9.0 SIERRA NEVADA ECOREGION

The Sierra Nevada ecoregion is roughly bound by the Modoc Plateau and Cascade Ranges to the north, the Great Basin to the east, the Antelope and Fremont Valleys to the south, with the Central Valley forming the western boundary (Figure 1-1, *California Regions and Topography*). The primary vegetation types of the region are mixed coniferous forest, oak woodland, foothill riparian woodland, mixed chaparral, sagebrush, alkali sink, vernal pools, grassland, and desert scrub.

The Sierra Nevada ecoregion is comprised of various vegetation zones. The foothills are a natural mosaic of oak woodland, chaparral, riparian forest habitats, and grass-covered slopes in the lower reaches. Canyon oak (*Quercus chrysolepis*) and interior live oak (*Q. wislizenii*) trees are co-dominant species in the montane hardwood forests of the region. River and stream systems are lined with cottonwood (*Populus* spp.) and willow (*Salix* spp.), important habitat for neotropical migratory birds.

Further up the western slopes of the Sierra Nevada, mixed coniferous forest is the dominant habitat type. Here, the canopy is comprised of species such as yellow pine (*Pinus ponderosa*), lodgepole pine (*P. contorta*), Douglas-fir (*Pseudotsuga menziesii*), white fir (*Abies* concolor), and black oak (*Quercus kelloggii*). On more mesic sites, there are groves of giant sequoia (*Sequoiadendron gigantea*).

At high elevations, wet meadows are an important habitat type. Subalpine and alpine habitats are present at higher elevations, with the white-bark pine (*Pinus albicaulis*) as the dominant tree at or below timberline.

The eastern part of the range is comprised of more drought-tolerant species, with Jeffrey pine (*P. jeffreyi*) as the dominant conifer, as well as, juniper (*Juniperus* spp.) woodlands, sagebrush and desert scrub.

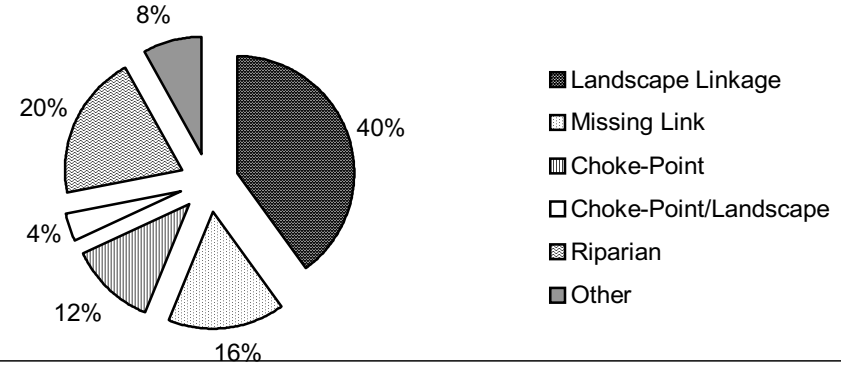
The majority of the region is publicly owned. There are eleven national forests and four national parks in the region. National Forests include: Lassen, Plumas, Tahoe, Eldorado, Humboldt-Toiyabe, Stanislaus, Sierra, Inyo, Lake Tahoe Basin, Modoc and Sequoia. Checkerboard ownership of land is an issue in Lassen, Plumas, Tahoe, and Eldorado National Forests. National Parks in the region include: Yosemite, Sequoia and Kings Canyon, and Lassen Volcanic. The Bureau of Land Management and California State Parks manage additional publicly owned land in the region. The Bureau of Land Management administers the majority of the land in the eastern foothills. Additional publicly owned land is administered by the Bureau of Reclamation and the California Department of Fire.

A total of 25 habitat linkages were identified for the region (Figure 9-1, *Sierra Nevada Missing Linkages*). Of the linkages identified, 40% (10/25) were considered Landscape Linkages[1],

[1] 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.

12% (3/25) were recognized as Choke-Points[2], and 16% (4/25) were determined to be Missing Links[3]. Participants also identified other linkage types, 4% (1/25) were considered Choke-Points[2] and a Landscape Linkages[1], 20% (5/25) were listed as Riparian linkages, and 8% (2/25) were identified as other types of linkages (Figure 9-2, *Sierra Nevada: Types of Linkages*).

Figure 9-2, *Sierra Nevada: Types of Linkages*



The key species used to identify the linkages belonged to a number of taxonomic groups. In the riparian linkages, Swainson's hawk (*Buteo swainsoni*), neotropical migratory birds, kangaroo rat (*Dipodomys* spp.), gray fox (*Urocyon cinereoargenteus*), mink (*Mustela vison*), and fish were recognized as key species. In the terrestrial linkages, forest carnivores such as the Pacific fisher (*Martes pennanti*), coyote (*Canis latrans*), mountain lion (*Felis concolor*), bobcat (*Lynx rufus*), spotted owl (*Strix occidentalis*), and ungulates such as bighorn sheep (*Ovis canadensis*) and mule deer (*Odocoileus hemionus*) were listed as species indicative of connectivity. Both single and multiple key species were used in identifying the linkages; 56% (14/25) of the linkages recognized mammals as key species, 28% (7/25) used birds, 8% (2/25) used fish, while 24% (6/25) did not specify key species. Mammalian carnivores were recognized as key species in 40% (10/25) of the linkages.

The primary features identified as facilitating animal movement in the region included riparian corridors and contiguous or semi-contiguous habitat, some which connect existing protected land, such as the Yosemite-Kings Canyon linkage (Figure 9-1, *Sierra Nevada: Missing Linkages,* Map ID#16). The North Fork of the Tule River, the Kings River, and the Upper Consumnes River were named as important riparian linkages, along with numerous streams. One Landscape Linkage[1] (Figure 9-1, *Sierra Nevada: Missing Linkages,* Map ID#10) identified semi-contiguous habitat connecting the Sierras to the Coast and Transverse Ranges of the South Coast ecoregion. Another ecoregional linkage in the southern Sierra Nevada (Figure 9-1, *Sierra Nevada: Missing Linkages,* Map ID# 17) was recognized as a Choke-Point[2] at the conference. Underpasses and culverts were also identified as facilitating wildlife movement in the ecoregion.

The primary barriers to animal movement in the ecoregion varied, though no barriers were

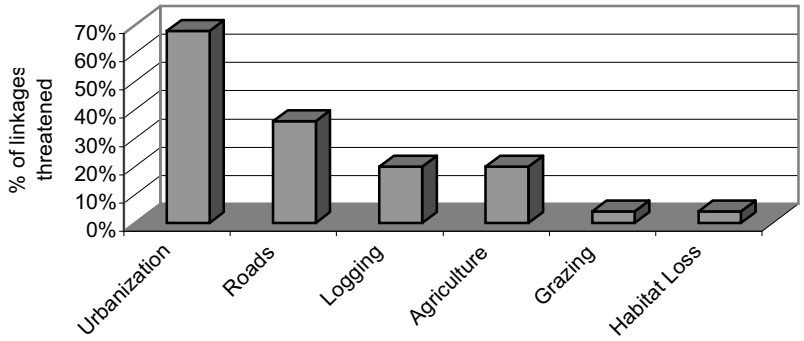
[2] Choke-Point = A narrow, impacted, or otherwise tenuous habitat linkage connecting two or more habitat blocks ("core areas").
[3] Missing Link = A highly impacted area currently providing limited to no connectivity function (due to intervening development, roadways, etc.), but based on location one that is critical to restore connectivity function.

listed for seven of the linkages identified. In some of the linkages, habitat fragmentation and gaps in cover were listed as barriers due to urban, rural and ski resort development, as well as clearcutting, and/or intense logging. Checkerboard ownership of industrial timberlands caused one of the linkages to be identified as a Missing Link[3]. Different types of roads were identified as barriers to passage, from those associated with extractive industries to major highways. Highways 395, 14, 80, 58, 50, and 36 were specifically mentioned as major barriers. The over-appropriation of water in the major river systems was also named as an obstacle to movement.

Habitat types identified in need of restoration included foothill riparian, chaparral, oak woodland, mixed coniferous and desert scrub. Of the linkages, 64% (16/25) did not list any restoration needs, while it was specified that no restoration was necessary in 8% (2/25) of the linkages (Figure 9-1, *Sierra Nevada: Missing Linkages*, Map ID#s 20 & 23). Acquisition and reforestation of logged-over mixed coniferous forest habitat were restoration priorities in two of the identified linkages (Figure 9-1, *Sierra Nevada: Missing Linkages*, Map ID#s 11 & 14). Toxic cleanup of mercury was listed as a priority in one of the riparian linkages (Figure 9-1, *Sierra Nevada: Missing Linkages*, Map ID# 7). Maintenance of ecosystem function in high desert scrub habitat was also mentioned as a restoration need. In general, participants felt plans for restoring habitat linkages need to be developed, implemented, and monitored for use by target species.

The primary threats identified in the ecoregion included urbanization, roads, logging, and agriculture; other threats included grazing and habitat loss (Figure 9-3, *Sierra Nevada: Threats to Connectivity*). Urbanization was listed as a threat in 68% (17/25) of the linkages recognized, 59% (10/17) of which ranked as severely threatened (rank = four or five). Roads jeopardized 36% (9/25) of the linkages identified, 33% (3/9) of which were ranked as severely threatened. Of the linkages, 20% (5/25) were threatened to some degree by logging, 60% (3/5) of which were ranked as severely threatened. Agriculture was identified

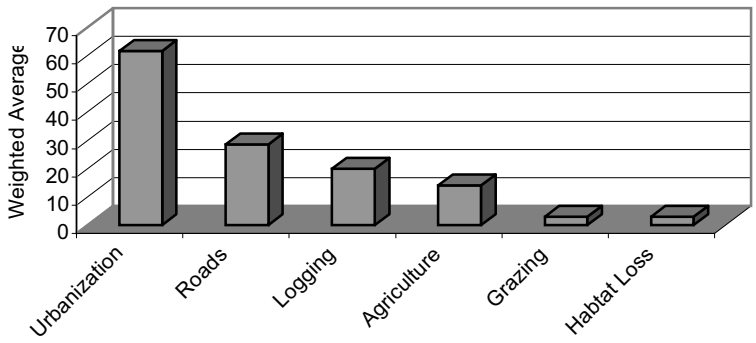
Figure 9-3, *Sierra Nevada: Threats to Connectivity*



as a threat to connectivity in 20% (5/25) of the linkages, only one of which was considered severely threatened. Of the linkages, 4% (1/25) were threatened by livestock grazing and habitat loss. 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 × number of linkages affected) was calculated for each threat identified to determine the severity of each threat in the region (Figure 9-4, *Sierra Nevada: Severity of Threats*). Figure 9-4, average severity of each threat among linkages, reveals similar trends as Figure 9-3, the number of linkages affected by each threat.

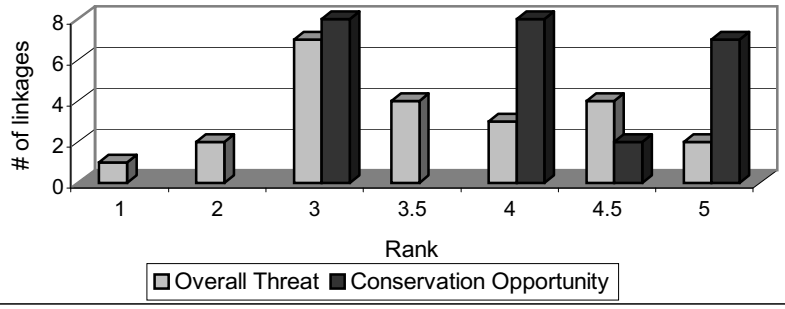
Conference participants also scored the feasibility of conserving the linkage and ranked the overall threat to connectivity (Figure 9-5, *Sierra Nevada: Ranking the Priorities*). Scientists ranked 68% (17/25) of the linkages as high priorities with good opportunities for conservation (rank = four or five), 35% (6/17) of which were ranked as severely (rank = four or five) threatened (Figure 9-1, *Sierra Nevada: Missing Linkages,* Map ID#s 1, 2, 9, 11, 17, & 22). Overall, 36% (9/25) of the linkages identified were ranked as severely threatened (rank = four or five). In addition, 28% (7/25) of the linkages were identified as

Figure 9-4, *Sierra Nevada: Severity of Threats*



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

Figure 9-5, *Sierra Nevada: Ranking the Priorities*



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

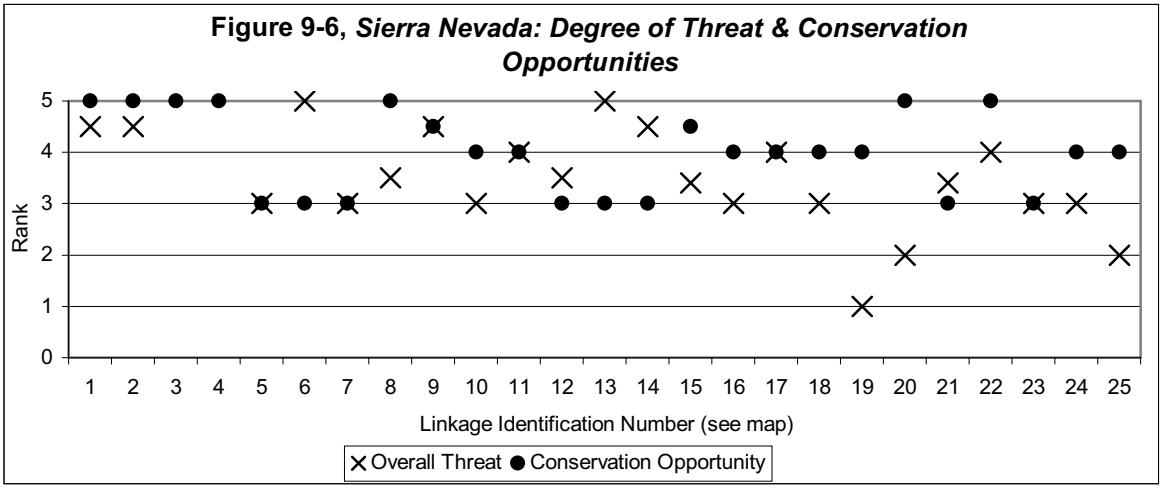
the highest conservation opportunities (rank = five), 43% (3/7) of which were ranked as severely threatened (Figure 9-1, *Sierra Nevada: Missing Linkages,* Map ID#s 1, 2 & 22). These included two Riparian Linkages (the North Fork of the Tule linkage Map ID# 1 and the St. Johns-Cottonwood-Cross Creek linkage Map ID# 2), and one Choke-Point[2] and Landscape Linkage[1] (the Sierra Nevada-Coso Hills linkage Map ID# 22). Brief descriptions of the top-ranked conservation opportunities are provided below. A comparison of how individual linkages were ranked is depicted in Figure 9-6, *Sierra Nevada: Degree of Threat and Conservation Opportunities*.

The North Fork of the Tule linkage (Figure 9-1, *Sierra Nevada: Missing Linkages,* Map ID# 1) was listed as a Riparian Linkage, with the potential to connect riparian forests to Tulare Lake. Marshes, grassland and vernal pool communities were also listed as habitat types in the linkage. Neotropical migratory birds were recognized as the key species for this linkage. The

over-appropriation of water was identified as the primary barrier, while the primary threat listed was expanding ranch development. Landownership in the linkage was listed as a mixture of public and privates lands. Participants indicated that there were willing sellers in this linkage. They also identified this linkage as part of California Department of Fish and Game and Sierra Los Tulares Land Trust conservation plans. Please refer to the corresponding Linkage Description Log sheet for more specific information.

The St. Johns-Cottonwood-Cross Creek Riparian Linkage (Figure 9-1, *Sierra Nevada: Missing Linkages,* Map ID# 2) was identified as providing habitat connectivity for kangaroo rat, fox,

Figure 9-6, *Sierra Nevada: Degree of Threat & Conservation Opportunities*



Note: The above graph compares how each linkage wasranked 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).

mink, and neotropical migratory birds, from the Kaweah River to Tulare Lake. This linkage boasts the last alkali sink habitat in Kings County. The principal threat recognized was development, but no barriers were identified for this linkage. Riparian habitat was considered the primary conduit for wildlife movement. Landownership in the linkage was listed as a complex mixture of public and private lands, including unincorporated county land and the City of Visalia. Participants indicated that there were willing sellers in the linkage, and that the linkage was part of a Sierra Los Tulares Land Trust conservation plan. Please refer to the corresponding Linkage Description Log sheet for more specific information.

The Sierra Nevada-Coso Hills linkage (Figure 9-1, *Sierra Nevada: Missing Linkages,* Map ID# 22) was identified as a Choke-Point[2] and a Landscape Linkage[1]. This linkage was recognized as providing a dispersal corridor for bighorn sheep, connecting populations in the Sierra Nevada with those in the Mojave ecoregion. Highway 395 was identified as the primary barrier and threat to this linkage. Landownership in this linkage is comprised of federal and state agencies including the National Park Service, Bureau of Land Management, United States Air Force, and water agencies. CalTrans was identified as a possible solution for restoring connectivity through retrofitting an underpass to accommodate bighorn sheep and other wildlife species. Please refer to the corresponding Linkage Description Log Sheet for more specific information.

Scientific documentation and/or GIS-based maps referenced for the region included (see Appendix C, *Connectivity References*, for complete citation, if provided):

- California Spotted Owl Technical Report
- Guernsey Endangered Species Recovery Plans
- El Dorado City Resource Conservation District
- Models predicting fisher and owl occurrences

Conference participants also provided a GIS-based map to highlight some of the linkages. Six of the linkages recorded (Figure 9-1, *Sierra Nevada: Missing Linkages,* Map ID#s 10-15) coincide with ecologically significant areas depicted in Figure 9-7, *Areas of Concern for the California Spotted Owl*.

Ecoregional team members indicated that 28% (7/25) of the linkages have willing sellers in all or a portion of the linkage. Potential exists for agency acquisition in 40% (10/25) of the linkages, 30% (3/10) of which were identified as having willing sellers (Figure 9-1, *Sierra Nevada: Missing Linkages,* Map ID#'s 6, 21, and 24). Five of the high-ranking conservation opportunities (Figure 9-1, *Sierra Nevada: Missing Linkages,* Map ID#'s 1, 2, 3, 16, and 24) were noted as having willing sellers; one of which has the potential for agency acquisition (Map ID# 24). Other opportunities identified to secure or restore connectivity function included landowner incentives for conservation easements, acquisition through private land trusts, formal conservation plans, coordination among federal and state agencies, acquisition of key tracts of post-logging industrial timberland, and coordination between land managers and CalTrans to plan for underpasses at various elevations.