Conserved**

(Conserved areas shown in darker color on map)

Climate Resilient Connectivity Network
Area- 25
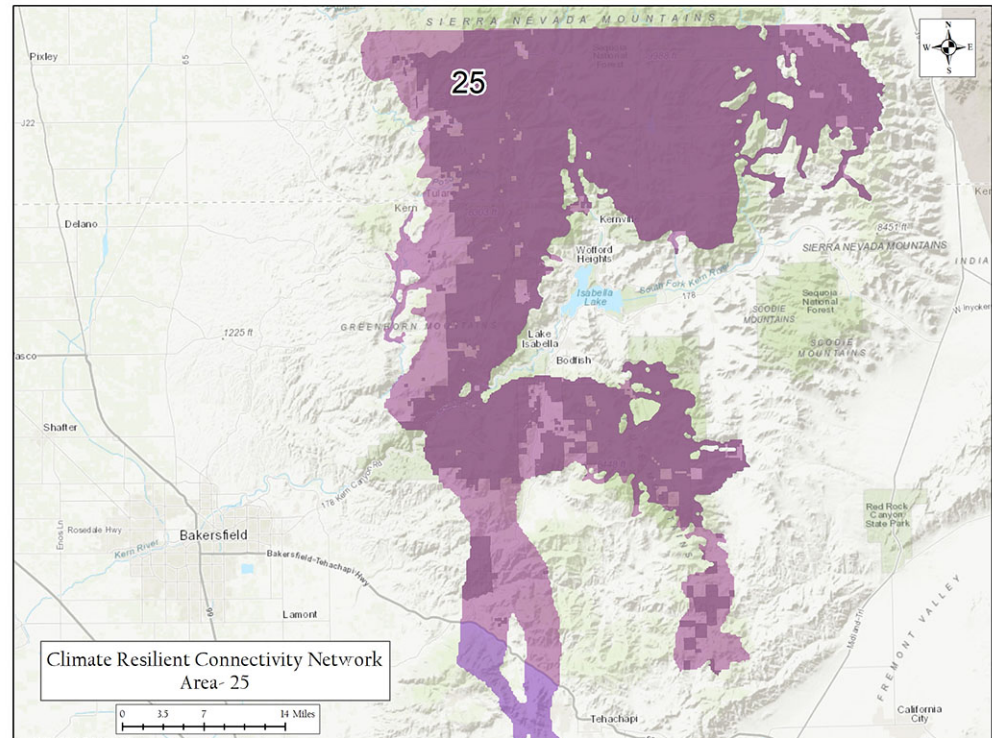
Land Cover	Vegetation Composition	
0.0% Urban	97.8% Vegetation	
0.0% Agriculture	*26.4% Chaparral*	*0.0% Coastal Sage Scrub*
0.4% Water or Wetlands	*34.9% Conifers*	*10.8% Grasslands*
1.8% Barren	*25.0% Hardwood*	*0.6% Desert Sage Scrub*
2 **Focal Species**: Big-eared woodrat, Western toad		
Majority Land Owners: Sequoia National Forest and Giant Sequoia National Monument, BLM, Tollhouse Ranch (TNC)		

Description:

Area 25 is located in Kern and Tulare Counties, encompassing the southernmost section of the Sierra Nevada within the Sequoia National Forest that meet the Tehachapi Mountains, and includes some lands suitable for cattle grazing. This zone is bounded by the Central Valley to the west, SR-58 to the south, and US-395 to the east. The area serves as a critical linkage between the southern California Transverse and coastal mountains to the southern Sierra Nevada, and was identified by both the CEHC and SCML as a key linkage zone. Activity along nearby roads and railways as well as a stand replacing fire in the overly dense forest in the mountains pose a threat to connectivity within this linkage. Wildlife road crossing improvements along SR-178 could enhance connectivity within the linkage, and improvements to SR-58, and US-395 could support connectivity to/from surrounding areas.

APPENDIX B: DECISION-MAKING WITH THE CLIMATE RESILIENT CONNECTIVITY DATA PRODUCTS

Prioritization of Linkage Network for Decision-Making

As described in the main report, we established two different prioritization strategies to facilitate decision-making using the linkage network we generated. One was developed to support the identification of acquisition targets while the other focused on management targets where actions may be needed on existing conserved lands. We began the prioritization process by segmenting the linkage network into subregions based on the locations where major highways or freeways intersected the network to attribute each linkage type within these subregions.

We used this approach to not only support the use of our data products in management and planning decisions, but also to demonstrate the development of a prioritization framework. We selected broadly applicable prioritization targets and data inputs that were available across the entire linkage network area. However, this process could be repeated using different input metrics, prioritization goals, or even different spatial configurations of that data. For example, where restoration efforts are being implemented, a metric such as invasive species cover may be useful. Additionally, the linkage network could be subset to examine priorities such as acquisitions or mitigations targets within a Natural Community Conservation Plan (NCCP) or Conceptual Area Protection Plan (CAPP) area. This would require dissolving the linkage network subareas and splitting them using the geography of the desired framework. Then, summary metrics for each newly identified segment can be calculated based on the input variables selected based on the prioritization goal.

To assess priorities for the two prioritizations we demonstrated, we used the same Environmental Evaluation Management System (EEMS) hierarchical decision-making tool employed in our species-specific prioritization and multispecies network assembly. We used this tool to quantitatively prioritize patches within our established networks by deriving an overall value for each patch based on metrics related to conservation need or value for acquisitions and threats to connectivity for management priorities. For further information about EEMS and fuzzy logic in general, see: https://eemsonline.org/static/docs/EEMS2.0_Manual.pdf

To create any prioritization, key variables or attributes must first be thoughtfully considered, then appropriate data sources can be gathered and summarized by linkage segment. Once values have been attributed to each polygon segment, the EEMS modeling process reads in each parameter and uses one of three fuzzifying functions to rescale the values so they can then be selected or combined through the use of EEMS operators. Rescaling our selected prioritization metrics into fuzzy space involves reinterpreting metrics on a scale from being 'completely untrue', wherein they are assigned a value of -1, to being 'completely true', and thus receiving a value of 1.

Common Values for Prioritization

Because biodiversity and connectivity are the primary goals of the linkage plan, both prioritization strategies included metrics derived from our modeling products as well as the

statewide California Department of Fish and Wildlife (CDFW) biodiversity database, Areas of Conservation Emphasis III (ACE III). Based on the outputs of modeling from the Climate Resilient Connectivity project, we included the number of focal species represented in a segment, as well as the maximum priority value for any single species within the linkage. From the ACE III database, we included a metric of overall biodiversity, rare species diversity, and a connectivity ranking status. The connectivity product used to generate this metric was developed by CDFW staff and is a rank of connectivity value based on a combination of available linkage planning efforts. For the southern California region, these available efforts include the South Coast Missing Linkages Plan, the California Essential Habitats Connectivity Project data, and The Nature Conservancy's Omniscape assessment of statewide structural connectivity. After assessing these core values of each linkage, we included additional metrics for the two different strategies.

Acquisition Priority

To focus the acquisition model (Figure B1) on unconserved lands, we removed all large, conserved segments of the network. As these areas are already conserved, they did not need to be included in a prioritization for acquisition. The remaining linkage segment types were further attributed based on conserved lands status, and potential for future conversion to urban land uses. The descriptions of these values and their sources are included in Table B1. Using this information, we identified locations that are currently undeveloped and prioritized them if they were important for multiple focal species, had high biodiversity, were either near to or included a large proportion of conserved lands, and were likely to be converted to urban land-uses under either of the future development scenarios considered. Table B2 provides details about the range of input values for each parameter and how they are rescaled into fuzzy space (*i.e.*, "Fuzzified"), before being used in the model.

After initial values were fuzzified as described in Table B2, we combined some of the input metrics in an intermediate step before the final priority value was calculated. This was done using an OR operator in EEMS that selects for the highest value among input values. For example, we combined the overall biodiversity and rare biodiversity rankings into a *Richness* metric because we wanted to prioritize linkages that had either high overall biodiversity or high rarity rather than requiring a linkage have both. We used the same process for the proportion conserved and distance to large conserved lands, which were combined into a *Conserved Land* metric, as well as the values from the two land use projections for 2100, which were combined into a *Maximum Probability of Development*. Once these intermediate values were calculated we averaged all inputs to produce a single priority value. The final result of the model was the *Acquisition Priority* for the linkage area. It was constructed by using an EEMS UNION operator to take the average of the rescaled/fuzzified values of *Species Count, Maximum Multi-Species Priority, Connectivity Rank, Richness, Conserved Land, and Maximum Probability of Development*.

Management Target Priority

For the management target model, we examined the entire linkage network so actions to establish or enhance connectivity on conserved lands could be prioritized based on risks to functioning (Figure B2). The strategy included the same biological/biodiversity values as the acquisition models described above, but in contrast, focused on areas where management action could potentially mitigate the most pressing threats to connectivity in the region (Table B3).

These included either the amount of impervious surface or average distance to nearest urban edge, road density, and average fire return-interval departure (FRID) which could help identify areas that may be at risk of vegetation-type conversion. Whereas our acquisition model selected for maximum or minimum values of most variables, the management prioritization targeted areas with middling values of risk for action. For example, where there is a very high degree or close proximity to urbanization, there is often little that can be done. On the opposite end of the spectrum are areas that have little existing development or are far from urban areas, which are less likely to need management intervention to improve connectivity. Our prioritization targeted areas where some mitigation of risks is needed and where action is likely to have a measurable impact on connectivity. Table B4 provides details about the range of input values for each parameter and how they are rescaled into fuzzy space (*i.e.*, "Fuzzified"), before being used in the model.

As in the acquisition model, we combined some of the input metrics described in Table B4 in an intermediate step before the final priority value was calculated. This was again done using an OR operator in EEMS that selects for the highest value among input values. In addition to the *Richness* metric that combined the overall biodiversity and rare biodiversity rankings, we combined the percent impervious and distance to urban edge metrics into a single Urbanization metric. Once these intermediate values were calculated we averaged all inputs to produce a single priority value. The final result of the model was the *Management Target Priority* for the network of linkages and conserved areas. It was constructed by taking the average, using an EEMS UNION operator, of the rescaled/fuzzified values of *Species Count, Maximum Multi-Species Priority, Connectivity Rank, Richness, Urbanization, Average Road Density, and the Fire Return Interval Departure*.
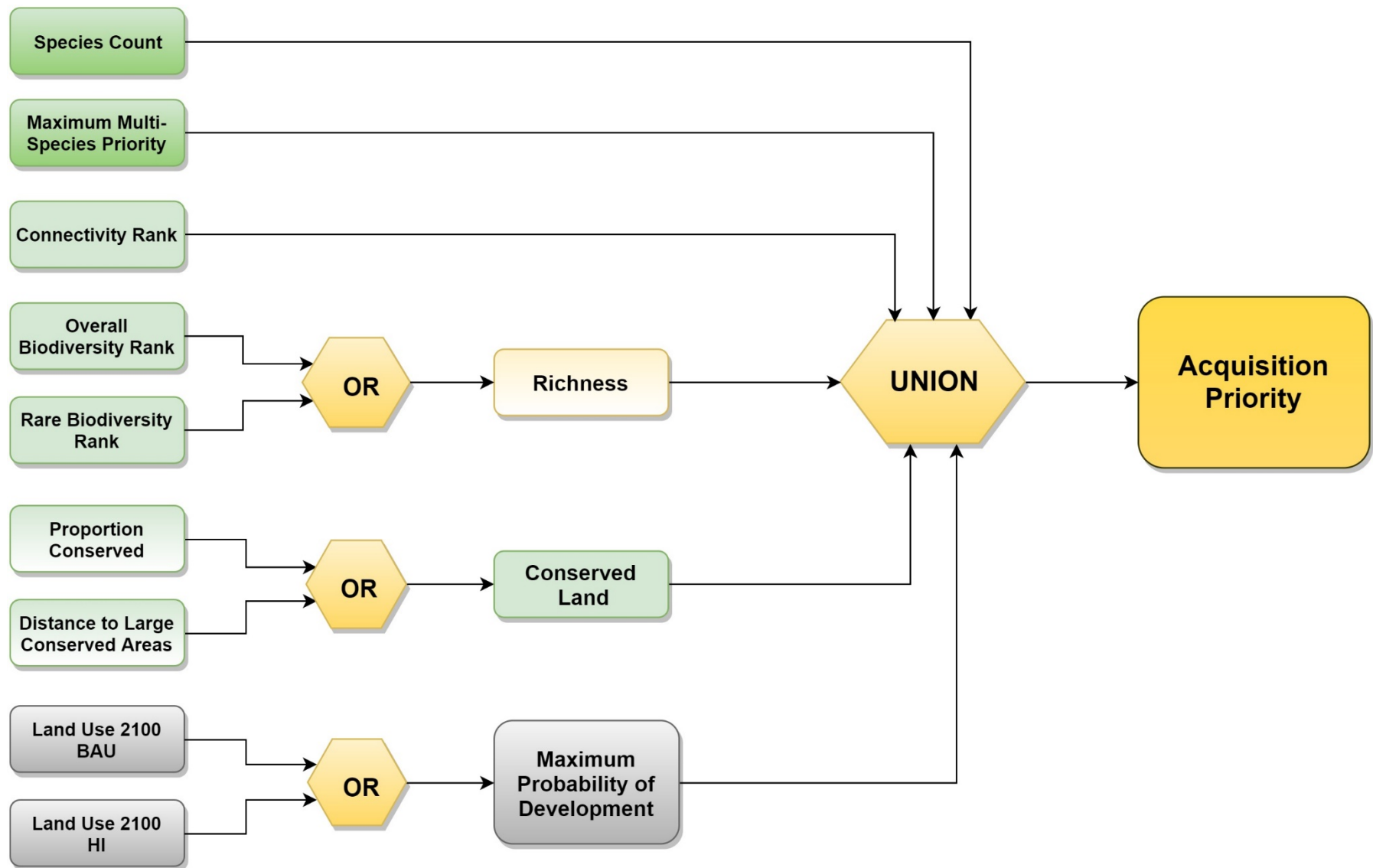
Figure B1. Diagram of prioritization strategy for acquisition decision-making. All variables were evenly weighted in the final union.

Table B1. Description of variables and sources used in the acquisition prioritization model depicted in Figure B1.

Attribute	Description	Source
Species Count	Count of individual species linkages that overlap linkage segment (up to 5 species)	Climate Resilient Connectivity focal species modeling
Maximum Multi-Species Priority	Averaged maximum priority value of within-species prioritization for any given species across each linkage segment	Climate Resilient Connectivity focal species modeling
Connectivity Rank	Averaged ecoregional connectivity ranking based on compiled connectivity data, including California Essential Habitats Connectivity and South Coast Missing Linkages (ranks range from 1-5 with 5 being the highest)	California Department of Fish and Wildlife, Areas of Conservation Emphasis III (ACE III) database
Overall Biodiversity Rank	Averaged ecoregional biodiversity ranking; ranks range from 1-5 with 5 being the highest.	California Department of Fish and Wildlife, Areas of Conservation Emphasis III (ACE III) database
Rare Biodiversity Rank	Averaged ecoregional rarity ranking; ranks range from 1-5 with 5 being the highest.	
Proportion Conserved	Proportion of each linkage segment in conservation status	Combined data from the SANDAG and the California Protected Areas Database (GreenInfo Network 2018)
Distance to Large Conserved Areas	Calculated as the distance from the centroid of each linkage segment to the nearest edge of any block of conserved land >1,000 acres in size	
Land Use in 2100 Business As Usual	Proportion of each linkage segment projected to have converted to urban land use by 2100 under a business as usual growth scenario.	USGS California land-change projections (Sleeter *et al.* 2017)
Land Use in 2100 High Rate of Development	Proportion of each linkage segment projected to have converted to urban land use by 2100 under a business as usual scenario with a simulated high population growth trajectory.	

Table B2. Range of input values and processing approach to fuzzify variables for the acquisition prioritization model depicted in Figure B1 using the EEMS modeling toolbox.

| Attribute Description	Fuzzify Function	Intermediate Combination	Final Combination
Species Count	Higher value is more TRUE Values from 1 - 5 Convert to Fuzzy Category with these Pairs: 1,.2 : 2,.4 : 3,.6 : 4,.8 : 5,1		The *average* of all inputs = **Acquisition Priority** (UNION)
Maximum Multi-Species Priority	Higher value is more TRUE; Values fall into -1 to 1 range, so no need to fuzzify.		
Connectivity Rank	Higher value is more TRUE Values from 0 - 3.83 False Threshold = 0, True Threshold = 3.83		
Overall Biodiversity Rank	Higher value is more TRUE Values in range 0 - 5 Convert to Fuzzy Curve with these points: 0,-1 : 3,0 : 5,1	The *most true* value = **Richness** (OR)	
Rare Biodiversity Rank	Same as Overall Biodiversity Rank		
Proportion Conserved	Higher value is more TRUE Values from 0 - 0.9 False Threshold = 0, True Threshold = 1	The *most true* value = **Conserved Land** (OR)	
Distance to Large Conserved Areas	Higher value is more FALSE Values from 0 - 18320 False Threshold = 18320, True Threshold = 0		
Land Use in 2100 Business As Usual	Higher value is more TRUE Values from 0 - 0.77 False Threshold = 0, True Threshold = 0.77	The *most true* value = **Maximum Probability of Development** (OR)	
Land Use in 2100 High Rate of Development	Higher value is more TRUE Values from 0 - 0.75 False Threshold = 0, True Threshold = 0.75		
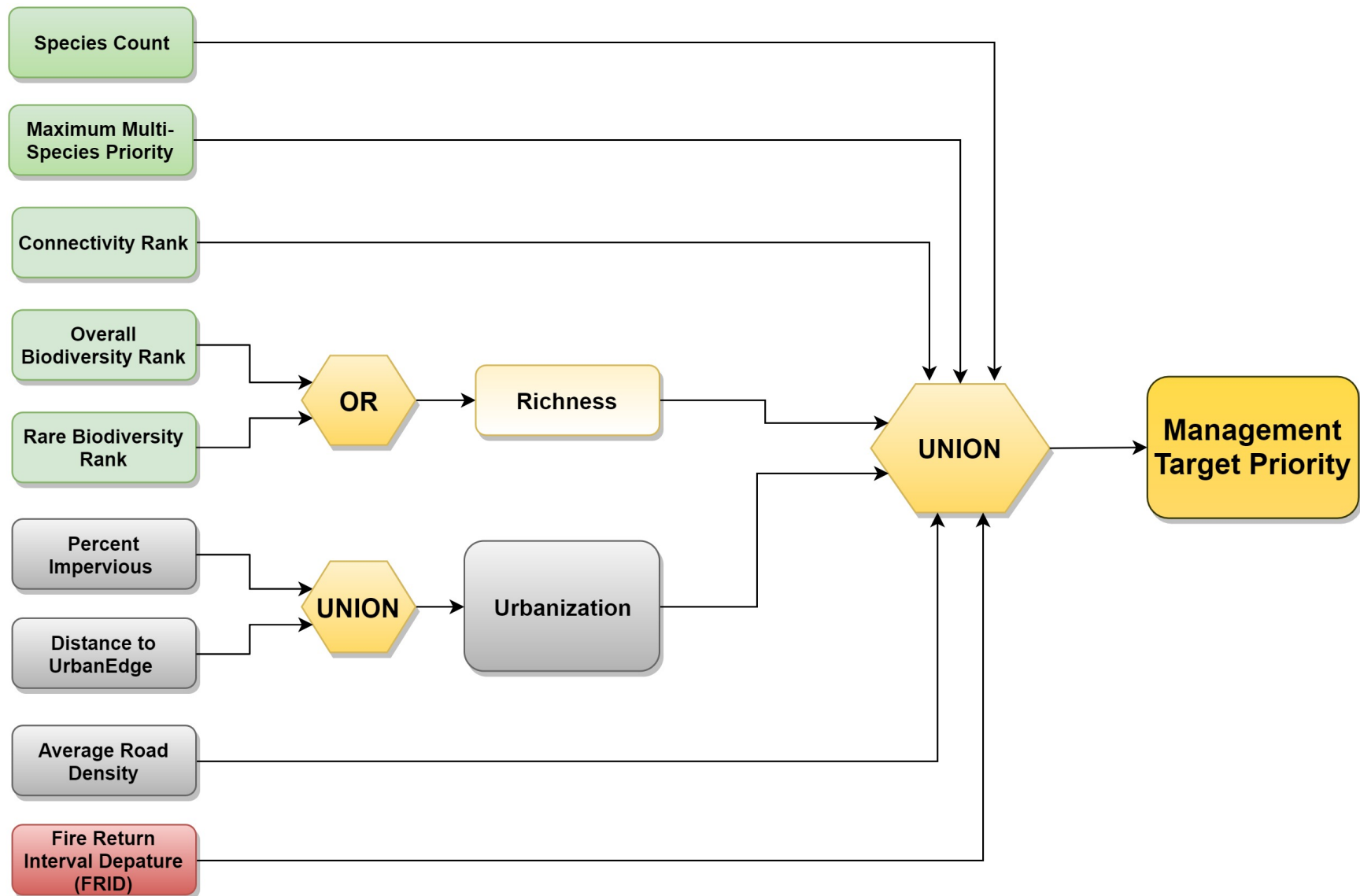
Figure B2. Diagram of prioritization strategy for setting management targets to enhance connectivity. All variables were evenly weighted in the final union.

Table B3. Description of variables used in the management target prioritization model depicted in Figure B2.

Attribute	Description	Source
Species Count	Count of individual species linkages that overlap linkage segment (up to 5 species)	Climate Resilient Connectivity focal species modeling
Maximum Multi-Species Priority	Averaged maximum priority value of within-species prioritization for any given species across each linkage segment	Climate Resilient Connectivity focal species modeling
Connectivity Rank	Averaged ecoregional connectivity ranking based on compiled connectivity data, including California Essential Habitats Connectivity and South Coast Missing Linkages (ranks range from 1-5 with 5 being the highest)	California Department of Fish and Wildlife, Areas of Conservation Emphasis III (ACE III) database
Overall Biodiversity Rank	Averaged ecoregional biodiversity ranking; ranks range from 1-5 with 5 being the highest.	California Department of Fish and Wildlife, Areas of Conservation Emphasis III (ACE III) database
Rare Biodiversity Rank	Averaged ecoregional rarity ranking; ranks range from 1-5 with 5 being the highest.	
Percent Impervious	Average percent impervious surface cover (used as a proxy for the degree of urbanization) within each network segment	National Land Cover Database (Jin *et al.* 2013)
Distance to Urban Edge (m)	Calculated as the distance from the centroid of each network segment to the nearest edge of urban lands	Urban lands from the California Farmland Mapping and Monitoring Project data (2016)
Average Road Density (km/km^2)	Density of paved roads calculated as km per km^2	Open Street Map (2014)
Fire return interval departure	Mean percent departure from assumed historic fire return intervals. Positive values indicate lengthening intervals between fires whereas negative values indicate increasing frequency in fires.	Fire Return Interval Database (Safford and van de Water 2014)

Table B4. Range of input values and processing approach to fuzzify variables for the management target prioritization model depicted in Figure B2 using the EEMS modeling toolbox.

Attribute Description	Fuzzify Function	Intermediate Combination	Final Combination
Species Count	Higher value is more TRUE; Values from 1 - 5 Convert to Fuzzy Category with these Pairs: 1,.2 :2,.4 :3,.6: 4,.8: 5,1		The *average* of all inputs = **Management Target Priority** (UNION)
Maximum Multi-Species Priority	Higher value is more TRUE; Values fall into -1 to 1 range, so no need to fuzzify.		
Connectivity Rank	Higher value is more TRUE; Values from 0 - 3.83 False Threshold = 0, True Threshold = 3.83		
Overall Biodiversity Rank	Higher value is more TRUE; Values in range 0 - 5 False Threshold = 0 True Threshold = 5	The *most true* value = **Richness** (OR)	
Rare Biodiversity Rank	Same as Overall Biodiversity Rank		
Percentage of Impervious Surface	Low to moderate % of impervious is more TRUE; Values from 0 -60 Convert to Fuzzy Curve with these points: 60,-1 : 10,1 : 20,0.8 : 0,0.2	The *average* of %Impervious and Distance to Urban Edge = **Urbanization** (UNION)	
Distance to Urban Edge (m)	Middling distances to urban are more TRUE; Values from 6.5 - 20,000 Convert to Fuzzy Curve with these points: 6.5,-1 : 5,000 ,-0.3 : 7,000,0.3 : 10,000, 1 : 12,000, 0.8 : 20,000, 0.3		
Average Road Density (km/km^2)	Higher value is more FALSE; Values from 0 - 16 False Threshold = 16, True Threshold = 0		
Fire Return Interval Departure	Values closer to zero indicate lower level of departure and are more TRUE; Values from -63 - 63 Convert to Fuzzy Curve with these points: 63,-1 : -63, -1 : 45,-0.5 : 45, -0.5 : 30, 0 : -30, 0 : 15, 0.5 : -15. 0.5 : 0,1		

Combining Datasets for Decision-Making

The goal of the Climate Resilient Connectivity Project was to develop a regional landscape connectivity plan that identifies landscape linkages while accounting for species distribution shifts under climate change. The linkage network we have developed is primarily intended to support planning for climate resilience for biodiversity. Recall, the project was designed to:

- provide information and context for decision-making under uncertainty
- complement existing fine-scale preserve designs for rare/protected/listed natural communities, not serve as a substitute
- maintain targets for preservation of biodiversity beyond rare/protected/listed species (*i.e.*, **keep common species common**).
- serve as a complement to work done on rare, habitat specialists
- contribute a needed application to the expanding conservation planning toolbox

Because this work was designed with the primary intent of preserving overall biodiversity, it is somewhat generalized in nature and should be evaluated in that context when being used for conservation planning and decision-making related to connectivity and acquisitions. While the network can help guide decisions about identifying and prioritizing conservation actions, no single modeling output or scientific study can completely guide such planning. Instead, we recommend the combination of our model outputs and geospatial data with existing monitoring data and research. As such, decision making should incorporate other datasets which can provide that additional context. To that end, below we have compiled a list of potential datasets that should be considered for review in combination with the Climate Resilient Connectivity network.

The review and application of these data for decision making may include a re-prioritization of the Climate Resilient Connectivity data at different spatial scales and for different purposes using the approach described above. Further, additional prioritization could be undertaken with supplemental datasets to further support informed decision making.

Suggested datasets to consider *(list not all-inclusive)*

Additional biodiversity data

- CDFW ACE III data
- CDFW BIOS data for the area
- State or federally protected species data
    - Occurrence data from USFWS, CNDDB, or other local sources or data repositories
    - Designated critical habitat
    - Other available data such as suitability models, genetic analyses, etc.

Local planning data

- Other conservation planning guidance (*e.g.*, Natural Community Conservation Plans, Regional Conservation Investment Strategies, and Regional Conservation Assessment areas, and GreenPrints)
- Threats from proposed development
- Proposed restoration targets for other purposes (*e.g.*, mitigation)

Other planning efforts

- Caltrans – Wildlife Connectivity Opportunity Areas, Planned transportation improvement projects
- USFWS – Strategic Habitat Conservation planning, Recovery plan actions
- CDFW – Natural Community Conservation Plan, Regional Conservation Investment Strategy, and Regional Conservation Assessment areas
- Prior or ongoing conservation planning – *e.g.,* South Coast Missing Linkages Project, California Essential Habitats Connectivity Project, Rim of the Valley Plan, Emerald Necklace Vision, Santa Ana River Parkway

Troubleshooting EEMS Models

Below are some tips we found while we were learning EEMS and creating the models for the Climate Resilient Connectivity project.

1. It's very helpful to have a naming convention and name your outputs in a way that makes sense to you. These names will get carried through to the feature class.   We used the convention of using FZ at the end of a name to indicate a fuzzy value.

2. Make sure the variables you input into the EEMS operators that require fuzzy value are fuzzy, meaning that their values fall in the range of -1 to 1. In order to obtain a fuzzy value, use one of the EEMS Convert to Fuzzy operators on the variables before using them in an operator. However if you have a variable that is already in that range, you won't need to. We had this situation in our model because we used the output from a previous model as one of the inputs.   If you do input values that are not in that range, the model run will fail and the software will give you an error that looks like this:

```
    self.EEMSFlds[inFldNm]['data'].max()))
Exception:
********************ERROR********************
Field in fuzzy operation has range outside of fuzzy limits (-1,+1):
  Field *AvgConnRnk* has range (0.000000,5.000000).


Failed to execute (EEMS Model Run).
Failed at Tue Sep 17 15:47:05 2019 (Elapsed Time: 2.27 seconds)
```

3. The final output feature class that EEMS produces will contain all the attributes used in the model and the intermediate and final values that are produced along the way along with an OBJECTID field. The OBJECTID field will start numbering with one. The feature class used as input to the model probably uses a FID field that starts with zero. If you want to join the final output values with your original input feature class you'll need to do something to create a field to do the join on. There are multiple ways to do this, we chose to create a field in our input feature class called KeyFID and copy the values from the FID field into it. Then in the model, we did an EEMS READ on the KeyFID field and put it into the final EEMS Model Run operator as a precondition. This causes that value to be included in the final output feature class. In the Management Targets model, it looked like this:
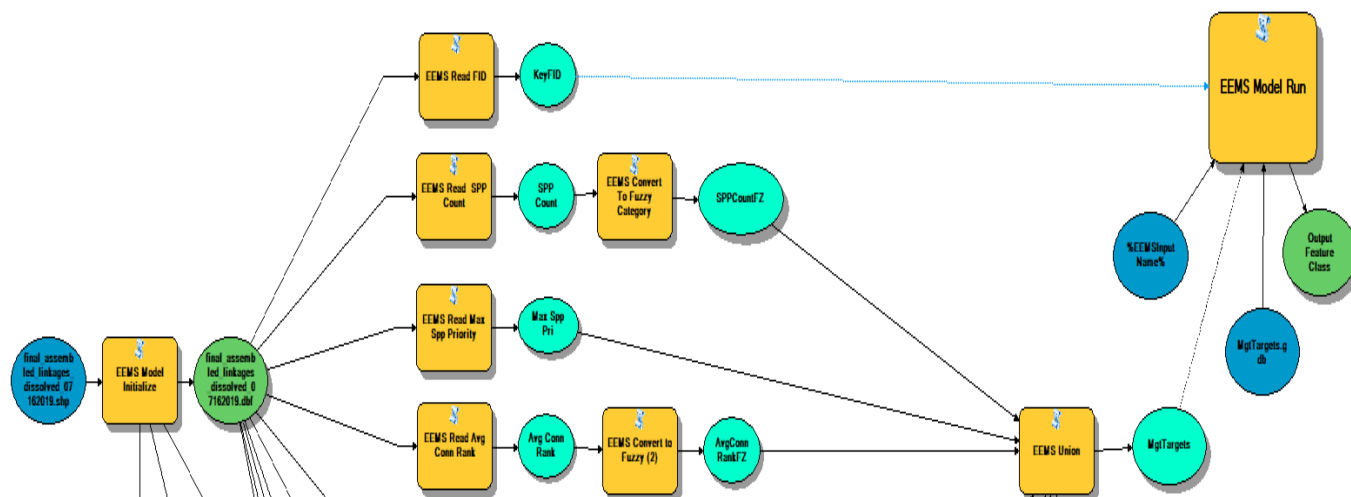
4. As you are building your model you can manually run individual pieces of it by right-clicking the operator (a yellow box) and selecting Run. This allows you to make sure each piece of the model works along the way. It can also help to pinpoint where there is a problem if something doesn't run. It is especially useful to run the EEMS model *Initialize* and the EEMS *Read* commands before setting up the rest of the model.

5. If you run into issues, contact Diane Foote for assistance: dfoote@sdsu.edu

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APPENDIX C. FOCAL SPECIES DESCRIPTIONS

The **big-eared woodrat (*Neotoma macrotis*)** is a large-bodied rodent that lives in the mature chaparral and forests of the southern Sierra Nevada, California's Central Valley, southern California, and south into northern Baja California, Mexico. The species is restricted to areas of dense undergrowth as it requires adequate material to build its conspicuous nests, made from dead branches, leaves, and bark strips. The big-eared woodrat range does not extend to the desert and is restricted to the coastal portions of northern Baja California, Mexico suggesting that shifts in temperature, precipitation, as well as vegetation composition and structure under climate change may all negatively impact the species (Moritz *et al.* 2013). They are also known to be sensitive to urbanization in southern California (Sauvajot *et al.* 1998), having been extirpated from many small fragments (Bolger *et al.*1997), as they require adequate cover for nesting habitat and movement corridors (Bolger *et al.* 2001). Additionally, big-eared woodrats are particularly vulnerable to increasing frequency of wildfires in the region (Brehme *et al.* 2011, Diffendorfer *et al.* 2012) as their food resources and above-ground nests of dried vegetative material are extremely flammable.

The **bobcat (*Lynx rufus*)** is a habitat generalist that occurs throughout most of the temperate regions of North America extending north into Canada and south to central Mexico. Bobcats are a relatively vagile species, dispersing distances of 20 km or greater, but sensitive to fragmentation and urban development (Riley *et al.* 2003) such as roads (Poessel *et al.* 2014, Lee *et al.* 2012, Riley *et al.* 2006) and housing tracts. The species demonstrates sensitivity to fragmentation when habitat patches become too small, too isolated, or a combination of both (Crooks 2002), making them a good indicator of connectivity at local to regional scales in urbanized environments like southern California. They are not only sensitive to development pressure and fragmentation, but may also be at risk from frequent fire (Brehme *et al.* 2011, Diffendorfer *et al.* 2012). In areas subject to short fire-return intervals, bobcats may be come extirpated as persistent early successional state of the vegetation and prey populations may restrict their ability to use these areas (Jennings 2013).

The **California spotted owl (*Strix occidentalis occidentalis*)** occupies mixed-conifer forests from the southern Cascades to the eastern Tehachapi Mountains of eastern Kern County and fragmented patches of montane hardwood and hardwood-conifer from Monterey to San Diego County. We are focusing our study on the fragmented southern portion of the owl's range (as in LaHaye *et al.* 1994). The owl population within this portion of its range was considered most vulnerable to global change, and thus critical for determining whether the species should be listed under the Endangered Species Act (USFWS 2006). Numerous studies have shown that the species prefers "old-growth" forests (Perry *et al.* 2012). Because of this preference, the spotted owl is particularly sensitive to habitat fragmentation. The impact of fires on spotted owls is not clear. Severe fires larger than 50 acres have been shown to reduce owl detection in previously occupied sites (Bond *et al.* 2009, Lee *et al.* 2013). Conversely, fires might have little impact on owl foraging behavior (Lee *et al.* 2012). The impacts of climate change on the California spotted owl are unclear, varying across the owl's range (Perry *et al.* 2012) with higher fitness associated with warmer weather in the western portion of the owl's range, and higher fitness in the colder, wetter weather in the eastern range. Because recent modeled declines in population growth rates

(Tempel and Gutierrez 2004) are likely to lead to further petition requests, it is important to understand how climate and land-use change might influence population dynamics.

The **western toad (*Anaxyrus boreas*)** is a widespread amphibian that occurs through much of the western United States in or near riparian habitats, wetlands, marshes, meadows, creeks, and forests. Although they must come to water to breed, they are able to move through uplands and spend portions of the summer and fall in moist terrestrial habitats. Their reliance on these wet areas may result in a loss of suitable habitat and decreased reproductive success under increased temperature regimes coupled with reduced precipitation (Bartelt *et al.* 2010, Blaustein *et al.* 2001). Habitat loss and fragmentation of wetlands has led to population declines in other parts of the western toad's range (Hammerson 1999). Specifically, roads are a known source of mortality for migrating western toads and have the potential to restrict movement (Clevenger *et al.* 2003). It has also been suggested that disease caused by the spread of fungal infection and increased exposure to UV-B has resulted in high mortality of western toad embryos (Kiesecker *et al.* 2001).

The **wrentit (*Chamaea fasciata*)** occupies shrublands from the coasts of northern Oregon to El Rosario in Baja California, Mexico, making southern California near the warm edge limit of wrentit's range. Within Baja California, there are few sites with annual average temperatures as hot as those predicted in Southern California. As a shrubland species, wrentit is likely to be sensitive to frequent fires that decrease shrub cover and can lead to vegetation type conversion. Further, coastal sage scrub and chaparral communities often occur in slowly sloping, desirable locations for human development. With up to 90% of coastal sage land already developed, we expect that wrentit will be vulnerable to land-use change. Throughout California, the wrentit is expected to retain or expand its range with climate change (Stralberg *et al.* 2009) but lose more than 50% due to land-use change (Jongsomjit *et al.* 2013). Mating for life, sedentary wrentits defend territory year-round and have short to moderate dispersal abilities (Baker *et al.* 1995), making connectivity important to long-term population resilience.

Table C1. Status and habitat association of at-risk species that may benefit from comprehensive connectivity planning in the south coast ecoregion and the focal species likely to confer protection ([1]western toad, [2]California spotted owl, [3]wrentit, [4]big-eared woodrat, [5]bobcat).

Common name	Scientific Name	Taxon group	Legal Status	Habitat association
California tiger salamander[1]	*Ambystoma californiense*	Amphibian	FE, ST, SGCN	Aquatic and upland
Arroyo toad[1]	*Anaxyrus californicus*	Amphibian	FE, SSC, SCGN	Aquatic and upland
Western spadefoot[1]	*Spea hammondii*	Amphibian	SSC, SGCN	Aquatic and upland
California newt[1]	*Taricha torosa*	Amphibian	SSC, SGCN	Aquatic
Southern western pond turtle[1]	*Actinemys pallida*	Reptile	SSC, SGCN	Aquatic and upland
Golden eagle[5]	*Aquila chrysaetos*	Bird		Grasslands, chaparral, scrub
Long-eared owl[2,4,5]	*Asio otus*	Bird	SSC, SGCN	Grasslands, riparian forest, woodlands
Northern harrier[2,4,5]	*Circus cyaneus*	Bird	SSC, SGCN	Grasslands, riparian forest, woodlands
White-tailed kite[2,4,5]	*Elanus leucurus*	Bird		Grasslands, riparian forest, woodlands
Southwestern willow flycatcher[1]	*Empidonax traillii extimus*	Bird	FE, SE, SGCN	Riparian forests
Yellow-breasted chat[1]	*Icteria virens*	Bird	SSC, SGCN	Riparian forests
Summer tanager[1,2,4]	*Piranga rubra*	Bird	SSC, SGCN	Riparian forest and woodlands
Yellow-headed blackbird[1,2]	*Xanthocephalus xanthocephalus*	Bird	SSC, SGCN	Riparian forest and woodlands
Pallid bat[2,3,4]	*Antrozous pallidus*	Mammal	SSC, SGCN	Grasslands
Townsend's big-eared bat1,[2,3,4]	*Corynorhinus townsendii*	Mammal	SC, SSC,SGCN	Riparian forest and woodlands
Long-eared bat[1,2,4]	*Myotis evotis*	Mammal	SSC, SGCN	Riparian forest and woodlands
Southern grasshopper mouse[4,5]	*Onychomys torridus ramona*	Mammal	SSC, SGCN	Grasslands, riparian forest, woodlands
Jacumba pocket mouse[1,4]	*Perognathus longimembris internationalis*	Mammal	SSC, SGCN	Riparian forest and woodlands
Mountain lion[5]	*Puma concolor*	Mammal		Shrublands, riparian, woodlands
American badger[5]	*Taxidea taxus*	Mammal	SSC, SGCN	Grasslands

FE - Fed. endangered; FT - Fed. threatened; SE - State Endangered; ST - State Threatened; SC - State Candidate; SSC - State Species of Special Concern; SGCN - SWAP Species of Greatest Conservation Need

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