5.4 Central Valley and Sierra Nevada Province

5.4.1 Geophysical and Ecological Description of the Province

The Central Valley and Sierra Nevada Province is the largest within the state (Figure 5.4-1), composed of two of California's major geographic and ecological regions. Although the Central Valley and the Sierra Nevada range are very distinct physically and ecologically, together they contain most of the state's major watersheds and form an important elevation and ecological gradient that drives much of California's biodiversity patterns. Elevations in the province range from less than 300 feet throughout most of the Central Valley to over 14,500 feet in the Sierra Nevada. The types, distribution, and functions of vegetation and wildlife resources in the province are strongly influenced by variations in geology, climate, topography, and hydrology along this gradient, as well as development and land use patterns. These physical and ecological conditions support a diverse mix of vegetation communities, wildlife habitats, and conservation challenges.

Central Valley

The Central Valley comprises most of the low-lying lands of central California. Much of the region is part of a vast hydrological system that drains much of the state's water. This water, falling as either rain or snow over much of the northern and central parts of the state, culminates in the Sacramento and San Joaquin rivers into the Delta.

The Central Valley has two distinct subregions: the Sacramento Valley and the San Joaquin Valley. Each subregion has unique combinations of climate, topography, ecology, and land use patterns. Together, they form a vast, flat valley, approximately 450 miles long and averaging 50 miles wide, with elevations almost entirely under 300 feet. The Sutter Buttes, a circle of 2,000-foot-high hills left over from the eroded remains of a volcano, rise from the middle of the Sacramento Valley (promoted locally as the "Smallest Mountain Range in the World") and is the only topographic feature that exceeds the valley floor elevation. The Central Valley is surrounded by the Sierra Nevada on the east, the coastal ranges on the west, the Tehachapi Mountains on the south, and the Klamath and Cascade mountains on the north. Less influenced by marine air than San Francisco Bay, the valley's climate has hot, dry summers and foggy, rainy winters. Annual rainfall averages from 5 to 25 inches, with the least rainfall occurring in the southern portions and along the west side (in the rainshadow of the coastal mountains).

Agriculture dominates land uses in the Central Valley, with very few remnants of natural habitat remaining. The major natural upland habitats are annual grassland, valley oaks on floodplains, and vernal pools on raised terraces. The more arid lands of the southern San Joaquin Valley contain desert habitats which include alkali sink and saltbush shrublands. Slow-moving rivers

along the valley floor provide habitat for fish and invertebrates and help maintain adjacent riparian, freshwater wetland, and floodplain habitats.

Hydrology is the main difference between the two Central Valley subregions. The Sacramento Valley contains the Sacramento River, the largest river in the state. This river historically overflowed into several low-lying areas, particularly in its lower reaches. The lower 180 miles of the river, below Chico Landing, are now constrained by levees, and excess floodwaters are diverted into large bypasses to reduce risks to human populations. The San Joaquin Valley has two separate drainages. In the northern portion, the San Joaquin River flows north toward the Delta. It captures water via several major rivers that drain the central Sierra Nevada. The southern portion of the valley is isolated from the ocean and drains into the closed Tulare Basin, which includes the beds of the former Tulare, Buena Vista, and Kern lakes. These lakes and vast wetlands historically were fed by the rivers that drain the southern Sierra Nevada (the Kings, Kaweah, Tule, and Kern). These lakes are now dry most of the time because water has been diverted to upland agriculture. Runoff during the wettest years will occasionally flood out of river channels and temporarily refill some of these lakebeds. The California Aqueduct extends along the entire western edge of the valley, delivering water from the Delta to farmers in the Tulare basin and over the Tehachapi Mountains to Southern California.

Central Valley Flood Management Planning and Flood System Conservation Strategy

A cornerstone of efforts by the California Department of Water Resources (DWR) to improve integrated flood management in California's Central Valley, the Central Valley Flood Management Planning (CVFMP) Program was launched in 2008 and is managed by the Division of Flood Management's Central Valley Flood Planning Office. The Central Valley Flood Protection Plan (CVFPP) sets forth a plan for sustainable flood management and investment to improve flood risk management in the Central Valley through use of the State Plan of Flood Control (SPFC) facilities. Following adoption of the CVFPP in 2012, DWR began refinement of the CVFPP recommendations via the three significant planning efforts—Basin-Wide Feasibility Studies, Regional Flood Management Planning, and Central Valley Flood System Conservation Strategy.

The Conservation Strategy is an informational document that identifies specific tools and approaches to restore natural areas to benefit fish and wildlife as part of a sustainable flood management plan. The Conservation Strategy and CVFPP as a whole support two of the key actions identified in the California Water Action Plan, in particular increasing flood protection and protecting and restoring important ecosystems.

There has been an unprecedented amount of data collection, modeling, and the development of Central Valley-wide restoration targets and numerical objectives developed through this effort. They are focused on the riparian systems within the SPFC facilities. It has been a collaborative development process with input from CDFW, U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), local Flood Agencies, and many conservation organizations including The Nature Conservancy, Point Blue, and Audubon Society.
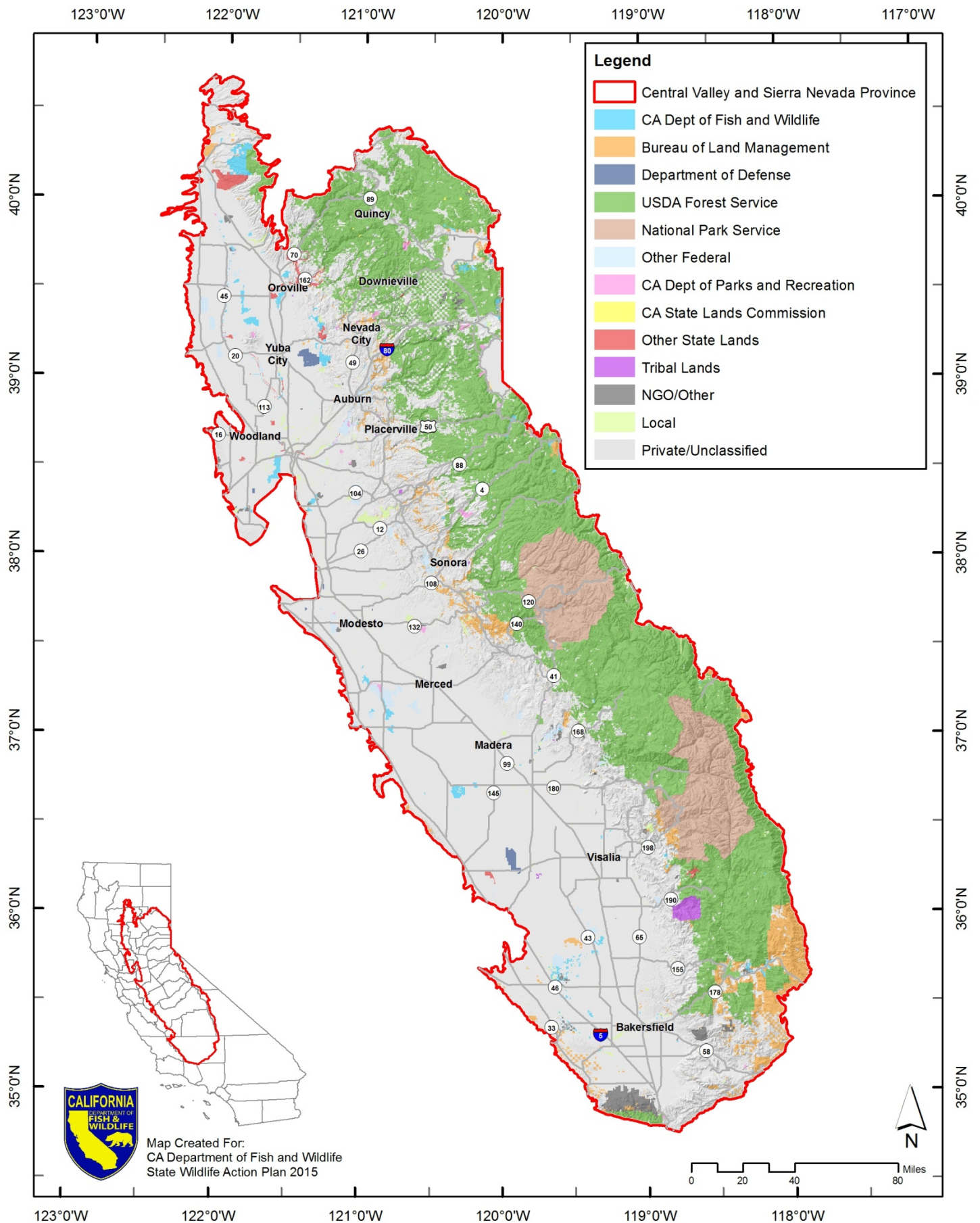
Legend

- Central Valley and Sierra Nevada Province
- CA Dept of Fish and Wildlife
- Bureau of Land Management
- Department of Defense
- USDA Forest Service
- National Park Service
- Other Federal
- CA Dept of Parks and Recreation
- CA State Lands Commission
- Other State Lands
- Tribal Lands
- NGO/Other
- Local
- Private/Unclassified

Map Created For:
CA Department of Fish and Wildlife
State Wildlife Action Plan 2015

Data Source: California Protected Areas Database; US Geological Survey (hillshade); CDFW Lands.

Figure 5.4-1   Land Ownership of the Central Valley and Sierra Nevada Province

The wildlife of this region is affected by a variety of pressures, described below. The major problem has been the loss, degradation, and fragmentation of habitats, both terrestrial and aquatic, because of the development of agriculture, construction of moderate and large dams and reservoirs, and urban areas. Many of the streams have been dammed, blocking fish migration, or have been so severely degraded that they are no longer usable by many native fishes. Flood control structures, such as dikes, levees, and hardened embankments (riprap), have altered floodplain habitats like riparian forests, river processes (meanders and associated functions), and wetlands throughout the region. This loss of habitat has led to population reduction for waterfowl, wading birds, and tricolored blackbird, as well as other wetland dependent species. Some species that persist on the remaining habitat fragments are at risk of local extirpation or rangewide extinction (e.g., Clear Lake hitch, winter-run Chinook salmon). A large percentage of the historic Central Valley salmon habitat has been lost; the estimate is between 75-95 percent (California Department of Fish and Game [CDFG] 1993; Clemmins et al. 2008; National Marine Fisheries Service [NMFS] 2014).

The Central Valley is primarily in private ownership, and the role of private landowners in conservation is very important. More than 75 percent of the known California locations of 32 special-status animal species occur predominately on private lands. Examples of these species include Swainson's hawk, burrowing owl, California tiger salamander, and Buena Vista Lake shrew.

Central Valley agricultural habitat is very important to species such as greater and lesser sandhill cranes, waterfowl, shorebirds, and other waterbirds; as well as many other avian species, including tricolored blackbird and Swainson's hawk. Therefore, it is important to focus on maintenance of wildlife-friendly agriculture (e.g., discouraging habitat loss from urbanization and orchard and vineyard encroachment into important wintering areas and encouraging wildlife friendly crops and cropland management [Ivey et al. 2014]). The Central Valley Joint Venture Implementation Plan (2006), currently being updated, provides recommendations for wildlife management and conservation on private lands in the Central Valley.

Managed wetlands in the Central Valley are broadly categorized as seasonal, semi-permanent or permanent. Seasonal wetlands are typically flooded in the fall, with drawdown occurring between March and May. Semi-permanent wetlands are usually flooded from early fall through early July, while permanent wetlands are flooded year round. Since the majority of these non-seasonal wetland habitats are semi-permanent, for planning purposes, semi-permanent and permanent wetlands are combined. About two thirds of all managed wetlands in the Central Valley are privately owned, while nearly 90 percent of all wetlands are managed on a seasonal basis. Seventy-seven percent of all wetlands are located in four basins: Butte, Colusa, Suisun, and San Joaquin (CVJV 2006).

Sierra Nevada

Extending approximately 400 miles from north to south, the Sierra Nevada forms the spine of the California landscape. The predominantly granitic Sierra Nevada ranges from the Susan River

and Fredonyer Pass in the north to Tehachapi Pass in the south. To the south, the Sierra Nevada range embraces the Mojave Desert to the east and curves south to link with the Tehachapi Mountains. The region includes the oak woodland foothills on the western slopes and, on the east, the Owens Valley and edges of the Great Basin.

On the west side, the slope of the Sierra Nevada rises gradually from near sea level at the floor of the Central Valley to ridges ranging from 6,000 feet in the north to over 14,000 feet in the south, then drops off sharply to the east. As the elevation increases from west to east, life zones transition from chaparral and oak woodlands to lower montane forests of ponderosa and sugar pine to upper montane forests of firs, Jeffrey and lodgepole pine and, above timberline, to alpine plant communities.

Sierra Nevada Foothills Fine-Scale Habitat Connectivity Model

A connected landscape is crucial for maintaining ecological processes and healthy wildlife populations. Habitat connectivity supports the movement of wildlife across the landscape to find food, cover and mates; to seasonally migrate; and to move in adaptation to climate change. Wildlife movement patterns can be disrupted by barriers such as roads, urban development, and habitat conversion. There are many factors that influence wildlife movement including physical and ecological attributes of the landscape, and species behavior. Wildlife connectivity models help us to better understand potential species movement patterns and how barriers may impact wildlife movement.

In 2014 the Conservation Analysis Unit in the Biogeographic Data Branch completed a fine-scale connectivity analysis of the northern Sierra Nevada foothills ecoregion. This ecoregion contains intermediate elevation oak woodland, grassland, and chaparral habitats and represents an important movement corridor between the low elevations of the Central Valley and the mountains of the Sierra Nevada. The ecoregion is bisected by several major highways and is experiencing rapid growth, underscoring the need for a regional connectivity analysis to support conservation and transportation planning.

The purpose of this project was to build onto the statewide California Essential Habitat Connectivity work using a regional approach based on species-specific wildlife movement needs, as recommended in the CEHC report. The project used state-of-the-art methods to develop habitat suitability models for 30 focal species representative of the ecoregion. The models, together with species-specific information on patch size and dispersal ability, were used to identify core habitat areas and wildlife corridors across the landscape. In addition, riparian and land facets corridors were identified. Riparian corridors offer an important tool for conservation planning, representing areas that are important for wildlife and serve multiple ecological functions. Land facet corridors are areas of land with uniform topographic and geologic features that will interact with future climate to support species and species movement under future climate conditions.

The maps of core habitat patches and wildlife linkages, supplemented by maps of riparian corridors and land facets, can be used to address species-specific conservation needs as well as overall habitat connectivity in conservation planning. The analysis also helps us better understand what barriers to species movement are present in the landscape. Scientists in the CDFW Region 2 office are conducting a field-based analysis to evaluate corridor use through the deployment of camera traps throughout the ecoregion.

Federal agencies manage about 75 percent of the Sierra Nevada: 57 percent by the U.S. Forest Service (USFS), 13 percent by the National Park Service (NPS), and 5 percent by the Bureau of Land Management (BLM). About 2 million acres are wilderness areas, mostly in the southern Sierra, managed by USFS. Lands managed by the NPS include Sequoia, Kings Canyon, and Yosemite National Parks and Devils Postpile National Monument. State parks and wildlife areas account for

0.6 percent of the region, and the remaining, approximately 24 percent of the Sierra Nevada, is privately owned. Most of the higher elevations and the eastern Sierra are public lands, whereas most of the oak woodlands and lower mixed conifer forests and rangelands below 3,000 feet on the western slope are in private ownership. There is a checkerboard ownership pattern of private and public lands in areas of the northern half of the Sierra Nevada that lie near historical railway routes (California Resources Agency [CRA] 2004; Sierra Nevada Ecosystem Project [SNEP] 1996).

Much of the state's surface-water runoff flows to the Central Valley from the Sierra Nevada and adjacent Cascades. These flows are critical to meet California's hydropower demands and agricultural and drinking water needs. Much of the water is stored in reservoirs and is conveyed by aqueducts to irrigate agriculture from Redding to Bakersfield and to provide drinking water for most of urbanized California, including the San Francisco Bay Area and Southern California (California Department of Water Resources [DWR] 1998).

The hundreds of creeks and streams of the western slopes of the Sierra Nevada drain via a dozen major river basins to merge with the Sacramento River in the north and the San Joaquin River in the south, which eventually join at the San Francisco Bay Delta. The southern forks of the Kings River and streams farther south drain into the Tulare basin. The streams east of the Sierra crest flow into the Great Basin through the Lahontan, Mono, and Owens drainages. Maintaining and restoring the ecological health of these watersheds and aquatic systems is important to ensure clean water.

Variable topography, the large elevation gradient, and varied climatic conditions of the Sierra Nevada support diverse plant communities. The Sierra Nevada supports at least 1,300 vascular plant species, along with numerous bryophytes and lichens, and more than 450 species of vertebrate animals (USFS 2004a). The varied conditions and floristically and structurally diverse plant communities provide a large array of habitats important for maintaining California's wildlife diversity and abundance.

Several major pressures have altered aquatic ecosystems and transformed forest structure and habitats on both public and private lands. Dramatic human population growth and development in the western Sierra foothills, forest management practices, fire suppression, and livestock grazing have altered ecosystems and continue to affect wildlife habitats. Hydropower facilities and agricultural and municipal water diversions have disrupted natural river flow regimes. Eroding access roads in forested and other habitats and excessive livestock grazing have resulted in the conversion of wet meadows to drier lands and have degraded streams and aquatic habitat. The introduction of trout has caused declines in native species. In the central Sierra, historical mining severely altered watersheds and water courses, and those effects persist. Importantly, effects of climate change are already evident; the Sierra Nevada has experienced increased minimum temperatures, earlier snowpack melting, changes in stream hydrology, and increased frequency of large, severe wildfires (Safford et al. 2012). Fire suppression and inadequate forest management have led to uncharacteristic fires, which drastically change landscapes and habitat for decades and start self-perpetuating cycles of uncharacteristic fire.

The altered forest ecosystems of the Sierra Nevada largely lack the qualities of old-growth or late seral stage forests (forests that are in the later stages of development with large-diameter trees, snags, and logs) that are important for diverse and abundant wildlife (Franklin and Fites-Kaufman 1996; USFS 2001). Species that depend on old-growth or late-seral stage forest habitat, like the Pacific fisher, have been negatively affected. The degradation of mountain meadows and loss of quaking aspen, willow, and other riparian woody plants have affected the endangered willow flycatcher and other species that have similar habitat requirements.

New conservation challenges and opportunities will affect the Sierra Nevada in the next few decades. How new development is managed will determine the extent of wildlife habitat fragmentation. Changing global climate will alter depth and seasonality of snowpack, further modifying river flow regimes, fire behavior, and ecosystems. The relicensing of hydropower projects provides an opportunity to change hydropower operations to reduce their effects on fish and wildlife.

Concerned about the decline of old forests and associated wildlife species of the region, Congress funded, in 1993, the Sierra Nevada Ecosystem Project (SNEP), based at UC Davis, for the "scientific review of the remaining old growth in the national forests of the Sierra Nevada in California, and for the study of the entire Sierra Nevada ecosystem by an independent panel of scientists, with expertise in diverse areas related to this issue." The forests of the Sierra, Cascades, and the Modoc Plateau were evaluated by a multidisciplinary team of scientists from many organizations. SNEP completed its work and published a three-volume report in 1996. Based on the work of dozens of scientists, the report analyzed the status of conifer forests, rangelands, meadow and riparian plant communities, and aquatic ecosystems, and suggested alternatives to restore ecosystems.

Aquatic and riparian systems are believed to be two of the most altered and impaired habitats of the Sierra Nevada. Among other critical findings, SNEP found that key causes of the decline of mammals, birds, and other vertebrates in the Sierra, Cascades, and Modoc regions include the loss and degradation of riparian areas, foothill woodlands, and diverse old forest habitats (including large trees, snags, fallen logs, and layered vegetative structure).

A 1992 technical report by USFS Pacific Southwest Research Station highlighting at-risk California spotted owl populations triggered debate about habitat conservation and forest uses. That debate prompted USFS to initiate a multiyear planning process that resulted in the Sierra Nevada Framework for Conservation and Collaboration (Sierra Framework), which evolved into the Sierra Nevada Forest Plan Amendment (SNFPA) Final Environmental Impact Statement covering the national forests of the Sierra, Cascades, and Modoc regions. In January 2001, USFS announced the SNFPA Record of Decision, describing chosen management options. In January 2004, the SNFPA was amended, reducing livestock-grazing and timber-harvest restrictions and giving USFS greater management discretion. USFS Forest Plans are currently being updated to align with the new National Forest System planning rule adopted in 2012.
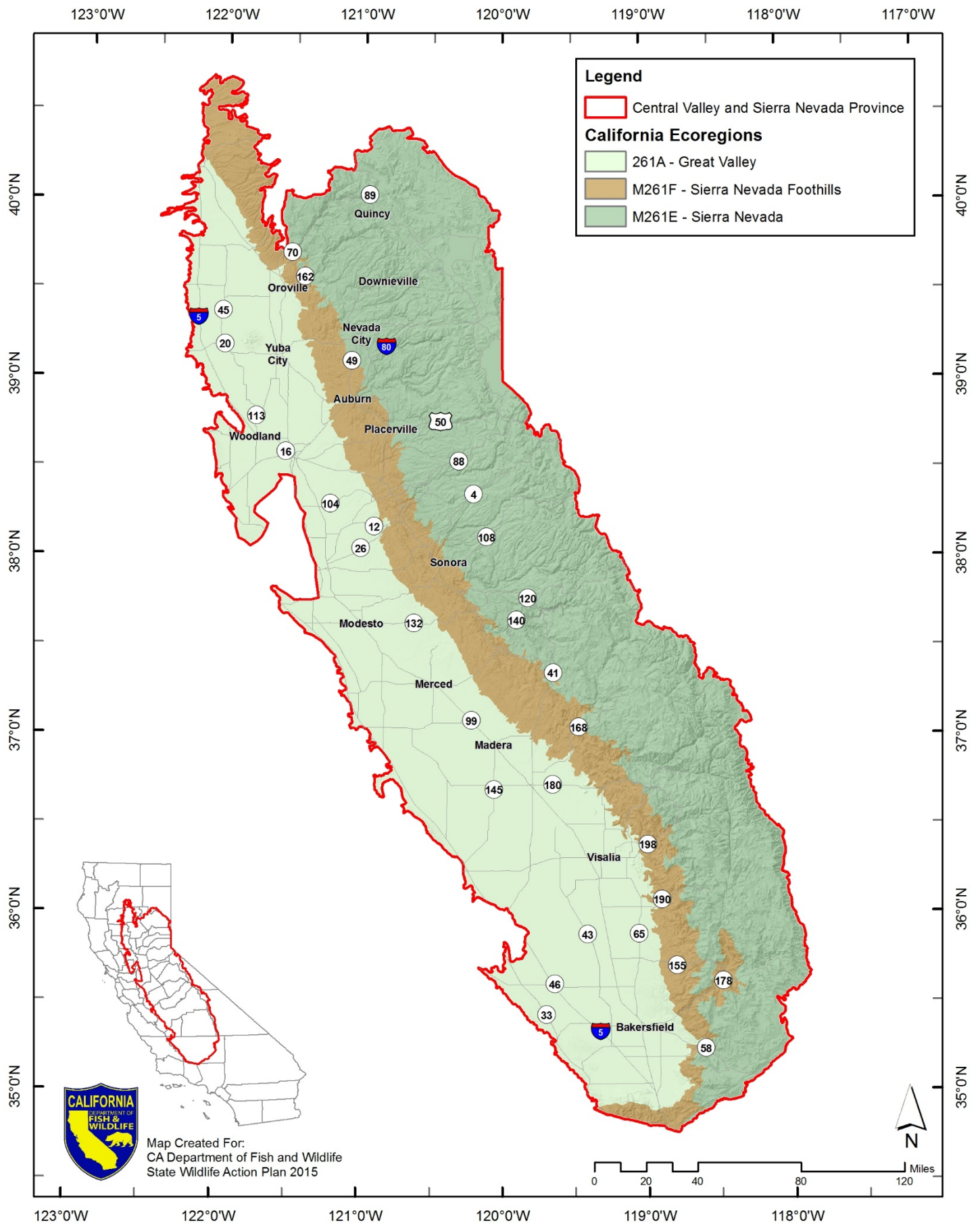
Numerous watershed groups, private landowners, local conservancies, resource conservation districts, and state and federal programs are engaged in habitat conservation and restoration work on public and private lands throughout the region. The legislatively created Sierra Nevada Conservancy, established in January 2004, is a key collaborator and a potential source of funding for conservation and restoration of habitats for species at risk in the Sierra Nevada.

5.4.2   Conservation Units and Targets

The conservation units associated with the Central Valley and Sierra Nevada Province are the Great Valley, Sierra Nevada Foothills, and Sierra Nevada ecoregions (Figure 5.4-2), and the Sacramento, Central Lahontan, San Joaquin, and Tulare-Buena Vista Lakes hydrologic units (Figure 5.4-3). The selected targets for each of these conservation units are summarized in Table 5.4-1.

Although numerous potential conservation targets were identified within the province, conservation strategies were only developed for the targets that contain the greatest number of SCGN and that are under immediate threat. Forests and woodlands, shrubland, and grassland were not among those targets selected, because these habitat types are under less threat or are being conserved through other programs. Additional key targets will be addressed through future conservation planning efforts. Information about the methods used to prioritize conservation targets is presented in Appendix D.

Figure 5.4-4 shows the distribution of the plant communities within the province. Some of the plant communities identified as conservation targets occur in areas smaller than the mapping unit and do not appear on the figure.

Figure 5.4-2   Ecoregions of the Central Valley and Sierra Nevada Province

Legend

▭ (red outline)	Central Valley and Sierra Nevada Province
┈┈ (blue dotted)	Hydrologic Unit Boundary
▨	Other Hydrologic Units Within Province

Code	Unit Name
1605	Central Lahontan
1802	Sacramento
1803	Tulare - Buena Vista Lakes
1804	San Joaquin

HUC 1808
See Cascades and
Modoc Plateau Province

HUC 1805
See Bay Delta and
Central Coast Province

HUC 1809
See Deserts
Province

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Although other watersheds are
important to this region, only those
discussed in this document, in this
region, are shown on this map

Data Source: Rivers/Lakes: National Hydrologic Dataset (NHD) and CDFW; Hillshade: US Geological Survey
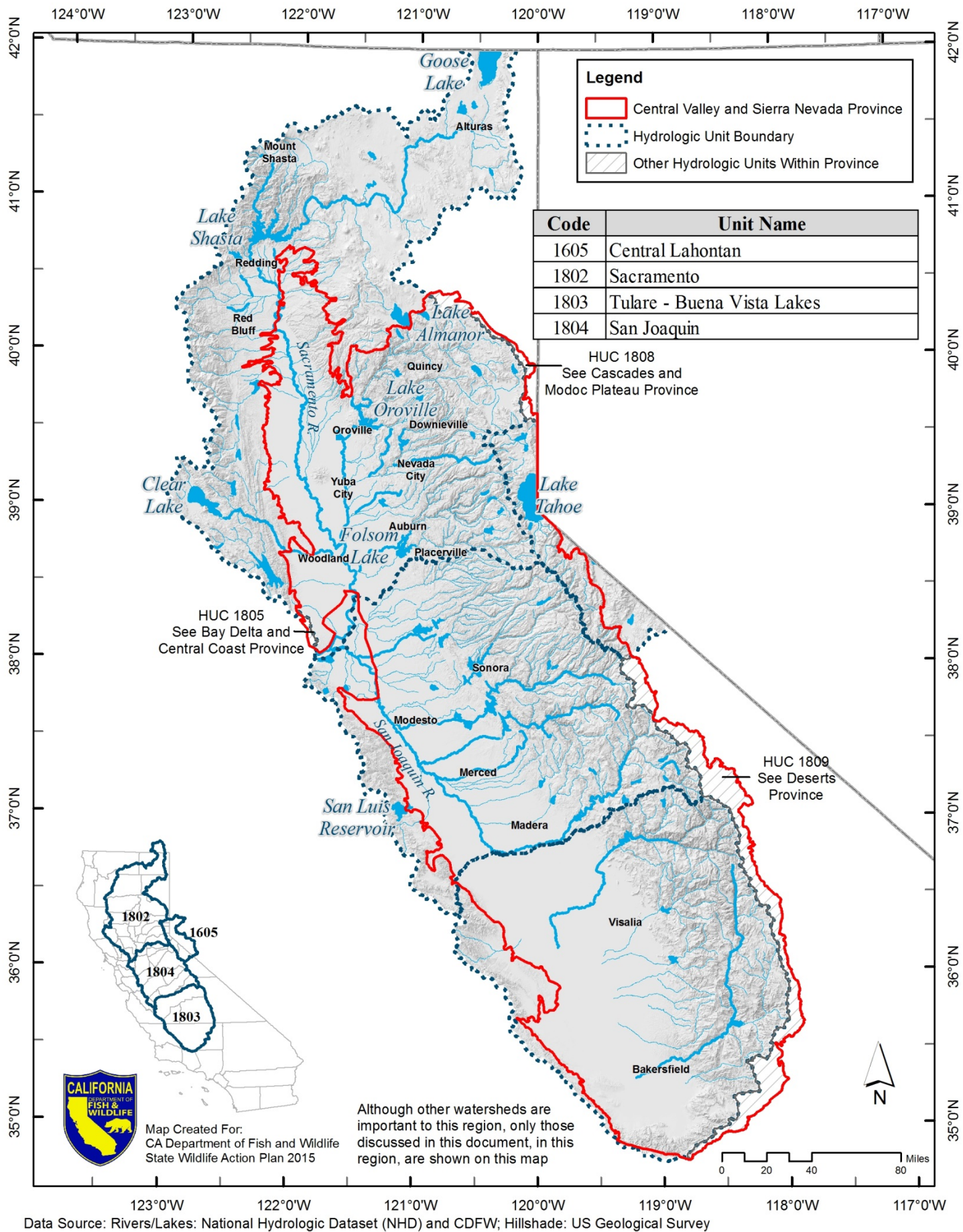
Figure 5.4-3   Hydrologic Units of the Central Valley and Sierra Nevada Province
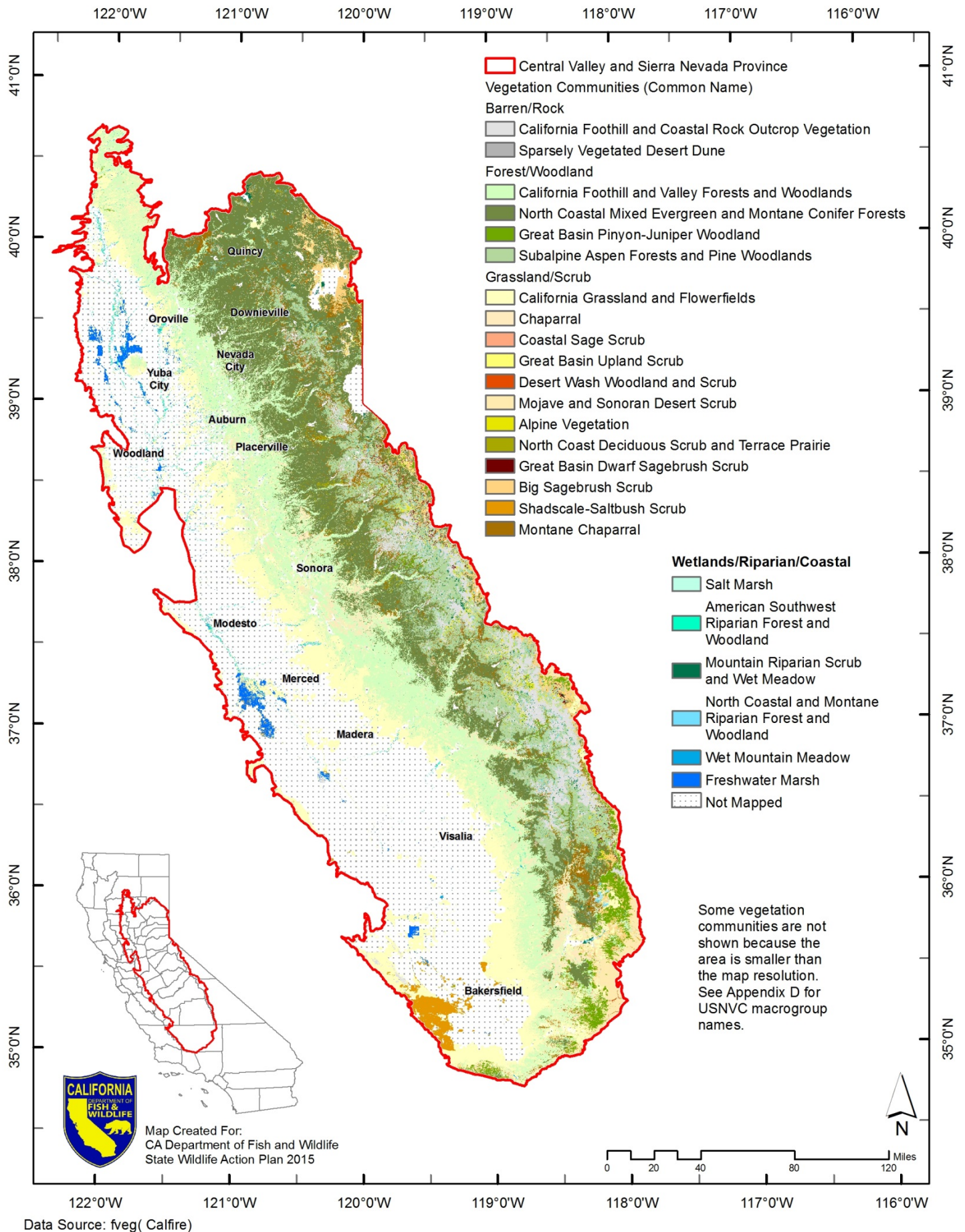
Figure 5.4-4   Plant Communities of the Central Valley and Sierra Nevada Province

Legend:

Central Valley and Sierra Nevada Province

Vegetation Communities (Common Name)

Barren/Rock
- California Foothill and Coastal Rock Outcrop Vegetation
- Sparsely Vegetated Desert Dune

Forest/Woodland
- California Foothill and Valley Forests and Woodlands
- North Coastal Mixed Evergreen and Montane Conifer Forests
- Great Basin Pinyon-Juniper Woodland
- Subalpine Aspen Forests and Pine Woodlands

Grassland/Scrub
- California Grassland and Flowerfields
- Chaparral
- Coastal Sage Scrub
- Great Basin Upland Scrub
- Desert Wash Woodland and Scrub
- Mojave and Sonoran Desert Scrub
- Alpine Vegetation
- North Coast Deciduous Scrub and Terrace Prairie
- Great Basin Dwarf Sagebrush Scrub
- Big Sagebrush Scrub
- Shadscale-Saltbush Scrub
- Montane Chaparral

Wetlands/Riparian/Coastal
- Salt Marsh
- American Southwest Riparian Forest and Woodland
- Mountain Riparian Scrub and Wet Meadow
- North Coastal and Montane Riparian Forest and Woodland
- Wet Mountain Meadow
- Freshwater Marsh
- Not Mapped

Some vegetation communities are not shown because the area is smaller than the map resolution. See Appendix D for USNVC macrogroup names.

Map Created For:
CA Department of Fish and Wildlife
State Wildlife Action Plan 2015

Data Source: fveg(Calfire)

Table 5.4-1	Conservation Units and Targets – Central Valley and Sierra Nevada Province*			
Conservation Unit	**Geographic and Ecological Summary**	**Conservation Target**	**Target Summary**	**Focal CWHR Types Associated with Target**
Great Valley Ecoregion	Contains the alluvial plains of the Sacramento and San Joaquin Valleys. Summers are hot and dry and winters are mild. Oceanic influence on climate is slight in the middle of the Great Valley, which receives some marine air through the Carquinez Strait, but becomes negligible at the north and south ends of the Valley. Predominant vegetation includes annual grassland, cheatgrass, valley oak, vernal pools and wetland communities, blue oak, allscale and saltgrass. Elevation range: 0 to 2,000	American Southwest Riparian Forest and Woodland	Diagnostic species include Fremont cottonwood, black and red willow, California sycamore, California wild grape, arroyo willow, narrow-leaf willow, button-bush, and spice bush. Most stands are found in permanently moist settings or riparian settings where sub-surface water is available year-round.	Valley Foothill Riparian
		Freshwater Marsh	This vegetation type consists of freshwater emergent marshes and coastal/tidal marshes and meadows. It can be found surrounding streams, rivers, lakes and wet meadows. These habitats occur on virtually all exposures and slopes, provided a basin or depression is saturated or at least periodically flooded. Dominant species are generally perennial monocots including graminoids such as rushes, reeds, grasses and sedges. Dominant species include: common reeds, hardstem bulrush, small-fruited bulrush, water parsley, slough sedge, soft rush, salt rush, and pacific silverweed.	Fresh Emergent Wetland
Sierra Nevada Foothills Ecoregion	Includes the hot foothills of the Sierra Nevada, and the southwestern end of the Cascade Ranges, adjacent to the Great Valley. Predominant vegetation communities include blue oak, broom, cheatgrass, chamise, mixed chaparral, foothill pine, and valley oak. Elevation range: 200 to 5,000	Chaparral	Represented by a wide variety of floristic alliances, but in general can be grouped into coastal (maritime), xeric (dry, sunny slopes), mesic (cooler, shady slopes), and lower montane (somewhat frost sensitive) types. All of these groupings have different characteristic species and fire regimes. The core diagnostic species are shrubs with evergreen thickened leaves including many species of manzanita, *Ceanothus*, scrub oaks, and other characteristic shrubs: toyon, chamise, flannel-bush, silk-tassel bush, and many others. Many shrubs tend to break down into their fire responses, including obligate-seeding and resprouting strategies.	Mixed Chaparral; Chamise-Redshanks Chaparral
		California Foothill and Coastal Rock Outcrop Vegetation	Vegetative cover is generally < 2%. Cliffs and outcrops west of the deserts and inland from the immediate coast, south of central California. Rock surfaces or rapidly eroding unstable slopes are characteristic. Stands do not include alpine or subalpine sparse, rocky vegetation, and also do not include the sparsely vegetated portions of the warm and cold deserts. Target is poorly understood floristically; includes coastal succulents (e.g., *Dudleya* and *Coreopsis gigantea*).	Barren

Table 5.4-1	Conservation Units and Targets – Central Valley and Sierra Nevada Province*			
Conservation Unit	**Geographic and Ecological Summary**	**Conservation Target**	**Target Summary**	**Focal CWHR Types Associated with Target**
Sierra Nevada Foothills Ecoregion (continued)		Desert Transition Chaparral	These chaparral stands occur in the "rain shadow" of the mountains. Compared to the target "Chaparral," the stands are less dense, contain a mix of other non-chaparral shrubs with desert affinities, and tend to have less frequent and less intense fires. This target contains the desert margin scrub oaks *Quercus john-tuckeri, Q. turbinella*, and *Q cornelius mulleri*, also sugar-bush, red-shank, Silk-tassel bush, and cup-leaf ceanothus. Understory short shrubs include golden-bush, California buckwheat, and matchweed. Prickly-pear, cholla, jojoba, nolina, and other desert perennials and annuals are also common associates in many of the stands.	Mixed Chaparral; Chamise-Redshanks Chaparral
		Montane Chaparral	These are cold-adapted and occupy successional relationships to various coniferous forests on productive sites, or persist in rocky or other poor soil sites. Contains the *Ceanothus cordulatus, C. velutinus, Arctostaphylos patula, A. nevadensis, Chrysolepis sempervirens*, and *Q. vaccinifolia*-dominated montane chaparrals. Does not include bittercherry, ocean spray or other taller winter deciduous shrub stands, which may occur near or adjacent to these evergreen stands.	Montane Chaparral
		California Foothill and Valley Forests and Woodlands	These forests may be open woodlands to denser forests, and may be dominated by broadleaf evergreen or deciduous hardwoods, co-dominated by hardwoods and conifers, or dominated entirely by conifers. Understories can be grassy, shrubby, or mixed with both. This target contains two groups, one dominated by broad leaf trees and the other dominated by conifers. Fire ecology is varied depending on the spacing of trees and the herbaceous or woody understory characteristics.	Coastal Oak Woodland; Blue Oak Woodland; Blue Oak-Foothill Pine; Montane Hardwood; Valley Foothill Riparian; Valley Oak Woodland; Closed-Cone Pine-Cypress; Juniper

Table 5.4-1   Conservation Units and Targets – Central Valley and Sierra Nevada Province*

Conservation Unit	Geographic and Ecological Summary	Conservation Target	Target Summary	Focal CWHR Types Associated with Target
Sierra Nevada Ecoregion	The temperate to very cold parts of the Sierra Nevada, which is a north-northwest aligned mountain range that is much steeper on the east than on the west side. Predominant vegetation communities include mixed conifer, ponderosa pine, Jeffrey pine, white fir, red fir, lodgepole pine, huckleberry oak, western juniper, aspen, big sagebrush, mixed subalpine forest, mountain hemlock, whitebark pine, and giant sequoia. Elevation range: 1,000 to 14,495	North Coastal Mixed Evergreen and Montane Conifer Forests	All of these forests average cooler and wetter conditions than California Foothill and Valley Forests and Woodlands. There is relatively broad overlap between the three groups composing this target. The moist coastal mixed evergreen has (or had) tanoak, madrone, giant chinquapin mixed frequently with Douglas-fir, but also mixes with bigleaf maple and red alder in upland settings. The more interior mixed evergreen forests have cooler winters and warmer summers than the moist coastal group above, and contain Oregon oak and drier Douglas-fir with canyon oak mixes.	Montane Hardwood; Montane Hardwood-Conifer; Douglas-Fir; Klamath Mixed Conifer; Sierran Mixed Conifer; White Fir; Eastside Pine; Jeffrey Pine; Ponderosa Pine
		Alpine Vegetation	This target is representative of the state's alpine zone in the Sierra Nevada, Cascades, White, Sweetwater, and Klamath Mountains. It either occurs above timberline or is found localized within subalpine areas in cold air drainages (e.g., North-facing slopes, often near long persisting snow banks). The characteristic species are either herbaceous (many are cushion plants, some tufted or rhizomatous graminoids) or low prostrate or dwarf shrubs. Different groups segregate based on substrate type (e.g., scree, talus, felfield) and moisture regime (e.g., snowbank, felfield). Snowbank indicator species include white heather, several species of saxifrage, and sedge. Felfield indicators include alpine reedgrass, Congdon sedge, alpine goldenbush, and Phlox species, among others. Alpine turf indicators include dwarf willows, dwarf huckleberry, Muir's hairgrass, and several sedges.	Alpine Dwarf-Shrub
		Pacific Northwest Subalpine Forest	Includes montane conifer forests and woodlands adapted to very high winter snowfall, from montane to subalpine elevations. Snow loads are the greatest anywhere in North America and persist well into the summer. Tree germination is also limited in some cases by the short period the ground is not covered by snow. Characteristic trees include red fir, mountain hemlock, and western white pine.	Red Fir; Subalpine Conifer

Table 5.4-1	Conservation Units and Targets – Central Valley and Sierra Nevada Province*			
Conservation Unit	Geographic and Ecological Summary	Conservation Target	Target Summary	Focal CWHR Types Associated with Target
Sierra Nevada Ecoregion (continued)		Wet Mountain Meadow	Typical of low lying sites in the mountains and in some lower elevation valleys and depressions. Widespread throughout the state wherever freshwater meadows and seeps occur. Saturated soil or standing water through the growing season are key characteristics. Wet mountain meadows are generally characterized by herbaceous plants with shrubs or trees absent or sparse (<20 percent cover), or along the edges. Most species are perennial and canopy cover is generally dense (60-100 percent).	Wet Meadow
		Western Upland Grasslands	Dominated by grasses, which are typically not restricted to moisture surrounding landscape (not seeps, riparian, or wet meadows). Dominant vegetation generally includes native grasslands of Idaho fescue, Great Basin wild rye, blue wild rye, one-sided bluegrass. It also includes the non-native grasslands that are from cool temperate settings in Eurasia such as creeping bentgrass, velvetgrass, Kentucky bluegrass, and Harding grass and cheat-grass.	Perennial Grassland; Annual Grassland
Sacramento HUC 1802	Encompasses much of northern California. Includes the Sacramento River Basin, including Shasta Lake and the isolated Clear Lake drainage basin, in California; and drainage into Goose Lake in Oregon. Covers an area of 27,600 square miles. Traverses the Coastal, Cascade, Warner, and Sierra Nevada mountain ranges and Modoc Plateau.	Clear Lake Native Fish Assemblage	Species of Greatest Conservation Need (SGCN) associated with target are Clear Lake hitch, Sacramento perch, Clear Lake tule perch, Pacific brook lamprey, prickly sculpin, Sacramento blackfish, Sacramento pikeminnow, California roach, Sacramento sucker, three-spine stickleback, and rainbow trout.	N/A
Central Lahontan HUC 1605	Includes the Central Lahontan Basin, consisting of the Carson, Truckee, and Walker River Basins in California and Nevada. Covers an area of 12,500 square miles. This unit is characterized by a diverse topography and climate. It includes high points along the eastern slopes of the Sierra Nevada and adjacent valley bottoms. The unit experiences very high to very low levels of precipitation associated with heavy snowfall in the mountainous regions and rainshadow effects in the valleys to the east and a similarly wide variation in temperature extremes. Varied topography and climate provides for a correspondingly diverse array of habitats, including abundant high quality waters and wetlands that support many distinct and unique plants and communities in this unit. Particularly notable are	Carson River Native Fish Assemblage	Includes 10 species of native fish. SGCN associated with target are Paiute cutthroat trout, Lahontan cutthroat trout, mountain sucker, and mountain whitefish. Other species in native fish assemblage are Paiute sculpin, Lahontan creek tui chub, Lahontan redside, Lahontan speckled dace, and Tahoe sucker.	N/A
		Walker River Native Fish Assemblage	SGCN associated with target are Lahontan cutthroat trout, mountain sucker, mountain whitefish, and freshwater mussels.	N/A

Table 5.4-1	Conservation Units and Targets – Central Valley and Sierra Nevada Province*			
Conservation Unit	Geographic and Ecological Summary	Conservation Target	Target Summary	Focal CWHR Types Associated with Target
Central Lahontan HUC 1605 (continued)	endemic fish species such as Paiute cutthroat trout and several species of desert pupfish. Numerous beneficial uses related to biological resources have been identified in this unit; as well as numerous CDFW-designated Significant Natural Areas. Elevation range: 4,200 to 11,400			
San Joaquin HUC 1804	Includes the entire San Joaquin River basin and its tributaries, including the Chowchilla, Merced, Stanislaus, Calaveras, Cosumnes, Mokolumne, Fresno, and Tuolumne rivers, Panoche Creek, and Mormon Slough. Also includes the San Luis reservoir and the San Joaquin Delta. Covers an area of 15,600 square miles. This unit, together with the Sacramento unit (1802), covers about one fourth of the total area of the state and furnishes roughly 51% of the State's water supply. The upper portions of this unit are characterized by high gradient mountain streams entering low gradient meadows and grasslands/agricultural lands and in areas terminating into large warm water lakes with unique native fish assemblages. Surface water from this unit in combination with the Sacramento unit meet and form the Delta, which ultimately drains into the San Francisco Bay. Two major water projects, the CVP and SWP, deliver water from the Delta to Southern California, the San Joaquin Valley, Tulare Lake Basin, the San Francisco Bay area, as well as within the Delta boundaries. The Delta is a maze of river channels and diked islands. Historic and ongoing point and nonpoint source discharges impact surface waters in this unit. Significant portions of major rivers and the Delta within this unit are impaired, to some degree, by discharges from agriculture, mines, urban areas and industries. The wetlands of this unit form important waterfowl habitat for migratory waterfowl using the Pacific Flyway. The alluvial fans within portions of this unit contain salts and selenium, which can be mobilized through irrigation practices and can pose potential threat to condition of surface waters and wetlands supporting important wildlife. Elevation range: 0 to 12,800	San Joaquin Native Aquatic Species	SGCN associated with target are hardhead, California roach, Red Hills roach, Sacramento sucker, Sacramento pikeminnow, Sacramento blackfish, Sacramento spittail, hitch, western pearlshell mussel, California floater mussel, Paiute cutthroat trout, Lahontan cutthroat trout, rainbow trout, California red-legged frog, foothill yellow-legged frog, and mountain yellow-legged frog.	N/A

Table 5.4-1	Conservation Units and Targets – Central Valley and Sierra Nevada Province*			
Conservation Unit	Geographic and Ecological Summary	Conservation Target	Target Summary	Focal CWHR Types Associated with Target
Tulare-Buena Vista Lakes HUC 1803	Includes drainage into the closed basins of Tulare and Buena Vista Lake in portions of Fresno, Kern, Kings, and Tulare counties of the southern San Joaquin Valley, California. Covers an area of 16,200 square miles. This unit is situated in the topographic horseshoe formed by the Diablo and Temblor Ranges on the west, by the San Emigdio and Tehachapi Mountains on the south, and by the Sierra Nevada Mountains on the east and southeast. It receives flood water from the major rivers during times of heavy runoff and surface water only drains from this unit north into the San Joaquin River in years of extreme rainfall. This unit once supported vast tule marshes, riparian corridors, abundant wetlands, and one of the most diverse, productive grasslands in temperate North America. However, the Tulare and Buena Vista lakes basin has been developed for farming due to its fertile soils, relatively cloudless summers, and high quality runoff from the adjacent mountains; it is now one of the most important agricultural centers of the world. Surface water supplies are inadequate to support the present level of agricultural and other development; ground water resources supply additional demands. Of primary concern in this unit is the accumulation of salts due to importation and evaporative use of the water. Evaporation ponds are being used for disposal of these saline waters, but the ponds are known to detrimentally impact wildlife. Additionally, historically poor sanitation associated with recreational uses and erosion from construction, logging, grazing, and irrigated agriculture are threats to stream environments in this unit. Elevation range: 160 to 13,200	Upper Kern Native Fish Assemblage	SGCN associated with target are California golden trout, hardhead, Kern River rainbow trout, and Little Kern golden trout. Other native fish in the assemblage is Sacramento sucker	N/A

* Description referenced from CDFG 1988, USDA 1994, USDA 2007 and Keeler-Wolf 2010.

5.4.3   Key Ecological Attributes

Key ecological attributes (KEAs) were identified for each conservation target. These attributes are considered the most important for the viability of the targets and their associated species. The KEAs for the Central Valley and Sierra Nevada Province are listed in Table 5.4-2. The most commonly identified attributes for the Central Valley and Sierra Nevada Province are:

- area and extent of community;
- fire regime;
- connectivity among communities and ecosystems;
- successional dynamics;
- community structure and composition; and
- soil quality and sediment deposition regime.

Table 5.4-2   Key Ecological Attributes – Central Valley and Sierra Nevada Province

Key Ecological Attributes	Great Valley		Sierra Nevada Foothills					Sierra Nevada					Sacramento HUC 1802	Central Lahontan HUC 1605		San Joaquin HUC 1804	Tulare-Buena Vista Lakes HUC 1803
	American Southwest Riparian Forest and Woodland	Freshwater Marsh	Chaparral	California Foothill and Coastal Rock Outcrop Vegetation	California Foothill and Valley Forests and Woodlands	Desert Transition Chaparral	Montane Chaparral	North Coastal Mixed Evergreen and Montane Conifer Forests	Alpine Vegetation	Pacific Northwest Subalpine Forest	Wet Mountain Meadow	Western Upland Grasslands	Clear Lake Native Fish Assemblage	Carson River Native Fish Assemblage	Walker River Native Fish Assemblage	San Joaquin Native Aquatic Species	Upper Kern River Native Fish Assemblage
Area and extent of community	X	X	X	X		X	X		X	X	X	X	X	X	X	X	X
Community structure and composition		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Connectivity among communities and ecosystems	X	X	X	X		X	X		X		X	X	X		X	X	
Fire regime			X	X	X	X	X	X		X	X	X		X			X
Hydrological regime	X								X							X	
Nutrient concentration and dynamics													X				
Pollutant concentrations and dynamics													X	X			
Soil quality and sediment deposition regime	X				X					X	X		X	X			X
Successional dynamics	X	X	X		X	X	X	X		X							
Surface water flow regime	X	X											X	X	X	X	X
Water level fluctuations											X	X				X	
Water quality															X	X	
Water temperatures and chemistry																X	

5.4.4   Species of Greatest Conservation Need in the Central Valley and Sierra Nevada Province

The SWAP regional team identified species that would benefit from the conservation strategies for each target within the province. These species are the focus of the conservation strategies and will benefit from the actions taken to implement the conservation strategies (Table 5.4-3). Not all of the focal species meet the criteria to be considered Species of Greatest Conservation Need (SGCN). SGCN are indicated with an asterisk. SGCN associated with the Central Valley and Sierra Nevada Province are shown by ecoregion in Tables C-17 through C-19 in Appendix C.

Table 5.4-3 Focal Species of Conservation Strategies Developed for Conservation Targets – Central Valley and Sierra Nevada Province

Common Name	Scientific Name	Great Valley		Sierra Nevada Foothills					Sierra Nevada					Sacramento HUC 1802	Central Lahontan HUC 1605		San Joaquin HUC 1804	Tulare-Buena Vista HUC 1803
		American Southwest Riparian Forest and Woodland	Freshwater Marsh	Chaparral	California Foothill and Coastal Rock Outcrop Vegetation	California Foothill and Valley Forests and Woodlands	Desert Transition Chaparral	Montane Chaparral	North Coastal Mixed Evergreen and Montane Conifer Forests	Alpine Vegetation	Pacific Northwest Subalpine Forest	Wet Mountain Meadow	Western Upland Grasslands	Clear Lake Native Fish Assemblage	Carson River Native Fish Assemblage	Walker River Native Fish Assemblage	San Joaquin Native Aquatic Species	Upper Kern River Native Fish Assemblage
Invertebrates																		
California floater mussel	*Anodonta californiensis*															X	X	
Western pearlshell mussel	*Margaritifera falcata*														X	X	X	X
Valley elderberry longhorn beetle*	*Desmocerus californicus dimporphus*	X																
Fishes																		
Pacific lamprey*	*Entosphenus tridentatus*																X	
Goose Lake lamprey*	*Entosphenus tridentatus* ssp.[1]																	
Pit-Klamath brook lamprey	*Lampetra lethophaga*																	
Green sturgeon*	*Acipenser medirostris*																X	
Lahontan cutthroat trout*	*Oncorhynchus clarkii henshawi*														X	X	X	
Paiute cutthroat trout*	*Oncorhynchus clarkii seleniris*														X		X	
Rainbow trout	*Oncorhynchus mykiss*													X			X	
California golden trout*	*Oncorhynchus mykiss aguabonita*																	X
Kern River rainbow trout*	*Oncorhynchus mykiss gilberti*																	X
Goose Lake redband trout*	*Oncorhynchus mykiss* ssp.[1]																	
Little Kern golden trout*	*Oncorhynchus mykiss whitei*																	X
Mountain whitefish	*Prosopium williamsoni*														X	X		
Hitch	*Lavinia exilicauda chi*																X	
Clear Lake hitch	*Lavinia exilicauda chi*													X				
California roach	*Lavinia symmetricus*													X			X	
Pit roach*	*Lavinia symmetricus mitrulus*																	
Hardhead*	*Mylopharodon conocephalus*																X	X
Sacramento blackfish	*Orthodon microlepidotus*													X			X	
Sacramento pickeminnow	*Ptychocheilus grandis*													X			X	
Lahontan redside	*Richardsonius egregius*														X	X		
Speckled dace	*Rhinichthys osculus*														X	X		
Lahontan Lake tui chub*	*Siphateles bicolor pectinifer*														X			
Lahontan Creek tui chub	*Siphateles bicolor obesa*														X	X		
Goose Lake tui chub*	*Siphateles bicolor thalassina*																	
Sacramento sucker	*Catostomus occidentalis lacusanserinus*													X			X	X
Goose Lake sucker*	*Catostomus occidentalis lacusanserinus*																	
Mountain sucker*	*Catostomus platyrhynchus*														X	X		
Tahoe sucker	*Catostomus tahoensis*														X	X		
Unarmored threespine	*Gasterosteus aculeatus*													X				

Table 5.4-3   Focal Species of Conservation Strategies Developed for Conservation Targets – Central Valley and Sierra Nevada Province

Common Name	Scientific Name	American Southwest Riparian Forest and Woodland	Freshwater Marsh	Chaparral	California Foothill and Coastal Rock Outcrop Vegetation	California Foothill and Valley Forests and Woodlands	Desert Transition Chaparral	Montane Chaparral	North Coastal Mixed Evergreen and Montane Conifer Forests	Alpine Vegetation	Pacific Northwest Subalpine Forest	Wet Mountain Meadow	Western Upland Grasslands	Clear Lake Native Fish Assemblage	Carson River Native Fish Assemblage	Walker River Native Fish Assemblage	San Joaquin Native Aquatic Species	Upper Kern River Native Fish Assemblage
		Great Valley		**Sierra Nevada Foothills**					**Sierra Nevada**					**Sacramento HUC 1802**	**Central Lahontan HUC 1605**		**San Joaquin HUC 1804**	**Tulare-Buena Vista HUC 1803**
stickleback*	williamsoni																	
Sacramento perch	Archoplites interruptus													X				
Clear Lake tule perch	Hysterocarpus traski lagunae													X				
Prickly sculpin	Cottus asper													X				
Paiute sculpin*	Cottus beldingi*														X	X		
Pit sculpin	Cottus pitensis																	
Amphibians																		
California tiger salamander*	Ambystoma californiense	X		X		X	X	X										
Southern long-toed salamander*	Ambystoma macrodactylum								X	X	X	X	X					
Limestone salamander*	Hydromantes brunus			X	X		X	X										
Mount Lyell salamander*	Hydromantes platycephalus									X	X							
Red-bellied newt	Taricha torosa		X															
Western spadefoot*	Spea hammondii			X	X		X	X										
Kern Canyon slender salamander	Batrachoseps simatus					X												
Tehachapi slender salamander	Batrachoseps stebbinsi					X			X									
Relictual slender salamander	Batrachoseps relictus								X									
Yosemite toad	Anaxyrus canorus														X	X		
Northern leopard frog	Lithobates pipiens											X	X					
Foothill yellow-legged frog*	Rana boylii	X																
California red-legged frog*	Rana draytonii	X	X			X												
Southern mountain yellow-legged frog	Rana muscosa								X	X	X	X	X					
Sierra Nevada yellow-legged frog	Rana sierra														X	X		
Reptiles																		
Northwestern western pond turtle*	Actinemys marmorata	X	X			X												
Blunt-nosed leopard lizard*	Gambelia sila			X	X		X	X										
Blainville's horned lizard (coast horned lizard) *	Phrynosoma blainvillii			X	X		X	X										
Sagebrush lizard	Sceloporus graciosus								X		X							
Western skink	Plestiodon skiltonianus	X				X												
California legless lizard*	Anniella pulchra			X	X		X	X										
Southern rubber boa*	Charina umbratica								X									
Ring-necked snake	Diadophis punctatus	X		X	X	X	X	X										
California mountain kingsnake	Lampropeltis zonata											X	X					
San Joaquin whipsnake	Masticophis flagellum ruddocki			X	X		X	X										

Table 5.4-3   Focal Species of Conservation Strategies Developed for Conservation Targets – Central Valley and Sierra Nevada Province

Common Name	Scientific Name	Great Valley		Sierra Nevada Foothills					Sierra Nevada					Sacramento HUC 1802	Central Lahontan HUC 1605		San Joaquin HUC 1804	Tulare-Buena Vista HUC 1803
		American Southwest Riparian Forest and Woodland	Freshwater Marsh	Chaparral	California Foothill and Coastal Rock Outcrop Vegetation	California Foothill and Valley Forests and Woodlands	Desert Transition Chaparral	Montane Chaparral	North Coastal Mixed Evergreen and Montane Conifer Forests	Alpine Vegetation	Pacific Northwest Subalpine Forest	Wet Mountain Meadow	Western Upland Grasslands	Clear Lake Native Fish Assemblage	Carson River Native Fish Assemblage	Walker River Native Fish Assemblage	San Joaquin Native Aquatic Species	Upper Kern River Native Fish Assemblage
Gopher snake	*Pituophis catenifer*	X		X	X		X	X				X	X					
Coast patch-nosed snake*	*Salvadora hexalepis virgultea*			X	X		X	X										
Giant garter snake*	*Thamnophis gigas*	X	X	X	X		X	X										
Birds																		
Greater white-fronted goose	*Anser albifrons*	X	X	X	X		X	X									X	
Sooty grouse	*Dendragapus fuliginosus*								X		X							
California quail	*Callipepla californica*	X		X	X	X	X	X										
Great egret	*Adea alba*	X	X	X	X		X	X										
Great blue heron	*Ardea herodias*	X	X	X	X		X	X										
Black-crowned night heron	*Nycticorax nycticorax*	X	X															
Least bittern*	*Ixobrychus exilis*	X	X															
American white pelican*	*Pelecanus erythrorhynchos*		X														X	
California condor*	*Gymnogyps californianus*			X	X		X	X			X							
Osprey	*Pandion haliaetus*	X	X			X			X		X						X	
Northern goshawk*	*Accipiter gentilis*	X				X			X	X	X							
Golden eagle*	*Aquila chrysaetos*	X		X	X	X	X	X	X	X	X	X	X					
Rough-legged hawk	*Buteo lagopus*			X	X		X	X										
Ferruginous hawk	*Buteo regalis*			X	X		X	X										
Swainson's hawk*	*Buteo swainsoni*	X		X	X	X	X	X										
Northern harrier*	*Circus cyaneus*		X	X	X		X	X										
White-tailed kite*	*Elanus leucurus*			X	X	X	X	X										
Bald eagle*	*Haliaeetus leucocephalus*	X				X			X								X	
Snowy plover (interior population)*	*Charadrius nivosus*																X	
Western yellow-billed cuckoo*	*Coccyzus americanus occidentalis*	X																
Short-eared owl*	*Asio flammeus*		X	X	X		X	X				X	X					
Long-eared owl*	*Asio otus*	X		X	X	X	X	X				X	X					
Burrowing owl*	*Athene cunicularia*	X		X	X	X	X	X										
Great gray owl*	*Strix nebulosa*											X						
Spotted owl*	*Strix occidentalis*								X		X							
Vaux's swift*	*Chaetura vauxi*								X			X	X					
Black swift*	*Cypseloides niger*			X	X		X	X	X									
American peregrine falcon*	*Falco peregrinus anatum*		X	X	X	X	X	X				X						
Prairie falcon	*Falco mexicanus*			X	X		X	X										
Olive-sided flycatcher*	*Contopus cooperi*								X		X							
Loggerhead shrike*	*Lanius ludovicianus*			X	X		X	X										
Hutton's vireo	*Vireo huttoni*	X				X												

Table 5.4-3   Focal Species of Conservation Strategies Developed for Conservation Targets – Central Valley and Sierra Nevada Province

Common Name	Scientific Name	American Southwest Riparian Forest and Woodland	Freshwater Marsh	Chaparral	California Foothill and Coastal Rock Outcrop Vegetation	California Foothill and Valley Forests and Woodlands	Desert Transition Chaparral	Montane Chaparral	North Coastal Mixed Evergreen and Montane Conifer Forests	Alpine Vegetation	Pacific Northwest Subalpine Forest	Wet Mountain Meadow	Western Upland Grasslands	Clear Lake Native Fish Assemblage	Carson River Native Fish Assemblage	Walker River Native Fish Assemblage	San Joaquin Native Aquatic Species	Upper Kern River Native Fish Assemblage
		Great Valley		Sierra Nevada Foothills					Sierra Nevada					Sacramento HUC 1802	Central Lahontan HUC 1605		San Joaquin HUC 1804	Tulare-Buena Vista HUC 1803
Clark's nutcracker	Nucifraga columbiana										X							
Purple martin*	Progne subis	X	X	X	X	X	X	X	X									
Bank swallow*	Riparia riparia	X	X	X	X		X	X				X	X					
Common yellowthroat*	Geothlypis trichas*	X	X	X	X		X	X										
Marsh wren	Cistothorus palustris		X															
Yellow-breasted chat*	Icteria virens	X																
Yellow warbler*	Setophaga petechia	X		X	X	X	X	X	X									
Rufous-crowned sparrow	Aimophila ruficeps			X	X		X	X										
Grasshopper sparrow*	Ammodramus savannarum			X	X		X	X										
Song sparrow	Melospiza melodia	X	X															
California towhee	Melozone crissalis			X	X		X	X										
Savannah sparrow*	Passerculus sandwichensis			X	X	X	X	X										
Tricolored blackbird*	Agelaius tricolor	X	X	X	X	X	X	X										
Gray-crowned rosy-finch*	Leucosticte tephrocotis									X								
Mammals																		
Vagrant shrew	Sorex vagrans											X	X					
Pallid bat*	Antrozous pallidus	X		X	X	X	X	X										
Townsend's big-eared bat*	Corynorhinus townsendii			X	X		X	X										
Spotted bat	Euderma maculatum			X	X		X	X										
Western small-footed bat	Myotis ciliolabrum	X		X	X		X	X										
Long-eared bat*	Myotis evotis								X									
Fringed myotis*	Myotis thysanodes	X		X	X		X	X										
Yuma myotis	Myotis yumanensis	X																
Western pipistrelle	Parastrellus hesperus			X	X		X	X										
Western mastiff bat	Eumops perotis californicus	X	X	X	X		X	X										
American pika*	Ochotona princeps									X	X							
Snowshoe hare	Lepus americanus								X									
Black-tailed jackrabbit	Lepus californicus			X	X		X	X				X	X					
Riparian brush rabbit*	Sylvilagus bachmani riparius	X																
Mountain beaver	Aplodontia rufa								X		X							
Nelson's antelope squirrel*	Ammospermophilus nelsoni	X																
Northern flying squirrel	Glaucomys sabrinus								X		X							
California pocket mouse	Chaetodipus californicus			X	X		X	X										
North American beaver	Castor canadensis		X															
Heermann's kangaroo rat*	Dipodomys heermanni heermanni			X	X		X	X										
Giant kangaroo rat*	Dipodomys ingens	X																
San Joaquin kangaroo rat*	Dipodomys nitratoides			X	X		X	X										

Table 5.4-3   Focal Species of Conservation Strategies Developed for Conservation Targets – Central Valley and Sierra Nevada Province

Common Name	Scientific Name	American Southwest Riparian Forest and Woodland	Freshwater Marsh	Chaparral	California Foothill and Coastal Rock Outcrop Vegetation	California Foothill and Valley Forests and Woodlands	Desert Transition Chaparral	Montane Chaparral	North Coastal Mixed Evergreen and Montane Conifer Forests	Alpine Vegetation	Pacific Northwest Subalpine Forest	Wet Mountain Meadow	Western Upland Grasslands	Clear Lake Native Fish Assemblage	Carson River Native Fish Assemblage	Walker River Native Fish Assemblage	San Joaquin Native Aquatic Species	Upper Kern River Native Fish Assemblage
		Great Valley		Sierra Nevada Foothills					Sierra Nevada					Sacramento HUC 1802	Central Lahontan HUC 1605		San Joaquin HUC 1804	Tulare-Buena Vista HUC 1803
Fresno kangaroo rat*	*Dipodomys nitratoides exilis*			X	X		X	X										
San Joaquin pocket mouse*	*Perognathus inornatus inornatus*	X		X	X	X	X	X										
Dusky-footed woodrat	*Neotoma fuscipes*			X	X		X	X	X			X	X					
Riparian (=San Joaquin Valley) woodrat*	*Neotoma fuscipes riparia*	X																
Large-eared woodrat	*Neotoma macrotis*			X	X		X	X										
Deer mouse	*Peromyscus spp.*	X		X	X		X	X	X									
Porcupine*	*Erethizon dorsatum*					X			X		X							
Gray wolf*	*Canis lupus*								X									
Sierra Nevada red fox*	*Vulpes vulpes necator*									X								
Ringtail*	Bassariscus astutus	X		X	X	X	X	X	X			X	X					
California wolverine*	*Gulo gulo*								X	X	X							
Northern river otter	*Lontra canadensis*	X	X			X												
Pacific marten*	*Martes caurina [=americana]*								X	X	X							
Fisher - West Coast DPS*	*Pekania [=Martes] pennanti*								X		X							
American badger*	*Taxidea taxus*	X		X	X	X	X	X	X			X	X					
Western spotted skunk	*Spilogale gracilis*	X		X	X	X	X	X	X									
Tule elk*	*Cervus elaphus nannodes*	X																
Sierra Nevada bighorn sheep	*Ovis canadensis sierrae*									X	X							

[1] A species is shown for a particular conservation unit only if it is associated with specific conservation targets identified for the unit. For a complete list of SGCN associated with each habitat type by ecoregion, see Appendix C.
* Denotes a species on the SGCN list. Non-asterisked species are not SGCN but are identified as important species by CDFW staff.

5.4.5   Pressures on Conservation Targets

If the KEAs are degraded, then the target is experiencing some type of stress. Stresses are induced by negative impacts of pressures, anthropogenic (human-induced) or natural drivers that have string influences on the health of targets. Pressures can be positive or negative depending on intensity, timing, and duration. The major pressures identified for conservation targets in the Central Valley and Sierra Nevada Province are summarized in Table 5.4-4. These are considered the most significant pressures to the selected conservation targets in the province but do not represent a complete list of pressures for the province. The relationship between the stresses and pressures is unique for each conservation target and is identified in Section 5.4.6. Some of the major pressures for the province are discussed in more detail below.

Table 5.4-4   Key Pressures on Conservation Targets – Central Valley and Sierra Nevada Province

Pressure	American Southwest Riparian Forest and Woodland (Great Valley)	Freshwater Marsh (Great Valley)	Chaparral (Sierra Nevada Foothills)	California Foothill and Coastal Rock Outcrop Vegetation	California Foothill and Valley Forests and Woodlands	Desert Transition Chaparral	Montane Chaparral	North Coastal Mixed Evergreen and Montane Conifer Forests (Sierra Nevada)	Alpine Vegetation	Pacific Northwest Subalpine Forest	Wet Mountain Meadow	Western Upland Grasslands	Clear Lake Native Fish Assemblage (Sacramento HUC 1802)	Carson River Native Fish Assemblage (Central Lahontan HUC 1605)	Walker River Native Fish Assemblage	San Joaquin Native Aquatic Species (San Joaquin HUC 1804)	Upper Kern River Native Fish Assemblage (Tulare-Buena Vista Lakes HUC 1803)
Agricultural and forestry effluents	X	X												X			
Annual and perennial non-timber crops	X	X									X	X	X	X		X	
Climate change	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Commercial and industrial areas	X	X															
Dams and water management/use	X	X									X	X	X	X	X	X	
Fire and fire suppression			X	X	X	X	X	X		X	X	X		X			
Household sewage and urban waste water	X	X												X		X	
Housing and urban areas	X	X	X	X	X	X	X				X	X		X			
Industrial and military effluents																	
Introduced genetic material														X	X		X
Invasive plants/animals	X	X			X				X		X	X	X	X	X	X	X
Livestock, farming, and ranching	X	X	X	X	X	X	X	X	X		X	X		X	X		X
Logging and wood harvesting	X							X			X	X					
Marine and freshwater aquaculture																X	
Mining and quarrying		X											X	X			
Parasites/pathogens/diseases										X							
Recreational activities					X				X	X	X	X	X			X	
Renewable energy			X	X		X	X	X									
Roads and railroads	X	X			X						X	X		X	X		
Tourism and recreation areas																	
Utility and service lines	X							X									

Dams and Water Management/Use

Central Valley
Water management pressures in the Central Valley include water diversions, dams, flood control structures (e.g., levees and bank protection), groundwater pumping, stream and river crossings (e.g., culverts, bridges), and dredging. Because of the important hydrologic connections, water management interrelationships, and other linkages between the Central Valley and the Bay Delta watersheds, the following includes some discussion of Central Valley water management influences on the Bay Delta.

Water diversions are found throughout the Central Valley's rivers and tributaries. Water is diverted for agriculture, municipal and industrial uses, and managed wetlands. Up to 70 percent of the freshwater flow that would naturally enter San Francisco Bay is now diverted (Steere and Schaefer 2001). Dams are located on all of the major rivers in the Central Valley and on many of their tributaries.

Dams and diversions have dramatically affected the aquatic ecosystems of the Central Valley, altering historical flooding regimes, erosion, and deposition of sediments that maintain floodplains. They also decrease riparian habitats and coarse gravel supplies needed for salmon and other native fish reproduction. Dam operations create rapid changes in flow rates that have led to the stranding of fish and exposure of fish spawning areas (CDFG 2005).

Dams reduce the amount of water remaining in the river that is needed by fish at critical times, and they alter the flow regimes in ways that are detrimental to aquatic life. Less water in the rivers also means less water for managed wetlands. Reduced river flows down- stream also allow saltwater intrusion into the Delta, increasing the salinity levels in the San Francisco estuary and bay beyond the tolerance levels of many species (Steere and Schaefer 2001).

Agricultural diversions usually get the highest quality water, discharging salty water that is then used in wildlife areas. By the time it is discharged from some wildlife areas, its salinity triggers concerns about water quality by regulatory agencies, particularly in the San Joaquin Valley. Efforts to correct this problem are complicated, owing to a poor understanding of the historic elements of salinity and the naturally saline wetlands of the San Joaquin drainage (CDFG 2005).

Dams and diversions also block fish movement to upstream habitat, remove fish and wildlife habitat, alter water quality (i.e., temperature and flow), and kill fish through entrainment and entrapment. Dams have cut off salmon access to 70-95 percent of their historical range (State Lands Commission 1993; Trust for Public Land [TPL] 2001; Clemmins et al. 2008; NMFS 2014). The diversion of water through powerful pumps from the Delta to the canals heading to Southern California reverses Delta flows and confuses migrating fish trying to find their way to the ocean. At times, the young fish swim with the flowing waters toward the pumps rather than toward the open ocean.

Levee, bridge, and bank-protection structures are present along more than 2,600 miles of rivers in the Central Valley and in the Delta (DWR 2005). These structures prevent flood flows from entering historic floodplains and eliminate or alter the character of floodplain habitats, such as shaded riverine habitat, and floodplain ecosystem processes. Constrained flood-level flows increase scouring and incision of river channels and reduce or halt the formation of riparian habitat, channel meanders, and river oxbow channels.

These changes in water supply also stress many upland species. Most of the resident terrestrial animals need to find adequate water during California's long, dry summer months. As human demand for water increases, there is less water available for resident wildlife species, so they experience greater physiological stress. In some cases, water management has also led to sustained year-round flows in streams that historically dried up in the summer. Central Valley

habitats rely on a large and complex drainage, involving snowmelt and land uses up to 300 miles away and water imports from and exports to other river basins.

Current water management practices exemplify interactions between pressures and resulting stresses. As urban development expands, it creates more impermeable surfaces like concrete, asphalt, and the roofs of buildings. Subsequent rainfall is then less able to soak into the ground and runs off quickly. Rapid runoff reduces the recharge of groundwater reservoirs and reduces later summer stream flows. Combined with water diversions, this reduction in groundwater causes streams to dry up more quickly, thus reducing the availability of water to wildlife during summer months. Increased urban runoff also is a major source of water pollution. Urban runoff washes various pollutants out of urban areas, depositing them into creeks, rivers, and other water bodies, adding to wildlife stress.

Central Valley Project Improvement Act

The Central Valley Project (CVP) is a federal water management project under the supervision of the U.S. Bureau of Reclamation (USBR). It was authorized in 1935 in order to provide irrigation and municipal water to much of the Central Valley—by regulating and storing water in reservoirs in the northern half of the state, and transporting it to the San Joaquin Valley and its surroundings by means of a series of canals, aqueducts and pump plants, some shared with the California State Water Project (SWP).

In addition to water storage and regulation, the system provides recreation and promotes flood control with its dams and reservoirs. Over time CVP operations have resulted in environmental impacts, such as salmon population decline in four major California rivers, and many natural river environments, such as riparian zones, meanders and sandbars no longer exist.

The Central Valley Project Improvement Act (CVPIA) was enacted in 1992 and mandated changes in management of the CVP, particularly for the protection, restoration, and enhancement of fish and wildlife. Its purposes are:

- Protect, restore, and enhance fish, wildlife, and associated habitats in the Central Valley and Trinity River basins of California
- Address impacts of the Central Valley Project on fish, wildlife and associated habitats, and improve the operational flexibility of the Central Valley Project
- Increase water-related benefits provided by the Central Valley Project to the State of California through expanded use of voluntary water transfers and improved water conservation
- Contribute to the State of California's interim and long-term efforts to protect the San Francisco Bay/Sacramento-San Joaquin Delta Estuary
- Achieve a reasonable balance among competing demands for use of Central Valley Project water, including the requirements of fish and wildlife, agricultural, municipal and industrial and power contractors

Changes in management of the CVP under the CVPIA include: 800,000 acre-feet of water dedicated to fish and wildlife annually; tiered water pricing applicable to new and renewed contracts; water transfers provision, including sale of water to users outside the CVP service area; special efforts to restore anadromous fish population by 2002; restoration fund financed by water and power users for habitat restoration and enhancement and water and land acquisitions; no new water contracts until fish and wildlife goals achieve; no contract renewals until completion of a Programmatic Environmental Impact Statement; terms of contracts reduced from 40 to 25 years with renewal at the discretion of the Secretary of the Interior; installation of the temperature control device at Shasta Dam; implementation of fish passage measures at Red Bluff Diversion Dam; firm water supplies for Central Valley wildlife refuges; and development of a plan to increase CVP yield.

Sierra Nevada

Among the major rivers of the Sierra Nevada, all but a few have multiple dams or diversions. Flows are managed for hydropower generation, for water for irrigation and domestic uses, and for flood control (DWR 1998). A few small dams were developed and are still maintained for instream flow protection and management downstream, and/or for wet meadow habitat maintenance. Others were constructed by fisheries managers to provide barriers between sensitive native fish populations and introduced fish with capability to interbreed or prey upon the native species. The unnatural managed flows disrupt and degrade aquatic and riparian ecosystems. Below dams, river flows are ramped up and down and water temperatures are changed, often creating lethal conditions for aquatic species. Dams and diversions of the rivers that flow into the Sacramento and San Joaquin drainages have been particularly detrimental to anadromous Chinook salmon, steelhead trout, Pacific lamprey, sturgeon, and Delta smelt. Each of these species historically spawned in Sierra Mountain rivers and streams, their young swimming to the sea and returning a few years later as adult fish to spawn. The construction of dams and water diversions blocked fish passage, contributing to dramatic declines in salmon and steelhead populations of the Sacramento and San Joaquin drainages. Fewer anadromous fish also means fewer eggs, young fish, and fish carcasses that provide nutrients for numerous other aquatic species. Historically, one to three million Chinook salmon spawned each year in the western Sierra. Today, dams block salmon access to upstream spawning habitat in all but a few creeks. Late fall, winter, and spring runs of salmon have collapsed. Steelhead and the spring-run Chinook salmon are federally threatened, winter-run Chinook salmon are also listed by the state as endangered. Fall and late fall run salmon are taxa of special concern. Natural and hatchery produced fall run Chinook salmon continues to support ocean commercial and sport fisheries and a river fishery. Many other aquatic species are also affected by the migration impediments imposed by dams and their associated reservoirs.

In the foothills, residential development continues to add "river wells" located directly on stream aquifers. Increased water drafting has turned some year-round streams into seasonal creeks and dried up other streams (CDFG 2005). Native fish (such as hitch, hardhead, and native rainbow trout), amphibians, and native invertebrate populations are adversely affected where streams have receded. Similarly, the development of springs for domestic water supply on private and public lands has degraded riparian habitats for native amphibians and invertebrates.

Fire and Fire Suppression

Most of California's forest ecosystems have evolved with recurring fire, and each plant community of the Sierra Nevada has adapted to some range of frequency of wildfire. The plant communities, topography, elevation, and climatic conditions influence the "fire regime," the frequency and intensity of fire for a specific plant community (McKelvey et al. 1996). In turn, the extent and intensity of fire influence ecological processes, shape plant communities, and affect wildlife.

A continuum of fire regimes exists in the various forest types. For example, ponderosa pine-dominated mixed conifer forests of the Sierra have historically had a fire regime of frequent, low- to moderate-intensity fires, with less frequent large, uncharacteristic fires. Additionally, Sierran forests consisted of highly clustered groups of trees with sparsely treed or open gap conditions but have been converted to less resilient and more fire prone habitats. (North et al. 2009). At higher elevations, lodgepole pine communities evolved with less frequent but more severe fires (McKelvey et al. 1996). Wildfire is such an influential ecological element that the regeneration of some plant communities and the survival of many plant species require fire (Kilgore 1973). Fire suppression coupled with selective harvest of large trees, re-forestation with dense plantations of young conifers, invasive weeds, and intensive grazing have dramatically reshaped forest structure and altered ecosystems over the last 100 years.

In the early 1900s, the nature and role of wildfire was not understood and was generally viewed as damaging to forests. As a result, state and national policy for the last century has been to aggressively suppress forest fires and to put them out quickly, minimizing fire on the landscape of the West (van Wagtendonk 1995). USFS's "Smokey Bear" campaign was highly successful, training generations of Americans that wildfire was synonymous with waste and destruction and that it was everyone's duty to prevent forest fires (Dombeck et al. 2004; Kaufman 2004).

To restore native plant communities, forest ecologists generally agree that fire needs to returne to forests at intervals consistent with historical fire regimes. But a century of fire suppression has created an enormous backlog of forest acreage with dense tree stands and high fuel loads (Husari and McKelvey 1996). The 1964 federal Wilderness Act recognized the ecological role of fire and established a policy allowing natural fires to burn in national parks. NPS has implemented prescribed fires for many years; however, most of the forests needing fire are lower in elevation than most of the wilderness areas. In 1971, USFS policy was amended to allow prescribed fires on national forest lands as well (Caprio and Swetnam 1993; Chang 1996, Kilgore 1973; Skinner and Chang 1996). The results of prescribed fires in the Sierra have shown excellent ecological benefits (Keifer et al. 2000). Yet, while the use of prescribed fire is increasing and considered a necessary tool to restore ecosystems and reduce the risk of uncharacteristic wildfire, it is currently applied to very few forested acres of the Sierra.

Returning fire to forest ecosystems presents great challenges, because of current-day property and safety risks. The fire threat to people and expanding communities in the forests, excessive fuel loads created by fire suppression and past forest management practices, effects on air quality and conflicts with clean-air laws, and liability all impose difficult constraints on the increased use of prescribed fire and allowing natural fires to burn. Even with the best efforts to reduce fire conflicts and risks, in many areas, reintroducing fire will not be practical or politically possible, at least as a first treatment. Certainly in some locations, selective timber harvest may have to serve as the surrogate for natural fire to begin the process of restoring ecological diversity to forests. Mechanical thinning, however, will not provide all of fire's ecological benefits.

Recently, research priorities and questions relative to planning and implementing forest/fuels treatments are focusing on designing effective fuels treatment placement in landscapes under real world constraints; the historic and appropriate size of high-severity burn patches in a landscape with an active mixed-severity fire regime; planning for climate change; and better understanding historical forest conditions and fire regimes, and their relevance for management (North et al. 2012).

Climate Change

Climate change across the province is expected to occur as described below. These changes and their ecological impacts will likely interact with the other pressures described in this section, and in some cases will create a negative feedback (e.g., climate change could accelerate the spread of invasive species).

The climatic changes presented below will likely affect all conservation targets identified in this province. Climate change has only been included as a pressure for a subset of targets that are considered more vulnerable to climate impacts, and/or in instances where it was determined that interactions between climate change and other pressures could be addressed in a meaningful way through a conservation strategy.

Temperature
Average annual temperatures in the Central Valley are expected to increase 1.4 to 2.0°C (2.5 to 3.6°F) by 2070, and 1.5 to 4.5°C (2.9 to 7.9°F) by 2100 (PRBO 2011). January average temperatures are projected to increase 2.2 to 3.3°C (4 to 6°F) by 2050 and 4.4 to 6.7 °C (8°F and 12°F) by 2100. July average temperatures are projected to increase 3.3 to 3.9°C (6 to 7°F) in 2050 and 6.7 to 8.3°C (12°F to 15°F) by 2100 (CalEMA 2012). Within the Sierra Nevada and foothills region, topographic and elevation diversity are expected to vary the magnitude of temperature change at a very fine spatial resolution. Average annual temperatures are expected to increase 1.8 to 2.4°C (3.2 to 4.3°F) by 2070, and 3.6 to 3.8°C (6.5 to 6.8°F) by 2100 (PRBO 2011).

In the Northern Sierra, January average temperatures are projected to increase 1.4 to 2.2°C (2.5 to 4°F) by 2050 and 3.3 to 3.9°C (6°F to 7°F) by 2100. The largest changes are observed in the southern part of the region. July average temperatures are projected to increase 2.2 to 2.8 (4 to 5°F) by 2050 and 5.6°C (10°F) by the end of the century, with the greatest change in the northern part of the region (CalEMA 2012).

In the Southeast Sierra: January increase in average temperatures: 0.8 to 1.4°C (1.5 to 2.5°F) by 2050 and 2.8 to 5.6°C (5 to 10°F) by 2100. July average temperatures are projected to increase 1.7 to 2.8°C (3 to 5°F) by 2050 and 4.4 to 5.6°C (8 to 10°F) (CalEMA 2012).

Precipitation and Snowpack

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Within the Central Valley, lower-elevation areas are projected to experience declines in annual precipitation of 2.5 to 5 cm (1 to 2 inches) by 2050 and up to 8.9 cm (3.5 inches) by 2100, while more elevated areas are projected to experiences losses of up to 25.4 cm (10 inches).

In the Northern Sierra, precipitation decline is projected throughout the region. The amount of decrease varies from 7.6 to 12.7 cm (3 to 5 inches) by 2050 and from 15 to 25 cm (6 to 10 inches) by 2100, with the larger rainfall reductions projected for the southern portions of the region. Snowpack levels are projected to decline dramatically in many portions of the region. In southern portions of the region, a decline of nearly 15 inches in snowpack levels – a more than 60 percent drop – is projected by 2090 (CalEMA 2012).

In the southeastern Sierra potential precipitation decline is between 0 and 10 cm (4 inches) by 2050 and 2.5 to 38 cm (1 and 15 inches) by 2100. The range varies widely depending on location. Some areas receive less than 15 cm (6 inches) annually, with projected reductions bringing totals under 10 cm (4 inches) by 2090. In other areas, total rainfall exceeds 114 cm (45 inches) per year and is projected to decrease by roughly 38 cm (15 inches) by 2090. Snowpack levels are projected to decline dramatically by 2090 in some areas, with declines of over 50 percent (CalEMA 2012).

Freshwater Hydrologic Regimes

In the Sierra Nevada, the considerable loss in snowpack is projected to decrease the duration and magnitude of flows. Approximately 20 percent decrease in runoff and riverflow is expected by 2090. The combined effect of changes in precipitation, temperature, and snowpack are expected to produce an earlier arrival of annual flow volume by as much as 36 days by 2071–2100; and, warmer temperatures and more precipitation falling as rain rather than as snow are also projected to cause snowmelt runoff to shift earlier under all model simulations (PRBO 2011). Declining snowpack, earlier runoff, and reduced spring and summer streamflows will likely affect surface water supplies and increase reliance on groundwater resources in the Central Valley, which are often already overdrafted (PRBO 2011).

Wildfire Risk

Within the eastern portion of the Central Valley, an increase in wildfire risk of four to six times current conditions is projected (CalEMA 2012).

In the Northern Sierra, wildfire risk is projected to increase in a range of 1.1 to 10.5 times throughout the region, with the highest risks expected in the northern and southern parts of the region. In the Southeastern Sierra, wildfire risk is projected to increase substantially (up to 19.1 times) by 2085 over current levels in Alpine County and the northern part of Mono County. The rest of Mono County and all of Inyo County is projected to have a wildfire risk between 1.1 to 4.8 times greater than current levels (CalEMA 2012).

In the Sierra Nevada overall, the probability of large fires (>200 hectares) is projected to increase by 2100, more so on the west slope and in the foothills; and, up to 50 percent increase in area burned is projected in the eastern Sierra Nevada by 2070-2090. Over the longer term, however, these conditions may lead to vegetation shifts that support less severe wildfire regimes (PRBO 2011).

Central Valley

Although climate change is already affecting wildlife throughout the state (Parmesan and Galbraith 2004), and its effects will continue to increase, it has particular significance for this region's major river and estuarine systems.

In general, California winters will likely become warmer and wetter during the next century. Instead of deep winter snowpacks that nourish valley rivers through the long, dry summer, most of the precipitation will be winter rain that runs off quickly. For the Central Valley, this means more intense winter flooding, greater erosion of riparian habitats, and increased sedimentation in wetland habitats (Field et al. 1999; Hayhoe et al. 2004).

Hotter, drier summers, combined with lower river flows, will dramatically increase the water needs of both people and wildlife. This is likely to translate into less water for wildlife, especially fish and wetland species. Lower river flows will allow saltwater intrusion into the Bay and Delta, increasing salinity and disrupting the complex food web of the estuary. Water contaminants may accumulate during the summer as the natural flushing action decreases.

Sea level worldwide during the past 100 years has been rising from 1 to 2 millimeters per year, 10 times faster than the rate over the past 3,000 years. Gauges along the California coast have already measured 4-inch to 6-inch increases in sea level since 1900 (NOAA 2005). By 2100, sea levels might rise as high as 3 feet above their present levels (ACIA 2004; IPCC 2001).

Sierra Nevada

While climate change will undoubtedly affect all regions of the state, the consequences for vegetation, wildlife, and water resources will likely be most dramatic in the Sierra Nevada. Depending on the model and assumptions, scientists project the average annual temperature in California to rise between 4 and 10.5°F above the current average temperature by the end of the century (Hayhoe et al. 2004; Schneider and Kuntz-Duriseti 2002; Turman 2002). Within 50 years, average wintertime temperatures are expected to rise between 2 and 2.5°F. A rise in this range would substantially reduce annual snowpack and increase fire frequency and intensity. By mid-century, the Sierra snowpack could be reduced by 25 percent to 40 percent and by as much as 70 percent at the end of the century (duVair 2003). Snow season would be shortened, starting later and melting sooner, while fire season would be longer and hotter. The reduction of snowpack and more extreme fire conditions would have cascading effects on water resources, plant communities, and wildlife.

The average annual Sierra snowpack, which is roughly equal to half the storage capacity of all the state's reservoirs combined, holds water until the melt in late spring and early summer. Rising temperature has already begun to reduce the total snowpack and melt it earlier in the year, further shifting stream- and river-flow regimes throughout the Sierra (Stewart et al. 2004; Vanrheenen et al. 2004). As the runoff comes earlier, spring and summer stream flow is projected to decline by 10 percent to 25 percent by 2050 and decline by potentially as much as 40 percent to 55 percent by the end of the century (duVair 2003). The changing flow regimes will alter riparian and aquatic ecosystems. Streams may be reshaped by different timing and intensity of flood conditions, while some perennial streams may dry up and transition to ephemeral streams no longer supportive of many aquatic species (Turman 2002). One strategy to alleviate these effects would rely on maintaining and restoring healthy mountain meadows, which act like sponges and would help to hold water later into the dry season.

Average annual temperature is a key element that determines plant communities found across the elevation gradient of the Sierra Nevada. As temperature rises, alpine and sub-alpine plant communities will shrink as mixed conifer forest expands higher in the range. Alpine and sub-alpine plant communities may decline by 40 percent to 50 percent by mid-century. Oak woodlands may move higher, replacing pine and fir forest. At the lower elevations, the longer, warmer dry season could lead to increased fire

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frequency, likely converting some shrub communities to grasslands (du Vair 2003; Turman 2002). The expected changes in fire regimes will likely alter the abundance and distribution of plant communities, affecting habitats for wildlife (McKenzie et al. 2004; Miller and Urban 1999).

As climate change shifts annual average temperatures along the elevation gradient, as fire reshapes plant communities, and as stream flow regimes change, habitats and wildlife populations will be substantially affected.

Housing and Urban Areas; Annual and Perennial Non-Timber Crops

Central Valley

The main underlying cause of habitat loss and degradation is the increasing human population and its high demand for a limited supply of land, water, and other natural resources.

Up until the last few decades, much of the terrestrial habitat loss in the region has been because of agricultural land conversion. Recent land-use trends show a more mixed set of pressures from both urban and agricultural land conversion, depending on the habitat, topography, and proximity to major highways. Some habitats, such as wetlands and floodplains, are receiving increased environmental protection and thus less development pressure than other habitats (Landis and Reilly 2003). On the floor of the Central Valley, urbanization occurs mostly on previously cultivated lands, where much of the habitat has already been lost or highly degraded. In these areas, particularly in rural lands, the remaining fragments of habitat continue to be converted to intensive agriculture. In the eastern uplands and foothills of the Central Valley, urban and rural residential development has had a greater impact on habitat because it occurs generally on grasslands and other naturally vegetated lands.

The rate of population growth in the Central Valley and the Sierra Nevada is remarkable. Fifteen of the top 20 fastest-growing counties in California between 1990 and 2003 were in the Central Valley, all exceeding the statewide average growth rate. This pattern is likely to remain the same during the next 50 years. Between 1990 and 2003, the Central Valley gained 1.8 million residents, nearly 30 percent of the total gain statewide. By comparison, the San Francisco Bay Area gained 974,000 residents, and the Southern California coastal region gained 3 million. By 2050, the Central Valley will gain an additional 7.4 million people, exceeding the 7.1 million-person gain for Southern California and the 3.2 million-person gain of the Bay Area (California Department of Finance [CDOF] 2000; CDOF 2003; CDOF 2004; Sanders 2004). This region grew by approximately 2.8 percent from 2010 to 2014. Six counties exceeded the statewide average growth rate of 2.9 percent from 2010 to 2014 (Placer, Kern, Tulare, San Joaquin, Fresno, and Merced. Placer County had the highest growth rate in the state at 5.1 percent. Seven counties within the region had a negative growth rate between 2010 and 2014 (Amador, Sierra, Plumas, Tuolumne, Calaveras, Kings, and Nevada).

Natural habitats of this region have been converted to a variety of different land uses, including weedy pastureland, dryland farming, irrigated cropland, relatively permanent orchards and vineyards, large dairies, rural residential, and high-density urban. Wildlife species have different tolerances for each of these conversions, with many of them unable to adapt to the more-developed land uses. Beyond direct habitat loss, converting land to more intensive human-

related uses brings additional stresses, including invasive species, human disturbance, fire suppression, and insect control, which further degrade ecosystem health and wildlife viability.

In the Central Valley, 99.9 percent of the historic native grasslands, 99 percent of valley oak savanna, about 95 percent of wetlands, 89 percent of riparian woodland, 66 percent of vernal pools, and 67 percent of San Joaquin Valley shrublands are gone (CVHJV 1990; Hickey et al. 2003; Kelly et al. 2005; TNC 1987; TNC 1995; TNC 1998). Habitat conversion has continued since these analyses were conducted.

Growth and development fragment habitats into small patches that cannot support as many species as larger patches can. These smaller fragments often become dominated by species more tolerant of habitat disturbance, while less-tolerant species decline. Populations of less-mobile species often decline in smaller habitat patches because of reductions in habitat quality, extreme weather events, or normal population fluctuations. Natural recovery following such declines is difficult for mobility-limited species. Such fragmentation also disrupts or alters important ecosystem functions, such as predator-prey relationships, competitive interactions, seed dispersal, plant pollination, and nutrient cycling (Bennett 1999; ELI 2003).

Growth and development, along with associated linear structures like roads, canals, and power lines, impede or prevent movement of a variety of animals. This is generally less significant than habitat loss but makes it more difficult for those species that need to move large distances in search of food, shelter, and breeding or rearing habitat and to escape competitors and predators. Animals restricted to the ground, like mammals, reptiles, and amphibians, face such obstacles as roads, canals, and new gaps in habitats. Attempts to cross these obstacles can be deadly, depending on the species and the nature of the gap (e.g., four-lane highways with concrete median barriers compared to narrow, rural two-lane roads). Fish and other water-bound aquatic species attempting to move either upstream or downstream are blocked by lack of water resulting from diversions, physical barriers like dams, and by entrainment in diverted water. Even the movement of highly mobile species like birds and bats can be impeded by such features as transmission lines and wind energy farms, particularly in focused flight corridors like Altamont Pass, and 50 new wind energy sites are currently proposed throughout the state on land managed by BLM (CDFG 2005) Such species either cannot see or do not avoid these structures, and many die as a result. The actual extent of bird fatalities because of power-line collision in California is unknown; however, the California Energy Commission (CEC) estimates that fatality rates because of Central Valley power-line collisions alone could reach as high as 300,000 birds per year (CEC 2002a; CEC 2002b).

Sierra Nevada
The Sierra Nevada underwent population growth of 130 percent between 1970 and 1990, compared to the state's average of 49 percent growth over the same period, and growth in the region is expected to continue at a pace exceeding the state average, adding about 175,000 new residents every decade (Duane 1998; SNEP 1996).

The greatest growth and development have occurred in the mostly privately owned western foothills, particularly in the watersheds of the Yuba, American, and San Joaquin rivers, in the Lake Tahoe Basin, and around Lake Almanor. Development pressure is strong in the foothills adjacent to the metropolitan centers of Sacramento, Stockton, Merced, Fresno, and Bakersfield, particularly along the foothill river corridors near these cities. On the Sierra Nevada's east side, growth pressure is greatest between Reno and Susanville and near Bishop.

Ranchette and residential communities are expanding from metropolitan areas of Reno and Redding along Highways 395, 299, and 44 along the eastern foothills and across the northern Sierra Nevada and Cascades (CDFG 2005). New development along these highway corridors is displacing wildlife habitat and creating barriers in important wildlife migration areas. For example, development along Highway 395 south of Susanville hinders the seasonal migration of deer across the Bass Hill Wildlife Area. Key wildlife corridors in the region are crossed by highways. Highway 299 descends the Cascades between Mount Lassen and Mount Shasta and winds northeast across the Modoc Plateau (Penrod et al. 2000). As development expands on the private lands adjacent to Highway 299, migrating mule deer, elk, and antelope will be less able to move between seasonal ranges. Without conservation planning, future development along these corridors will likely have a significant impact on the region's wildlife.

In the Sierra Nevada, development is also expanding into the forest. New golf courses, scattered single-family homes, commercial properties, ski resorts, industrial sites, and new roads are replacing and fragmenting wildlife habitat. Where development occurs, fire is suppressed, preventing regeneration of fire-dependent vegetation and altering plant communities. Development also requires new water diversions and creates new sources of pollution. Mountain meadows, oak woodlands, and riparian streams are places of high wildlife diversity, and they are also preferred sites for development.

As seasons change, the survival of many mammal, bird, and fish species depends on their ability to migrate between higher and lower elevations in the Sierra Nevada. But opportunities to migrate successfully have been compromised by dams, reservoirs, highways, altered stream flows, residential community development, and predation by free-roaming domestic pets.

For 150 years, the west-slope foothills have been the most seriously affected area of the Sierra Nevada, with cattle ranching having the greatest presence. Western foothill development has fragmented riparian corridors and other habitats (Kattelman 2000). Much of the development on the western slope of the Sierra Nevada has degraded oak woodlands, lower mixed conifer forests, and similar habitats that support more wildlife diversity than other plant communities of the region. More than 350 species of birds, mammals, reptiles, and amphibians inhabit the oak woodlands (CalPIF 2002). The Sierra Nevada Ecosystem Project documented that 85 terrestrial vertebrate species require west-slope foothill savanna, woodland, chaparral, or riparian habitats to retain population viability, and 14 of these species are at risk of extinction.

Many early homestead settlements in the high Sierra Nevada clustered in level areas close to water, areas that are also particularly important for wildlife habitats, including meadows and areas along rivers and streams. While most higher-mountain habitats are public lands managed by federal agencies, these older settled areas remain largely in private ownership. Today, these private lands, surrounded by national forests, are prized for development.

Development in the Sierra Nevada over the last three decades has been primarily via incremental single-home and small commercial development, lacking the benefit of regional conservation planning. Low-density development has been the norm. Such development has resulted in greater fragmentation of the landscape and its corresponding negative consequences for wildlife. In many locations throughout the foothills, larger land holdings are being broken up into smaller parcels for single homes. In other areas, mountain meadows and pastures are being converted to golf courses and residential communities.

Development also exacerbates existing stresses on wildlife and habitats. Invasive plant species are often introduced along new roads and with new landscaping. Invasive species outcompete native species in development-disturbed lands. Additional domestic water use further reduces water available for aquatic ecosystems.

Growth has also increased the need to suppress fire, thereby expanding the conflict with efforts to restore more natural fire regimes in these fire-adapted ecosystems. Adding residents to the region will likely result in more citizen resistance to prescribed fire and more objections to the smoke it generates.

The severity of future development's effects on species at risk will depend on whether conservation planning is embraced and if growth allowed by counties is designed to account for fire, to protect ecosystems, and to minimize further fragmentation of habitats.

Invasive Plants/Animals

Invasive plant and animal species are an important pressure on wildlife in this province, just as they are in other regions throughout the state (CALFED 2000; CalIPC 1999; CDFG 2005; Goals Project 1999; Hickey et al. 2003; Jurek 1994; Lewis et al. 1993; RHJV 2004). Many of the conservation actions described below address prevention, early detection, and rapid response to new invasive plants to prevent them from becoming widespread. Distribution maps and summary reports for invasive plants, as well as regional strategic plans for prioritized invasive plant species can be found on the CalWeedMapper website (http://calweedmapper.cal-ipc.org). Some of the invasive species affecting the province are discussed below.

Central Valley

Invasive plants can be found in many different habitats in this region. In grasslands, some of the more challenging plant invaders include eucalyptus, fountain grass, gorse, medusahead, tree of heaven, and yellow starthistle. In riparian and wetland areas, invading plants include edible fig,

giant reed or arundo, Himalayan blackberry, pampas grass, Russian olive, tamarisk (or saltcedar), pennyroyal, pepperweed, tree of heaven, Scotch broom, and French broom. Oak woodlands are invaded by plants such as Scotch broom, French broom, pepperweed, medusahead, barbed goat grass, and yellow star thistle.

Introduced plants also invade aquatic habitats. These aquatic invaders include Brazilian waterweed, egeria, Eurasian watermilfoil, hydrilla, water hyacinth, water pennywort, and parrot feather.

Introduced animals have invaded both terrestrial and aquatic environments. Not all introduced vertebrates are invasive, and they have varying effects on wildlife. The species of most concern in the region parasitize songbird nests, dominate limited nesting habitat, prey on native species, or otherwise damage wildlife habitats.

Fifty-one new fish species have become established in California (Moyle 2002), dominating most of the rivers and streams in this region. These include species such as striped bass, white catfish, channel catfish, American shad, black crappie, largemouth bass, and bluegill. Many fish were historically introduced (via stocking) by federal and state resource agencies to provide sport fishing or forage fish to feed sport fish. Many introduced non-native fish and amphibians may out-compete native fish for food or space, prey on native fish (especially in early life stages), change the structure of aquatic habitats (increasing turbidity, for example, by their behaviors), and may spread diseases (Moyle 2002). However, not all non-native species are considered invasive, which typically refers to species whose introduction causes or is likely to cause economic or environmental harm to human health. Several of the introduced predatory fish may have increased predation levels on Chinook salmon and other native fishes (CALFED 2000).

In addition to introduced fish, native aquatic species are stressed by introduced bullfrogs, red-eared sliders (a turtle), and invertebrates. Introduced invertebrates, such as New Zealand mud snail, quagga mussels, Asian clam, zebra mussel, Chinese mitten crab, and mysid shrimp, are causing significant problems for native species in rivers, streams, and sloughs. While not all of the introduced aquatic species are invasive or have significant consequences for native species, biologists are concerned about the sheer dominance of these new species and their current and potential effects on the structure and function of the estuarine ecosystem.

Sierra Nevada

Invasive plants have transformed plant communities and contributed to the decline of native species in ecosystems of the Sierra Nevada. Foothill oak woodlands and riparian plant communities, so important for maintaining wildlife diversity, have been particularly affected by invasions of non-native grasses and shrubs. High desert shrublands on the east side of the Sierra have also been altered by invasive grasses. Sub-alpine and alpine plant communities, however, are relatively intact, with few invasive plants (Schwartz et al. 1996).

The understory of foothill woodlands of blue oak, interior live oak, valley oak, and gray pine are now dominated by wild oats, fescue, cheatgrass, and other invasive non-native grasses. Scotch

broom and yellow starthistle have also degraded the Sierra Nevada foothills (Bossard et al. 2000; DiTomaso and Gerlach 2000). Both weed species displace native species and are toxic to browsing wildlife. Saltcedar, Russian olive, giant reed, eucalyptus, and English ivy are among the invasive plants that have invaded low- and mid-elevation riparian habitats. On the east side of the Sierra, the combined effects of invasive cheatgrass—which outcompetes native perennial and annual grasses—and livestock grazing have contributed to changes in fire regimes and transformed desert scrub and grassland communities.

Generally, invasive plants that replace native plants degrade habitat quality for native species. Some wildlife species are dependent on specific native plants. Other animal species become stressed when the invasive plants offer inferior nutrition or nesting or prey habitat. In some areas, invasive annual grasses make for greater fuel loads compared to native vegetation, which increases the intensity of fires and causes further ecological changes.

The introduction of non-native fish to lakes and streams has significantly affected the aquatic life of the province. In the past, decades of stocking fish for recreational fishing have contributed to the decline of native fish and frog species in the province. Stocking of trout into historically fishless high mountain lakes has contributed to the extirpation of native amphibians in some basins, with particularly severe consequences for the once-common mountain yellow-legged frog (Milliron 1999; Milliron et al. 2004; Vredenburg 2004). By consuming the native amphibians and aquatic insects, the predatory trout also are negatively affecting the western terrestrial garter snake and some birds and bats that depend on these prey species (Mathews et al. 2001).

Historic stocking of non-native rainbow trout (hatchery-raised or not native to a particular watershed), brook trout, and brown trout into native trout waters has degraded native trout populations through predation and interbreeding. The introduced eastern brook trout outcompetes the native Lahontan cutthroat trout. Introduced rainbow trout have interbred with and altered the genetics of Lahontan cutthroat trout, Paiute cutthroat trout, and three subspecies of golden trout in portions of their historical ranges. In western foothill streams, introductions of non-native sunfish and other non-native species have seriously threatened the continued existence of native minnow and amphibian populations. Many of these are now either listed as threatened or as species of special concern (CDFG 2005).

CDFW conducted a Sierra-wide field study of amphibians, trout, and other fauna in the high mountain lakes. The multiyear project, begun in 1998, has completed initial surveys of the Sierra Nevada's 10,000 high-mountain lakes that are not located in National Parks. The results of the study are serving to inform Aquatic Biodiversity Management Plans that are being prepared for the high mountain watersheds of the Sierra. Also, as a result of this study and others, less than 10 percent of the high mountain lakes stocked prior to 1998 are currently being stocked. The goal of these plans is to protect and restore native amphibians and other fauna while maintaining thriving recreational fisheries where appropriate. The results of the field studies have yielded information needed to design management plans that will achieve both of these

goals. Lakes isolated by fish barriers and where non-native trout reproduction is absent have been identified for restoring native fauna. Other lakes and streams have been designated for non-native trout eradication efforts. Lakes identified as popular with anglers or where conflicts with native fauna restoration are absent are managed to maintain or improve their fisheries. Implementation of the completed aquatic biodiversity management plans and the completion of additional plans are contingent upon future funding and staffing.

Livestock, Farming, and Ranching

The effects of grazing on wildlife vary from beneficial to detrimental, depending upon how grazing is managed, including the seasonality and duration of grazing and the type and number of livestock. These effects also depend on the relative sensitivities of individual wildlife species, because not all species respond the same way to grazing. Well-managed livestock grazing can benefit sensitive plant and animal species, particularly by controlling annual grasses and invasive plants where these have become established, and by removing understory growth to create a fire-resilient landscape. These working lands are an essential part of the solution to conserving the state's wildlife.

While recognizing the values of compatible grazing practices, this plan focuses on the negative impacts of pressures affecting wildlife species at risk. Thus, the following discussion describes those situations where excessive grazing practices result in stresses to species. Excessive grazing, as used here, refers to livestock grazing at a frequency or intensity that causes degradation of native plant communities, reduces habitat values for native wildlife species, degrades aquatic or other ecosystems, or impairs ecosystem functions. (The term "overgrazing" has a different meaning; it usually refers to the productivity of the forage crop and range condition.)

Over the past 150 years, grazing on forests, shrublands, and grasslands of the Sierra Nevada has been characterized as excessive and unsustainable, destroying native vegetation and degrading meadows and streams (Menke et al. 1996). At one time, millions of sheep and cattle grazed throughout the Sierra forests, on private and public lands of oak woodlands of the western foothills to high mountain meadows and the east-side high-desert slopes. Sheep and cattle grazing were unregulated on public lands

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until after the establishment of USFS in 1905, and livestock numbers continued to exceed sustainable levels and reduce forage quality as late as the 1960s. On the western foothills and on higher forest lands, shrubs were often cleared with fire or herbicides to expand rangelands or to respond to brush encroachment on overgrazed lands (Burcham 1982; Menke et al. 1996).

Today, livestock numbers have been lowered to levels that are more sustainable for livestock forage and production (Kondolf et al. 1996; Menke et al. 1996). However, grazing continues to have negative consequences for forage, cover, and nest sites for dozens of wildlife species throughout much of the Sierra Nevada. Plant communities and ecosystems that are particularly important for sustaining wildlife diversity, including riparian, aspen, meadow, aquatic, and oak woodland habitats, continue to be subject to livestock grazing.

The 1996 SNEP found that "over-grazing in mountain meadows is a threat to many rare species that are restricted to these habitats." Sierra high mountain meadows and plant communities evolved without the kind of grazing pressure caused by livestock. Yet, as described by USFS, "the riparian and meadow systems are the key livestock forage areas within allotments above 4,000-foot elevations. Studies have shown that 50 percent to 80 percent of the herbage used comes from these meadow systems, which constitute a small percentage (generally less than 5 percent) of the allotment area. In the Sierra Nevada forests, the meadow systems cover an estimated 2 percent of the allotment areas" (USFS 2001).

The SNEP and the SNFPA also found that aquatic and riparian habitats are particularly affected by livestock grazing. Cattle are attracted to the lush forage, water, and shade of riparian habitat. In late summer and fall, especially when upland habitats have dried out, cattle can decimate riparian plant communities, grazing and trampling meadows, converting meandering meadow streams into eroded channels, and stripping forage and cover needed by wildlife. The erosion increases sediment runoff, degrading aquatic ecosystems.

Revised riparian grazing standards and guidelines were implemented by USFS in the late 1990s and early 2000s and those standards and guidelines have made significant changes on the management of grazing lands in the Sierra Nevada. The standards and guidelines establish limits of the percentage of meadow forage production that can be used, sets a minimum residual height for vegetation following grazing, and limits the percentage of new vegetation growth that can be browsed. In addition, between 2000 and 2013 livestock animal unit months (AUMs) on National Forests in California have declined by 28 percent (Tate et al. 2015).

Livestock grazing is affecting the composition of plant communities important for wildlife diversity. Where livestock grazing is excessive, forage often becomes scarce, and both livestock and deer consume young aspen shoots, hindering the regeneration of aspen stands. Excessive grazing is a factor in reducing the regeneration of blue oak and many other plant species throughout the predominantly privately owned foothill region (CDFG 2005; McCreary 2001). Livestock compact soils and remove leaf litter, making conditions less than optimal for germination of acorns and new growth. Livestock also consume acorns and young oak saplings.

Several aquatic, riparian, and meadow-dependent species are at risk in the Sierra region (USFS 2001). Half of the occupied willow flycatcher nest sites in meadow and riparian areas in the Sierra Nevada continue to be grazed by cattle or sheep. Knapp and Mathews (1996) concluded

that grazing at current levels is degrading streams and riparian components to the detriment of California golden trout. Wet meadow and stream areas for the Yosemite toad, a state species of special concern and federally listed species, are also grazed (USFS 2004b). The SNEP project concluded that "livestock grazing has been implicated in plant compositional and structural changes in foothill community types, meadows, and riparian systems, and grazing is the primary negative factor affecting the viability of native Sierran land bird populations" (SNEP 1996).

Livestock grazing also negatively affects native species by transmitting diseases to wild animals. *Pastuerella*, a bacteria transmitted from domestic sheep, has had a devastating effect on bighorn sheep in the Sierra Nevada. Efforts to reintroduce bighorn sheep to the Lava Beds National Monument and the Warner Mountains have failed as a result of disease transmission (Bleich et al. 1996; NCBSIAG 1991).

For the last decade, a major multiagency effort has implemented a recovery program for the Sierra Nevada bighorn sheep. Currently, there are 300-350 bighorn sheep in seven herds along the steep terrain of the eastern Sierra. The greatest threat to the survival of these endangered bighorn sheep is domestic sheep grazing nearby on public and private lands. The domestic sheep are still permitted to graze on allotments within the range of the wild bighorn sheep. If the California bighorn are exposed to these domestic sheep, pastuerellosis could wipe out the contacted wild sheep population within a few weeks (CDFG 2005).

Recreational Activities

The mountains and wildlands of the Sierra Nevada are very popular recreation destinations. National parks, wilderness areas, and wildlife areas provide recreational opportunities while also providing greater protection for wildlife. The public develops a better understanding and appreciation for wildlife by visiting these natural areas.

Recreational activities are diverse, from traditional ones like fishing, hiking, and back-packing to those requiring more infrastructure and visitor services, such as fixed camps, ski resorts, golf courses, and off-highway vehicle (OHV) areas. Some types of recreation have grown significantly in the last few decades, such as mountain biking and OHV use; the numbers of OHV users have risen several-fold over the past 30 years.

Accordingly, the effects of recreation on wildlife and ecosystems are diverse and increasing in many areas. Ski-resort runs and infrastructure crisscross steep mountains, and golf courses have replaced some mountain meadows. Vegetation is removed and soils are eroded along creeks in popular camping areas, and more land is cleared for recreation infrastructure. Recreation technologies, such as all-terrain vehicles, snowmobiles, and lighter, warmer, and waterproof camping gear and clothing, have allowed people to drive, mountain bike, ski, camp, and hunt in wild areas that years ago were natural refuges, too remote to be affected by recreation activities.

Recreation has consequences for soils, vegetation, wildlife, and aquatic resources. Soils become compacted or eroded, and habitat is cleared in areas that are heavily used by motorized vehicles, packhorses, and campers. A number of recreation activities inadvertently cause nest- or den-abandonment, displace wildlife from important foraging or watering sites, and interfere with migratory corridors (Leung and Marion 2000).

Providing more recreational opportunities while protecting wildlife habitats and aquatic ecosystems requires that sufficient resources be devoted to planning, management, and enforcement. Federal and state land agencies construct parking lots and restrooms, establish information kiosks, build and sign roads and trails, and manage garbage and sewage to accommodate recreational visitors. Additionally, there is an increased need for wildlife agencies to provide wildlife education to keep visitors safe and minimize their effects on species at risk.

5.4.6   Conservation Strategies

Conservation strategies were developed for 17 conservation targets in the Central Valley and Sierra Nevada Province. The goals for each target are listed below. The goals are set initially as a 5 percent improvement in condition, but will be refined over time using the adaptive management process described in Chapter 8. The strategies to achieve the goals for the target are provided, along with the objectives of the strategies and the targeted pressures. When actions that are specific to the conservation unit have been identified, they are listed with the strategy. Tables 5.4-5 through 5.4-17 show the relationships between the stresses and the pressures for each target. Table 5.4-18 summarizes conservation strategies for the province. Strategies for the Sierra Nevada Ecoregion focus on the higher elevation areas (approximately 5,000 feet and above).

Target: American Southwest Riparian Forest and Woodland

Goals:

- By 2025, acres of functional riparian habitat are increased by at least 5 percent from 2015 acres.
- By 2025, acres of connected riparian habitat are increased by at least 5 percent from 2015 acres.
- By 2025, acres/miles with natural hydrologic regime are increased by at least 5 percent from 2015 acres/miles.
- By 2025, acres/miles with total dissolved solids (meeting TMDL) are decreased by at least 5 percent from 2015 acres.

Conservation Strategy 1 (Land Acquisition/Easement/Lease): Acquire property and/or easements, including protection of land or water real property or rights through conservation easement.

Objective(s):
- Increase the acreage of valley riparian habitat protected through fee title or conservation easement.
- Protect high quality valley riparian habitat through fee title or conservation easement.

Targeted pressure(s): Annual and perennial non-timber crops; housing and urban areas; invasive plants/animals; livestock, farming, and ranching.

Conservation Strategy 2 (Land Acquisition/Easement/Lease): Acquire water rights focused on improving in-stream flow for fish and riparian habitat.

Objective(s):
- Water rights are acquired by CDFW to improve in-stream flow for fish and riparian habitat.

Targeted pressure(s): Dams and water management/use.

Conservation action(s):
- Identify priorities for acquisition.
- Coordinate with refuge water working groups.
- Advocate for "water for wildlife."
- Review existing in stream flow requirements.

Conservation Strategy 3 (Data Collection and Analysis): Conduct research focused on informing the development of new or updating of existing best management practices (BMPs) for invasive species, grazing, and water flow.

Objective(s):
- Collect and analyze adequate data to inform the development of new or updating existing invasive species BMPs.
- Collect and analyze adequate data to inform the development of new or updating of existing grazing BMPs.
- Collect and analyze adequate data to inform the development of new or updating of existing water flow BMPs.

Targeted pressure(s): Livestock, farming, and ranching; invasive plants/animals; dams and water management/use.

Conservation action(s):
- Identify study questions.
- Develop study design.

- Coordinate with experts.
- Conduct literature review.

Conservation Strategy 4 (Outreach and Education): Provide education and outreach for the conservation of natural resources.

Objective(s):
- Private landowners have increased knowledge in the identification and management of invasive species compared to 2015 levels.
- Public awareness and knowledge of the values of riparian habitats is increased from 2015 levels.
- The public is participating in monitoring invasive species and rapid response.
- The public has increased knowledge of grazing BMPs.
- The public has increased knowledge of wildlife-friendly land use policy compared to 2015 levels.

Targeted pressure(s): Livestock, farming, and ranching; invasive plants/animals; annual and perennial non-timber crops.

Conservation Strategy 5 (Law and Policy): Improve effective law enforcement focused on: complying with water rights and Section 1600 agreements, eliminating illegal water diversions, and increasing Law Enforcement Division (LED) staffing levels.

Objective(s):
- There is 100 percent compliance with water rights.
- There is 100 percent compliance with Section 1600 agreements.
- Illegal water diversions are reduced by 100 percent.
- LED staffing levels are increased by 50 percent.

Targeted pressure(s): Recreational activities; dams and water management/use.

Conservation action(s):
- Include BMPs as enforceable condition of Lake and Streambed Alteration Agreements.
- Include BMPs as enforceable condition of water right permit/license.
- Coordinate with LED.
- Advocate for opportunities to improve prosecutions of environmental laws and illegal diversions.
- Identify partners to improve enforcement capabilities.
- Evaluate and increase LED staffing levels.

Conservation Strategy 6 (Direct Management): Manage invasive species.

Objective(s):
- Develop and implement BMPs to control or eradicate invasive species.

Targeted pressure(s): Invasive plants/animals.

Conservation action(s):
- Conduct assessment of the distribution and type of invasive species.
- Coordinate with National Resources Conservation Service (NRCS) and other agencies.
- Identify existing invasive species management plans and ongoing activities.
- Support existing efforts or develop and implement invasive species control management plan.
- Treat invasive species for removal.

Conservation Strategy 7 (Direct Management): Manage water flows.

Objective(s):
- Allow more flows to support riparian habitat.
- Restore critical flow dynamics to benefit riparian ecosystem functions, and incorporate climate considerations into water flow management practices.

Targeted pressure(s): Dams and water management/use.

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Conservation action(s):
- Coordinate with State and Federal Water Projects, counties and local water districts.
- Coordinate with Floodsafe and local flood agencies.
- Identify and prioritize critical streams to restore flow dynamics.
- Assess opportunities for dam removal on smaller streams.
- Identify or create working groups focused on flow and ecological function.
- Identify and review existing local groundwater policies to inform future policy recommendations.
- Encourage setback levees to restore hydrological and geomorphic function.

Conservation Strategy 8 (Management Planning): Develop and implement Habitat Conservation Plans (HCPs) (Central Valley Flood Protection Plan, South Sacramento HCP, San Joaquin County Multi-Species Habitat Conservation and Open Space Plan, Bay Delta Conservation Plan [BDCP], Yolo, Solano, Butte, and Yuba-Sutter HCPs).

Objective(s):
- Riparian habitats are included and conservation measures proposed in the development of valley floor HCPs.
- The FERC re-license process is streamlined to better incorporate riparian conservation actions.
- Projects identified in the HCPs/NCCPs are compatible with ecosystem conservation requirements.
- Climate change adaptation strategies are incorporated into the conservation planning documents and activities by local, state and federal agencies.
- Invasive species are eradicated or controlled in riparian habitat areas.
- Riparian habitat is addressed and conservation measures are included in the Bay Delta Conservation Plan.

Targeted pressure(s): Housing and urban areas; utility and service lines; roads and railroads; recreational activities.

Conservation Strategy 9 (Management Planning): Provide input on local planning. Lead or participate in land use planning for rural, urban, or agricultural lands (e.g., provide input on local land use plans; develop county-wide zoning plans; participate in workgroup regarding low impact development siting).

Objective(s):
- Staff from local-governments are informed and knowledgeable about important wildlife habitats (riparian).
- Local policies are in place that protect important wildlife (riparian) habitats.

Targeted pressure(s): Housing and urban areas; utility and service lines; roads and railroads; recreational activities; annual and perennial non-timber crops; invasive plants/animals.

Table 5.4-5   Stresses and Pressures for American Southwest Riparian Forest and Woodland

Priority Pressures	Geophysical and Disturbance Regimes: Change in sediment erosion-deposition regime	Hydrology and Water Characteristics: Change in runoff and river flow	Change in flood occurrence, frequency, intensity, and area flooded (including hydroperiod)	Change in water levels and hydroperiod	Change in water temperature	Change in groundwater tables	Change in nutrients	Change in pollutants	Ecosystem Conditions and Processes: Change in spatial distribution of habitat types	Change in community structure or composition	Change in biotic interactions (altered community dynamics)	Change in succession processes and ecosystem development	Habitat fragmentation
Agricultural and forestry effluents	X			X			X	X		X			
Annual and perennial non-timber crops	X	X	X	X	X	X	X	X	X	X	X	X	X
Commercial and industrial areas	X	X	X	X		X		X	X	X		X	X
Dams and water management/use	X	X	X	X	X	X			X	X		X	X
Household sewage and urban waste water	X			X			X	X		X	X		
Housing and urban areas	X	X	X	X		X		X	X	X		X	X
Invasive plants/animals				X						X	X	X	X
Livestock, farming, and ranching	X		X				X		X	X	X		X
Logging and wood harvesting	X									X			
Roads and railroads	X	X								X		X	X
Utility and service lines										X			X

Target: Freshwater Marsh

Goals:

- By 2025, acres of freshwater emergent wetland habitat are increased by at least 5 percent from 2015 acres.
- By 2025, miles of freshwater emergent wetland where native species are dominant are increased by at least 5 percent from 2015 miles.
- By 2025, population abundance of key species (SGCN) is increased by at least 5 percent from 2015 population.
- By 2025, acres/miles of freshwater emergent wetland with desired inches of groundwater are increased by at least 5 percent from 2015.
- By 2025, acres of freshwater emergent wetland with suitable soil characteristics are increased by 5 percent from 2015 acres.
- By 2025, population of key species (beaver) is increased by at least 5 percent from 2015 population.
- By 2025, acres of freshwater emergent wetland with desired stages of succession are increased by at least 5 percent from 2015 acres.
- By 2025, acres/miles with desired channel pattern (connected floodplains) are increased by at least 5 percent from 2015 acres/miles.
- By 2025, miles with desired level of discharge (mimicking natural flood frequency, seasonality, and magnitude) are increased by at least 5 percent from 2015 miles.

Conservation Strategy 1 (Outreach and Education): Provide outreach and education.

Objective(s):

- Influence public awareness of proper land management for freshwater marshes by providing information to landowners regarding BMPs and proper wetland management.

Targeted pressure(s): Other ecosystem modifications; livestock, farming, and ranching.

Conservation action(s):

- Target Buckeye Conservancy and RCDs.
- Design and produce brochures with wetland conservation message.
- Employ web-based media for providing information to public.
- Coordinate with local landowners to determine what conservation efforts they are engaged with and determine how CDFW may assist in their efforts.

Conservation Strategy 2 (Land Acquisition/Easement/Lease): Purchase land and conservation easements.

Objective(s):
- Improve land management by removing invasive species and creating better grazing practices.

Targeted pressure(s): Livestock, farming, and ranching; annual and perennial non-timber crops.

Conservation action(s):
- Prioritize with Conceptual Area Protection Plan (CAPP) and Environmental Site Assessment.

Conservation Strategy 3 (Law and Policy): Advocate for laws and policies.

Objective(s):
- Strengthen regulatory authority over wetlands and integrate beaver ecology into wetland restoration activities.

Targeted pressure(s): Livestock, farming, and ranching; annual and perennial non-timber crops.

Conservation action(s):
- Evaluate and update Wetlands Policy.
- Implement wetland and riparian technical memorandum.
- Review and modify CDFW policy on beaver depredation.
- Update wetlands implementation policy.

Conservation Strategy 4 (Management Planning): Develop management plans.

Objective(s):
- Develop BMPs for ecosystem management on CDFW lands.
- BMPs would provide guidance on managing CDFW lands for multi-species use and benefit both recreation and conservation of native species.

Targeted pressure(s): Invasive plants/animals; livestock, farming, and ranching; annual and perennial non-timber crops; climate change.

Conservation action(s):
- Revise Land Management Plan (LMP) guidelines to include ecosystem management.
- Update LMPs to be consistent with new guidelines for managing at an ecosystem level.
- Develop policy on ecosystem management on public lands.

Conservation Strategy 5 (Economic Incentives): Provide economic incentives for improved resource management.

Objective(s):
- Provide economic incentives through restoration grants.

Targeted pressure(s): Livestock, farming, and ranching; annual and perennial non-timber crops.

Table 5.4-6 Stresses and Pressures for Freshwater Marsh												
Priority Pressures	**Stresses**											
	Geophysical and Disturbance Regimes	Hydrology and Water Characteristics						Soil and Sediment Characteristics	Ecosystem Conditions and Processes			
	Change in sediment erosion-deposition regime	Change in runoff and river flow	Change in water levels and hydroperiod	Change in flood occurrence, frequency, intensity, and area flooded (including hydroperiod)	Change in groundwater tables	Change in pollutants	Change in nutrients	Change in soil moisture	Change in spatial distribution of habitat types	Change in community structure and composition	Change in succession processes and ecosystem development	Habitat fragmentation
Agricultural and forestry effluents	X		X			X	X			X		
Annual and perennial non-timber crops	X	X	X	X	X	X	X	X	X	X	X	X
Commercial and industrial areas	X	X	X	X	X	X		X	X	X	X	X
Dams and water management/use	X	X	X	X	X			X	X	X	X	X
Household sewage and urban waste water	X		X			X	X			X		
Housing and urban areas	X	X	X	X	X	X		X	X	X	X	X
Invasive plants/animals	X		X					X	X	X	X	
Livestock, farming, and ranching	X	X		X			X			X	X	
Mining and quarrying	X					X						
Roads and railroads	X	X		X					X	X	X	X

Target: Chaparral; Desert Transition Chaparral; Montane Chaparral; California Foothill and Coastal Rock Outcrop Vegetation

Goals:

- By 2025, acres of macrogroup habitat (target) are maintained or increased by at least 5 percent from 2015 acres.
- By 2025, acres where native species are dominant are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired structural diversity are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired stages of succession are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired connectivity are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired fire regime are increased by at least 5 percent from 2015 acres.

Conservation Strategy 1 (Land Acquisition/Easement/Lease): Protect land through acquisition, easement, or lease.

Objective(s):

- Clear management and monitoring plans are developed.
- Funds are allocated by agency leadership for management and monitoring.
- Priority sites are put in easements.
- Sufficient funds are obtained.
- At each annual review, the easement or lease is in compliance.

Targeted pressure(s): Housing and urban areas; renewable energy.

Conservation action(s):

- Develop inter-regional and inter-agency team to develop priorities.
- Develop Conceptual Area Protection Plan (CAPP) for Great Valley.
- Develop protection criteria for conservation easements.
- Develop restoration and management plans.

Conservation Strategy 2 (Data Collection and Analysis): Collect and analyze data regarding the target.

Objective(s):

- Appropriate audiences are accessing data.
- Data are being used to inform conservation actions.
- Recommendations for conservation action have been developed.
- Research provides answer to relevant questions.
- The proposal includes management needs and outcomes that have been identified with input from relevant data users.

Targeted pressure(s): Annual and perennial non-timber crops; housing and urban areas; fire and fire suppression; renewable energy; invasive plants/animals.

Conservation action(s):
- Use data to inform state and federal land managers.
- Develop conservation strategies to reduce any pressures to target habitat that may be cumulative to climate change (e.g., recreation, grazing).

Conservation Strategy 3 (Direct Management): Conduct direct resource management.

Objective(s):
- Management actions are implemented, including the following:
  - implement measures to manage fire frequency (controlled burns or fuel management as appropriate),
  - control invasive species to prevent the spread of fire and invasive species,
  - conduct managed thinning and grazing,
  - remove non-native species, and
  - conduct resource assessments to inform management decisions.

Targeted pressure(s): Fire and fire suppression; invasive plants/animals.

Conservation action(s):
- Manage fire frequency to recur no more than every 20 years.
- Minimize and control invasive species.
- Maintain and improve community structure and composition, and soil nutrient concentrations.
- Develop plans for fire management to avoid controlled burns and to favor fire avoidance measures in areas near human centers are developed.

Conservation Strategy 4 (Management Planning): Work with partners on the development of large landscape conservation planning. Develop or update management plans to integrate the effects of climate change. Development of management plans for species, habitats and natural processes. Develop a management plan for SGCN or its habitat. Reintroduction, relocation, or stocking of native animals or plants to an area where they can better adapt. Translocate/breed in captivity a SGCN to establish new populations in suitable habitat. Restore SGCN to historically occupied habitats.

Objective(s):
- Management plans include appropriate strategies, actions, and monitoring plans for SGCN, habitats, and natural processes.
- Plan recommendations are being used to inform conservation actions.
- Within the first year and ongoing thereafter, fire management actions favor fire avoidance measures in areas near human centers.

Targeted pressure(s): Fire and fire suppression; invasive plants/animals.

Conservation action(s):
- Prepare plan recommendations (management strategies, action and monitoring plans) to reach the right people in right format.

Conservation Strategy 5 (Partner Engagement): Engage conservation partners, including state and federal agencies, tribal governments, the non-governmental organization (NGO) community, and other partners to achieve shared objectives and broader coordination across overlapping areas. Establish partnership to co-monitoring species/habitats on federally managed lands. Establish decision-making processes with other public and private entities to determine or implement strategies. Convene an advisory committee to assist with implementation of strategies.

Objective(s):
- A joint, mutually agreed on project is developed and implemented (e.g., invasive plant early detection program is implemented).

Targeted pressure(s): Annual and perennial non-timber crops; housing and urban areas; fire and fire suppression; renewable energy; invasive plants/animals.

Table 5.4-7	Stresses and Pressures for Chaparral; Desert Transition Chaparral; Montane Chaparral; California Foothill and Coastal Rock Outcrop Vegetation				
	Stresses				
	Geophysical and Disturbance Regimes	Ecosystem Conditions and Processes			
Priority Pressures	Change in natural fire regime	Change in spatial distribution of habitat types	Change in community structure or composition	Change in succession processes and ecosystem development	Habitat fragmentation
Annual and perennial non-timber crops		X	X	X	X
Climate change	X	X	X	X	X
Fire and fire suppression	X	X	X	X	X
Housing and urban areas	X	X			X
Invasive plants/animals	X	X	X	X	X
Renewable energy		X	X	X	X

Target: California Foothill and Valley Forests and Woodlands

Goals:
- By 2025, acres where native species are dominant are increased by at least 5 percent from 2015 acres.
- By 2025, populations of key species (oaks) are increased by at least 5 percent from 2015 population.
- By 2025, acres with desired fire regime are increased by at least 5 percent from 2015 acres.
- By 2025, miles with desired level of water yield are increased by at least 5 percent from 2015 miles.

Conservation Strategy 1 (Economic Incentives): Provide economic incentives to landowners for managing grazing at to maintain appropriate levels of residual dry matter.

Objective(s):
- Provide economic incentives to landowners for managing grazing at to maintain appropriate levels of residual dry matter.

Targeted pressure(s): Livestock farming and ranching; invasive plants/animals.

Conservation action(s):
- Outreach to landowner regarding programs.
- Fund priority projects.
- Monitoring of effectiveness and compliance.
- Review and update CDFW's Private Lands Management (PLM) program.
- Coordinate with local landowners to determine what conservation efforts they are engaged with and determine how CDFW may assist in their efforts.

Conservation Strategy 2 (Direct Management): Conduct ecologically sound controlled burns on CDFW lands.

Objective(s):
- Conduct ecologically sound controlled burns on CDFW lands.

Targeted pressure(s): Fire and fire suppression.

Conservation action(s):
- Prioritize candidate locations.
- Conduct pre-burn baseline inventories.
- Coordinate with BLM and CAL FIRE.
- Complete Environmental Assessment.
- Prepare burn plan in coordination with CAL FIRE.
- Evaluate and perform relevant BMPs.
- Plan and conduct post-fire monitoring.

Conservation Strategy 3 (Direct Management; Outreach and Education): Conduct demonstration management, including providing public demonstrations of successful BMPs and scientifically documenting environmental change from implementation of BMPs.

Objective(s):
- Provide public demonstrations of successful BMPs.
- Scientifically documenting environmental change from implementation of BMPs.

Targeted pressure(s): Livestock, farming, and ranching; invasive plants/animals.

Conservation action(s):
- Develop monitoring study design.
- Identify existing demonstration programs.
- Develop implementation plan for BMPs and budget.

Conservation Strategy 4 (Land Acquisition/Easement/Lease): Purchase and provide long-term conservation of land.

Objective(s):
- Provide long-term conservation of land.

Targeted pressure(s): Livestock, farming, and ranching; invasive plants/animals.

Conservation action(s):
- Develop CAPP or Land Acquisition Evaluation (LAE).
- Refer to Wildlife Conservation Board (WCB).
- Evaluate consistency with regional priorities.
- Develop management plan for purchased lands.

Conservation Strategy 5 (Land Acquisition/Easement/Lease): Protect land through conservation easements.

Objective(s):
- Protect land through conservation easements.

Targeted pressure(s): Livestock, farming, and ranching; invasive plants/animals

Conservation action(s):
- Develop CAPP or LAE.
- Coordinate with WCB.
- Evaluate consistency with regional priorities.
- Develop management plan for acquired lands/easements.

Conservation Strategy 6 (Outreach and Education): Provide education and outreach, including introduce landowners and leasee to new or existing BMPs for grazing; inform public of incentive programs available to them; educate recreation focused landowners on wildlife-BMP's; and keep CDFW staff current on relevant science (e.g., on restoration techniques, science).

Objective(s):
- Work with landowners and leasee to implement BMPs for grazing.
- Inform public of incentive programs available to them.
- Educate recreation focused landowners on wildlife-BMPs.
- Keep CDFW staff current on relevant science (e.g., restoration techniques, etc.).
- Coordinate with local landowners to determine what conservation efforts they are engaged with and determine how CDFW may assist in their efforts.

Targeted pressure(s): Livestock, farming, and ranching; invasive plants/animals.

Conservation Strategy 7 (Partner Engagement): Establish partnership: develop partnerships with agencies and organizations to enhance opportunities (currently BLM, RCDs, UCD, Audubon, and Blue Ridge Berryessa Partnership [BRBP]).

Objective(s):
- Develop partnerships with agencies and organizations to enhance opportunities (currently BLM, RCDs, UCD, Audubon, and BRBP).

Targeted pressure(s): Recreational activities; invasive plants/animals; livestock, farming, and ranching.

Conservation action(s):
- Engage partnerships through attendance at BRBP meetings.
- Participate in internal revamping of PLM program.
- Encourage use of CDFW's Shared Habitat Alliance for Recreational Enhancement program.

Table 5.4-8	Stresses and Pressures for California Foothill and Valley Forests and Woodlands						
	Stresses						
	Geophysical and Disturbance Regimes	Soil and Sediment Characteristics	Ecosystem Conditions and Processes				
Priority Pressures	Changes in natural fire regime	Changes in soil moisture	Change in spatial distribution of habitat types	Change in community structure or composition	Change in biotic interactions (altered community dynamics)	Change in succession processes and ecosystem development	Habitat fragmentation
Fire and fire suppression	X	X	X	X	X	X	X
Housing and urban areas	X		X	X			X
Invasive plants/animals	X	X		X	X	X	
Livestock, farming, and ranching	X		X	X	X	X	X
Recreational activities	X			X		X	
Roads and railroads				X			X

Target: North Coastal Mixed Evergreen and Montane Conifer Forests

Goals:

- By 2025, acres where native species are dominant are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired stages of succession are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired age class heterogeneity (increase rotation age) are increased by at least 5 percent from 2015 acres.
- By 2025, acres of habitat (with increased recruitment of oaks, aspen, and shrubs) are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired fire regime are increased by at least 5 percent from 2015 acres.
- By 2025, acres/miles with desired water yield are increased by at least 5 percent from 2015 acres/miles.

Conservation Strategy 1 (Land Acquisition/Easement/Lease): Protect land through acquisition and conservation easements, including increasing the amount of key conifer areas protected through purchase or conservation easement. Key conifer areas include old-growth forest, watercourse zones, and nest sites.

Objective(s):

- Increase the amount of key conifer areas protected through purchase or conservation easement. Key conifer areas include old-growth forest, watercourse zones, and nest sites.

Targeted pressure(s): Logging and wood harvesting.

Conservation action(s):

- Identify potential areas, identify what is already conserved.
- Develop HCPs and advanced mitigation plans.
- Develop interdisciplinary team to facilitate land acquisition and conservation.
- Develop database to track acquisition/tracking.
- Develop protection criteria (uniformity in wording) for conservation easement language: standardizing, complete, doable, executable, legally enforceable, protection criteria.
- Develop CAPP or LAE.

Conservation Strategy 2 (Data Collection and Analysis): Conduct research regarding effective target management.

Objective(s):
- Research efficacy of different techniques to manage forest and reduce uncharacteristic fire; document the response of wildlife post-fire.
- Document response of wildlife to different types of logging.
- Document baseline conditions and monitor trends of SGCN using occupancy as a metric.
- Document baseline conditions and monitor trends of the conifer forests ecosystem.

Targeted pressure(s): Fire and fire suppression; logging and wood harvesting.

Conservation action(s):
- Develop study and monitoring design.
- Work with federal agencies and add wildlife component to ongoing/funded research.
- Conduct pilot research project.
- Sustain ongoing relevant monitoring and resources assessment work.

Conservation Strategy 3 (Outreach and Education): Provide education and outreach for the conservation of natural resources.

Objective(s):
- Educate the public on the ecological effects of fire and on recent landscape changes.
- Relate fire management to beneficial uses of wildlife.

Targeted pressure(s): Fire and fire suppression.

Conservation action(s):
- Coordination with federal agencies and private landowners.
- Identify objectives/goals for outreach and education strategy.
- Develop key message, identify target audience.
- Conduct field trips and workshops.
- Develop brochures and web content.

Conservation Strategy 4 (Law and Policy): Advocate for laws and policies; coordinate with agencies to allow fires to burn when possible.

Objective(s):
- Coordinate with agencies to allow fires to burn when possible.

Targeted pressure(s): Fire and fire suppression.

Conservation action(s):
- Identify and work with agencies to review and modify their existing policies.
- Prioritize areas that can be allowed to burn.
- Link to education and outreach strategy.
- Coordinate with local Air Quality Management Districts to consider ways to allow for more prescriptive burn days.

Conservation Strategy 5 (Law and Policy; Partner Engagement): Engage in decision-making process to achieve shared objectives and broader coordination across overlapping area; cooperate with federal agencies and private landowners on where controlled burns and forest thinning would be most beneficial to wildlife.

Objective(s):
- Cooperate with federal agencies and private landowners on where controlled burns and forest thinning would be most beneficial to wildlife.

Targeted pressure(s): Fire and fire suppression.

Conservation action(s):
- Coordinate with federal agencies, private landowners, and Fire Science Centers.
- Engage in forest treatment priorities and elevate wildlife.
- Work with USFS to identify possible treatment areas.
- Establish ways to identify and prioritize high value wildlife habitat.

Conservation Strategy 6 (Management Planning; Partner Engagement): Develop management plans and improve existing fire management plans.

Objective(s):
- Improve existing fire management plans; identify high value wildlife habitat.

Targeted pressure(s): Fire and fire suppression.

Conservation action(s):
- Coordinate with state and federal agencies.
- Coordinate with partners to prevent intense wildfires to protect wildlife habitat, water quality, and recreation opportunities.
- Engage USFWS about listed species and management indicator species.
- Identify high value forested wildlife habitats.

Priority Pressures	Stresses				
	Geophysical and Disturbance Regimes	Ecosystem Conditions and Processes			
	Change in natural fire regime	Change in community structure or composition	Change in biotic interactions (altered community dynamics)	Change in succession processes and ecosystem development	Habitat fragmentation
Fire and fire suppression	X	X		X	X
Livestock, farming, and ranching	X	X	X	X	X
Logging and wood harvesting	X	X	X	X	X
Renewable energy					X
Utility and service lines		X			X

Table 5.4-9   Stresses and Pressures for North Coastal Mixed Evergreen and Montane Conifer Forests

Target: Alpine Vegetation

Goals:
- By 2025, connected acres are maintained or increased by 5 percent within the ecoregion from 2015 acres.
- By 2025, acres of macrogroup (target) are maintained or increased by 5 percent within the ecoregion from 2015 acres.
- By 2025, acres with desired plant diversity (species richness and subgroup/alliance diversity) are maintained or increased by 5 percent within the ecoregion from 2015 acres.

Conservation Strategy 1 (Data Collection and Analysis): Gather more information on alpine vegetation habitat, particularly on the physical and biological variables affected by climate change.

Objective(s):
- Within 10 years of research initiation, answers to relevant question are provided, appropriate audiences are accessing information, and data are being used to inform conservation actions. In particular, information is obtained on: macrogroup (target) habitat requirements and impacts to climate change on the macrogroup (target) and KEAs in the province, soil moisture regime and area requirements of target as a whole, soil temperature regime and area and requirements of target as a whole, snow pack levels and snow cover period requirement for habitat maintenance, minimal seasonality and weather regimes required to maintain target habitat, changes in the KEAs and area and extent of target in relation to current weather changes from climate change.

Targeted pressure(s): Climate change.

Conservation action(s):
- Develop conservation strategies to reduce any threats to alpine vegetation habitat that may be cumulative to climate change (e.g., recreation, grazing).
- Use data to inform state and federal land managers.

Conservation Strategy 2 (Outreach and Education): Engage urban citizens on climate change; expand conservation education programs (e.g., in grade schools) to include climate change.

Objective(s):
- Target audience receives the message, has desired attitudes and values, and continues the desired behavior.

Targeted pressure(s): Climate change; livestock, farming, and ranching; invasive plants/animals; recreation activities.

Conservation Strategy 3 (Economic Incentives): Develop economic incentives to reduce the impacts of climate change within California.

Objective(s):
- Economic incentives are developed and provided, are implemented in a manner that is consistent with design, and the desired pressure reduction is observed.

Targeted pressure(s): Climate change.

Conservation Strategy 4 (Direct Management): Restore subalpine and alpine meadows, including restoration/enhancement of degraded habitats, monitoring populations, and removing barriers to species movement.

Objective(s):
- Management actions are implemented.

Targeted pressure(s): Strategy acts directly on target.

Conservation action(s):
- Prioritize restoration of subalpine and alpine meadows.
- Remove non-native or invasive species.
- Add fencing to restrict livestock and human access to sensitive areas.
- Prioritize early detection of invasive species.
- Add BMPs for assisting vegetation shift from impending climate change.

Conservation Strategy 5 (Direct Management; Management Planning): Manage grazing and invasive species, remove trails, restrict grazing and pack animal use of subalpine and alpine meadows on public lands, remove trail and campground use away from subalpine and alpine meadows, and treat and remove invasive species.

Objective(s):
- Management actions are implemented.

Targeted pressure(s): Livestock, farming, and ranching; invasive plants/animals.

Conservation Strategy 6 (Management Planning): Develop or update management plans to integrate the effects of climate change.

Objective(s):
- More information is obtained on local climate change impacts; management plans include appropriate strategies, actions, and monitoring plans for SGCN, habitats, and natural processes.
- Plan recommendations are being used to inform conservation actions.

Targeted pressure(s): Climate change; livestock, farming, and ranching; invasive plants/animals; recreational activities.

Conservation Strategy 7 (Partner Engagement): Establish partnerships to co-monitor alpine vegetation habitat on state and federal lands.

Objective(s):
- Mutually agreed upon partnership and monitoring strategy is developed.
- Engaging with the partner, monitoring is implemented.

Targeted pressure(s): Climate change; livestock, farming, and ranching; invasive plants/animals; recreational activities.

Conservation action(s):
- Monitor extent of alpine vegetation habitat.

Conservation Strategy 8 (Training and Technical Assistance): Provide training on science-based applications and tools for climate change and natural resources management.

Objective(s):
- Target audience (land managers) that were trained have knowledge consistent with the training.
- Target audience (land managers) has adopted or continued actions consistent with the training.

Targeted pressure(s): Climate change; livestock, farming, and ranching; invasive plants/animals; recreational activities.

Table 5.4-10 Stresses and Pressures for Alpine Vegetation					
	Stresses				
	Soil and Sediment Characteristics	Ecosystem Conditions and Processes			
Priority Pressures	Change in soil moisture	Change in spatial distribution of habitat types	Change in community structure or composition	Change in biotic interactions (altered community dynamics)	Habitat fragmentation
Climate change	X	X	X		X
Commercial and industrial areas		X	X		X
Invasive plants/animals	X	X	X	X	X
Livestock, farming, and ranching	X	X	X	X	X
Recreational activities	X		X		

Target: Pacific Northwest Subalpine Forest

Goals:
- By 2025, acres of habitat are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired structural diversity are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired age class heterogeneity are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired stages of succession are increased by at least 5 percent from 2015 acres.
- By 2025, acres with desired fire regime are increased by at least 5 percent from 2015 acres.

Conservation Strategy 1 (Data Collection and Analysis): Collect data on climate-related impacts to species and habitats in the red fir/subalpine conifer zone, to better predict future distribution and viability and inform land acquisition and other strategies.

Objective(s):
- Proposal includes clear management needs and outcomes that have been identified with input from relevant data users.
- The research provides answers to relevant questions.
- The appropriate audiences are accessing data.
- Recommendations for conservation actions have been developed.
- The data are being used to inform conservation actions.

Targeted pressure(s): Climate change; fire and fire suppression.

Conservation Strategy 2 (Data Collection and Analysis): Collect data to evaluate effects of fuels treatments in the red fir zone, and whether treatments can partly offset climate-related increases in fire severity in the red fir zone.

Objective(s):
- Proposal includes clear management needs and outcomes that have been identified with input from relevant data users.
- The research provides answers to relevant questions, appropriate audiences are accessing data.
- Recommendations for conservation actions (e.g., fuels treatments) have been developed.
- The data are being used to inform conservation actions (e.g., fuels treatments).

Targeted pressure(s): Climate change; fire and fire suppression.

Conservation Strategy 3 (Economic Incentives): Develop economic incentives to reduce greenhouse gas emissions in California.

Objective(s):
- Economic incentives are developed and provided.
- The target population is using economic incentives.

Targeted pressure(s): Climate change.

Conservation Strategy 4 (Land Use Planning): Provide input on local land use plans to incorporate climate change; provide local assistance grant funds for participation in general plan updates favoring natural resource conservation and climate change.

Objective(s):
- Local land use planners receive input on land use plans from CDFW.
- Land use plans consistent with input provided by CDFW are approved.
- Plans are implemented in a manner consistent with the input.

Targeted pressure(s): Climate change; fire and fire suppression.

Conservation Strategy 5 (Direct Management): Implement fuels treatments in red fir forest, if determined to be effective (see "Data Collection and Analysis").

Objective(s):
- Implement management actions.

Targeted pressure(s): Fire and fire suppression.

Conservation Strategy 6 (Management Planning): Develop or update management plans to integrate the effects of climate change.

Objective(s):
- The management plan/project includes clear management needs and outcomes that have been identified with input from relevant data users (particularly information on local impacts from climate change and management actions that exacerbate climate change impacts to KEAs specifically in the Sierra Nevada).
- Management plans include appropriate strategies, actions, and monitoring plans for SGCN, habitats, and natural processes.
- The management plan, appropriate audiences are accessing data.

Targeted pressure(s): Climate change; fire and fire suppression.

Conservation Strategy 7 (Partner Engagement): Establish partnership to co-monitor target habitat on state and federal lands.

Objective(s):
- Mutually agreed upon partnership and monitoring strategy is developed and implemented.

Targeted pressure(s): Fire and fire suppression.

Conservation Strategy 8 (Environmental Review): Review projects for potential increases in greenhouse gas emissions; require mitigation as needed.

Objective(s):
- Input on environmental review document is provided.
- An environmental review document is approved that is consistent with the input provided.
- The plan is implemented in a manner that is consistent with the input.
- The behavior of local entity is consistent with input.

Targeted pressure(s): Climate change.

Conservation Strategy 9 (Training and Technical Assistance): Provide science-based applications and tools for climate change and natural resources management.

Objective(s):
- Target audience (land managers) that was trained has knowledge consistent with the training.
- Target audience (land managers) has adopted or continued actions consistent with the training.

Targeted pressure(s): Climate change; fire and fire suppression.

Priority Pressures	Stresses					
	Geophysical and Disturbance Regimes	Soil and Sediment Characteristics	Ecosystem Conditions and Processes			
	Change in natural fire regime	Change in soil moisture	Change in spatial distribution of habitat types	Change in community structure or composition	Change in succession processes and ecosystem development	Change in biotic interactions (altered community dynamics)
Climate change	X	X	X	X	X	X
Fire and fire suppression	X	X	X	X	X	X
Parasites/pathogens/diseases	X			X		X
Recreational activities				X		

Table 5.4-11   Stresses and Pressures for Pacific Northwest Subalpine Forest

Target: Wet Mountain Meadow; Western Upland Grasslands

Goals:

- By 2025, acres of habitat (meadows) are increased by at least 5 percent from 2015 acres.
- By 2025, populations of key species (hydrophilic vegetation for SGCNs) are increased by at least 5 percent from 2015 population.
- By 2025, acres where native species are dominant are increased by at least 5 percent from 2015 acres.
- By 2025, acres/miles with natural hydrologic regime are increased by at least 5 percent from acres/miles.
- By 2025, acres with desired fire regime are increased by at least 5 percent from 2015 acres.
- By 2025, acres with suitable soil characteristics (reduced sediment input) are increased by at least 5 percent from 2015 acres.
- By 2025, miles with desired level of discharge are increased by at least 5 percent from 2015 miles.

Conservation Strategy 1 (Land Acquisition/Easement/Lease): Protect land through acquisition and conservation easements, with emphasis on restoring and protecting degraded wet meadow habitat and conserving high-quality wet meadow.

Objective(s):

- Restore and protect degraded wet meadow habitat, with focus on riparian areas that have the greatest ecological potential such as larger impaired systems and those that support SGCN.
- Conserve high-quality wet meadow habitat.

Targeted pressure(s): Livestock, farming, and ranching.

Conservation action(s):

- Coordinate with Regional Water Quality Control Board.
- Develop CAPP or LAE.
- Identify existing conserved areas to form linkages.
- Identify and prioritize areas of conservation emphasis (ACE).
- Direct and use conservation banking to address impacts to wet meadow habitat.

Conservation Strategy 2 (Data Collection and Analysis): Gather and analyze data on wet meadows and wildlife: establish baseline inventory of wet meadows and research ecosystem services of wet meadows (e.g., carbon sequestration).

Objective(s):

- Establish baseline inventory of wet meadows, and research ecosystem services of wet meadows (e.g., carbon sequestration).

Targeted pressure(s): Dams and water management/use.

Conservation Strategy 3 (Outreach and Education): Provide education and outreach to broad resource users on multiple-use policy and educate the public on the beneficial use of fire.

Objective(s):

- Provide specific outreach to leaseholders and private landowners on grazing practices that benefit wildlife,
- Provide outreach to broad resource users on multiple-use policy, and
- Educate the public on the beneficial use of fire.

Targeted pressure(s): Parasites/pathogens/diseases; fire and fire suppression.

Conservation action(s):

- Coordinate with various Sierra Prescribed Fire Councils

Conservation Strategy 4 (Direct Management): Enhance habitat: improve water quality and temperature, coordinate water storage and timing of release to improve meadow hydrology, improve surface water recharge, reduce erosion and bank cutting, restore meadow hydrology, and improve resiliency of meadows to flood events.

Objective(s):

- Improve water quality and temperature, coordinate water storage and timing of release to improve meadow hydrology, improve surface water recharge, reduce erosion and bank cutting, restore meadow hydrology, and reduce effects of extreme events (improve resiliency of meadows to flood events).

Targeted pressure(s): Dams and water management/use.

Conservation action(s):
- Coordinate with state, federal, and local agencies and private landowners.
- Consult hydrologist and soil scientists.
- Develop methodology for meadow restoration/enhancement.
- Conduct temperature modeling to determine optimal flows.

Conservation Strategy 5 (Direct Management): Restore meadows impacted by roads and railroads: reduce sediment from existing and abandoned roads from entering meadows, restore hydrology altered by legacy roads and railroads, develop BMPs for road maintenance, and reduce the overall presence of roads and railroads in meadows (new and existing).

Objective(s):
- Reduce sediment from existing and abandoned roads from entering meadows.
- Restore hydrology altered by legacy roads and railroads.
- Develop BMPs for road maintenance.
- When Caltrans is currently implementing best management practices (BMPs), look for opportunities for alignment of BMPs through the implementation of SWAP strategies and existing processes such as those in place at Caltrans.
- Reduce the overall presence of roads and railroads in meadows (new and existing).

Targeted pressure(s): Roads and railroads.

Conservation action(s):
- Coordinate with high meadow landowners.
- Conduct road inventory and evaluation.
- Conduct post-treatment monitoring.

Conservation Strategy 6 (Direct Management): Manage invasive species.

Objective(s):
- Control invasive and problematic native vegetation (introduced from roads, pack animals, livestock feed).
- Control invasive fish and wildlife (livestock, pack animals, non-native fish).
- Prevent wet meadow habitat degradation.

Targeted pressure(s): Invasive plants/animals.

Conservation action(s):
- Conduct invasive and problematic native plant removal projects.
- Construct exclusion fencing.
- Monitor post project habitat conditions.
- Link to education and outreach.
- Advocate BMPs for grazing practices.
- Minimize road access.
- Identify specific locations impacted by non-native species.

Conservation Strategy 7 (Management Planning): Implement grazing practices that benefit meadow ecosystems (conduct managed grazing).

Objective(s):
- Reduce grazing impacts to wet meadow function and structure (including impacts to vegetation and stream bank erosion and sedimentation).
- Implement practices to reduce cattle use of meadows.

Targeted pressure(s): Mining and quarrying; livestock, farming, and ranching.

Conservation action(s):
- Coordinate with USFS, NRCS, RCDs, and private landowners.
- Consult with UC Extension.
- Link to education and outreach strategy.
- Identify and work with existing stakeholder groups, watershed groups, and others involved in meadow conservation.
- Review and update grazing management practices that benefit wildlife.
- Promote meadow restoration in standard practices.

Conservation Strategy 8 (Management Planning): Provide input on grazing management plans.

Objective(s):
- Reduce adverse impacts from allotment grazing practices.
- Improve enforcement of grazing lease conditions.
- Permanently retire problematic grazing allotments.

Targeted pressure(s): Livestock, farming, and ranching.

Conservation action(s):
- Coordinate with federal agencies to better link grazing leases, BMPs, standard practices, and Lake and Streambed Alteration Agreements.
- Conduct review of proposed allotment leases.
- Coordinate with development of total maximum daily load (TMDL).
- Work with federal agencies to amend/alter lease criteria that favor conservation.
- Coordinate with NRCS to implement Standard Practices and provide incentives.
- Incentivize rotational grazing, seasonal resting.
- Advocate for improved capacity within federal agencies in range specialists.
- Develop/support education and outreach in cooperation with NRCS and UC Cooperative Extension to leaseholders and private landowners on management practices that benefit wildlife.
- Review existing science and support ongoing research on grazing practices in high elevation meadows.
- Work with Cattlemen's Association and California Rangeland Conservation Coalition to explore efficacy of developing grass banks.

Table 5.4-12   Stresses and Pressures for Wet Mountain Meadow; Western Upland Grasslands

Priority Pressures	Geophysical and Disturbance Regimes		Hydrology and Water Characteristics				Soil and Sediment Characteristics	Ecosystem Conditions and Processes			
	Change in sediment erosion-deposition regime	Change in natural fire regime	Change in runoff and river flow	Change in water levels and hydroperiod	Change in groundwater tables	Change in nutrients	Change in soil moisture	Change in sediment quality	Change in spatial distribution of habitat types	Change in community structure or composition	Change in succession processes and ecosystem development
Agricultural and forestry effluents			X		X						
Annual and perennial non-timber crops	X	X	X	X	X	X	X	X	X	X	X
Catastrophic geological events	X		X				X		X	X	X
Dams and water management/use	X		X	X	X		X	X	X	X	X
Fire and fire suppression	X	X					X	X	X	X	X
Housing and urban areas	X	X	X	X	X	X		X	X	X	X
Industrial and military effluents			X								
Invasive plants/animals (non-native species)		X					X			X	
Invasive plants/animals* (native species)				X			X		X	X	X
Livestock, farming, and ranching	X	X	X		X	X	X	X	X	X	X
Logging and wood harvesting	X	X	X				X		X	X	X
Mining and quarrying					X						X
Parasites/pathogens/ diseases					X		X				X
Recreational activities		X						X		X	X
Roads and railroads	X		X							X	X

* This addresses native species encroachment

Target: Clear Lake Native Fish Assemblage

Goals:
- By 2025, acres of habitat (wetland) are increased by at least 5 percent from 2015 acres.
- By 2025, acres of habitat (riparian) are increased by at least 5 percent from 2015 acres.
- By 2025, populations of key species (tule perch, prickly sculpin, and Clear Lake hitch) are increased by at least 5 percent from 2015 population.
- By 2025, miles of river where native species are dominant are increased by at least 5 percent from 2015 miles.
- By 2025, water flow of Adobe, Scotts, Middle, Kelsey, Cole creeks in Lake County is increased by at least 5 percent during spring and early summer season so that native fish species could more effectively migrate in these creeks.
- By 2025, miles with desired stream stage (in Adobe, Scotts, Middle, Kelsey, Cole creeks in Lake Co. during spring and early summer season) are increased by at least 5 percent from 2015 miles.
- By 2025, miles with desired level water quality are increased by at least 5 percent from 2015 miles.
- By 2025, acres/miles with desired channel pattern are increased by at least 5 percent from 2015 acres/miles.

Conservation Strategy 1 (Land Acquisition/Easement/Lease): Purchase land and/or acquire easements.

Objective(s):
- Acquire riparian water rights by purchasing lands along the critical streams.
- Protect riparian areas by acquiring land adjacent to critical streams.
- Acquire appropriative water rights in the watershed.
- Reduce water diversions from the critical streams during late spring to summer.

Targeted pressure(s): Strategy acts directly on target.

Conservation Strategy 2 (Outreach and Education): Provide outreach and education for the conservation of natural resources.

Objective(s):
- Educate the public on the need for water management BMPs, impacts associated with their activities, and impacts of invasive species introductions on native species.
- Keep the public informed on development/status of water management BMPs.

Targeted pressure(s): Dams and water management/use; invasive plants/animals; recreational activities; annual and perennial non-timber crops.

Conservation Strategy 3 (Economic Incentives): Provide economic incentives for improved resource management.

Objective(s):
- Reduce economic burdens on original owners in upgrading water systems to meet BMP standards while enhancing parcel values.
- Provide incentives for water users to leave water in streams during critical seasons (late spring and summer).

Targeted pressure(s): Dams and water management/use; annual and perennial non-timber crops.

Conservation Strategy 4 (Law and Policy): Increase Law Enforcement Division (LED) staffing levels and implement effective law enforcement related to: illegal water diversions, illegal fishing, and invasive species introductions; compliance with Section 1600 agreements; and compliance with water rights.

Objective(s):
- Ensure compliance with water rights and Section 1600 agreements.
- Reduce illegal diversions.
- Increase LED staffing levels.

Targeted pressure(s): Recreational activities; invasive plants/animals; dams and water management/use; annual and perennial non-timber crops; mining and quarrying.

Conservation action(s):
- Include BMPs as enforceable condition of Lake and Streambed Alteration Agreements.
- Include BMPs as enforceable condition of water right permit/license.
- Advocate for opportunities to improve prosecutions of environmental laws.
- Identify partners to improve enforcement capabilities.
- Evaluate and increase LED staffing levels.

Conservation Strategy 5 (Direct Management): Manage invasive species.

Objective(s):
- Manage invasive species to improve conditions for native fish.
- Prevent additional future invasive species from becoming established in Clear Lake.

Targeted pressure(s): Invasive plants/animals.

Conservation action(s):
- Update data on extent and distribution of native and non-native species in Clear Lake.
- Examine alternative strategies for removal of non-native fish species and aquatic weeds.
- Coordinate with Lake County and private landowners.
- Conduct post treatment monitoring.
- Initiate long-term monitoring and management plan.
- Implement mechanical and chemical treatment of invasive weeds.

Conservation Strategy 6 (Direct Management): Control damage to creeks from OHV use.

Objective(s):
- Limit sediment entering creeks from OHV crossings.
- Limit access to creeks by OHVs.

Targeted pressure(s): Recreational activities.

Conservation action(s):
- Identify and close unauthorized roads.
- Identify locations where creek crossings could be constructed.
- Coordinate with federal and state partners.
- Link to education and outreach strategy.
- Coordinate with LED.

Conservation Strategy 7 (Direct Management): Develop BMPs for increased spring/summer flows for improved lake and fish health, improved fish passage, and water diversions.

Objective(s):
- Increase spring/summer flows for improved lake and fish health, improve fish passage (e.g., remove barriers created for diversions).
- Develop BMPs for water diversions.

Targeted pressure(s): Dams and water management/use; annual and perennial non-timber crops.

Conservation action(s):
- Develop agreement between partners to work together on BMPs.
- Look for existing management plans and evaluate their scope and success.
- Link to education and outreach plan to keep public informed.
- Develop options for optimal timing of diversions.
- Develop options for maintaining fish passage around diversion barriers.
- Identify water conservation actions.

Conservation Strategy 8 (Partner Engagement): Establish collaborative partnerships.

Objective(s):
- Understand stakeholders' diverse needs and how to meet those needs while meeting BMP standards.
- Develop trust among agencies and other stakeholders.

Targeted pressure(s): Dams and water management/use; recreational activites; annual and perennial non-timber crops.

Table 5.4-13 Stresses and Pressures for Clear Lake Native Fish Assemblage										
	Stresses									
	Geophysical and Disturbance Regimes	Hydrology and Water Characteristics					Ecosystem Conditions and Processes			
Priority Pressures	Change in sediment erosion-deposition regime	Change in runoff and river flow	Change in water chemistry	Change in water levels and hydroperiod	Change in nutrients	Change in pollutants	Change in spatial distribution of habitat types	Change in community structure and composition	Change in biotic interactions (altered community dynamics)	Habitat fragmentation
Annual and perennial non-timber crops	X	X	X	X	X	X	X	X	X	X
Dams and water management/use	X	X		X			X	X	X	X
Invasive plants/animals							X	X	X	X
Mining and quarrying	X		X			X		X		
Recreational activities	X	X					X	X		X

Target: Carson River Native Fish Assemblage

Goals:

- By 2025, miles of streams with target fish population are increased by at least 5 percent from 2015 miles in the Carson River basin.
- By 2025, miles with desired age class heterogeneity are increased by at least 5 percent from 2015 acres.
- By 2025, miles of river where native species are dominant are increased by at least 5 percent from 2015 miles.
- By 2025, acres with desired fire regime are increased by at least 5 percent from 2015 acres.
- By 2025, acres/miles with desired concentrations of pollutants are increased by at least 5 percent from 2015 acres/miles (consistent with TMDL).
- By 2025, acres/miles with total dissolved solids are decreased by at least 5 percent from 2015 acres.
- By 2025, miles with desired stream stage are increased by at least 5 percent from 2015 miles.

Conservation Strategy 1 (Land Acquisition/Easement/Lease): Purchase land and/or acquire easements: acquire water rights by purchasing lands along the critical Carson River tributaries, acquire conservation easements to protect riparian areas in the Carson River Basin, acquire large mountain meadow ranches for conservation, and acquire water storage rights in the Carson River Basin.

Objective(s):
- Acquire (by CDFW and partners) water rights by purchasing lands along the critical Carson River tributaries.
- Acquire conservation easements to protect riparian areas in the Carson River Basin.
- Acquire large (> 500 acres) mountain meadow ranches for conservation (e.g., Charity Valley, Pleasant Valley, Wolf Creek Meadows).
- Acquire water storage rights in the Carson River Basin.

Targeted pressure(s): Dams and water management/use; housing and urban areas.

Conservation action(s):
- Develop CAPP.
- Survey the interests from willing sellers.
- Partner with land trusts or NGOs for acquisition and management.
- Partner with Sierra Nevada Conservancy and TNC.

Conservation Strategy 2 (Data Collection and Analysis): Conduct research on SGCN; study the distribution and abundance of mountain whitefish and mountain sucker in the Carson River Basin, and the susceptibility of the Carson River Basin to invasive species.

Objective(s):
- Natural Resource Managers understands mountain whitefish, mountain sucker, and other SGCN distribution and abundance in the Carson River basin.
- Natural Resource Managers understands the susceptibility of the Carson River basin to invasive species.

Targeted pressure(s): Introduced genetic material; invasive plants/animals.

Conservation Strategy 3 (Outreach and Education): Conduct outreach; inform public of issues related to introduced genetic material, risks of invasive species, and importance of aquatic biodiversity management plants.

Objective(s):
- Introduced genetic material is reduced.
- The public is knowledgeable about the importance of aquatic biodiversity management plans and the risks of invasive species.

Targeted pressure(s): Invasive plants/animals; introduced genetic material.

Conservation Strategy 4 (Law and Policy): Implement effective law enforcement related to: illegal water diversions, illegal fishing, and introduction of invasive species in the Carson River Basin; compliance with 1600 agreements; and compliance with water rights.

Objective(s):
- Reduce illegal diversions in the Carson River basin.
- Reduce illegal fishing in the Carson River basin.
- Reduce invasive species in the Carson River basin.
- Increase LED staffing levels to enforce fishing regulations and Section 1600 regulations.
- Achieve compliance with Section 1600 agreements.
- Achieve compliance with water rights.

Targeted pressure(s): Invasive plants/animals.

Conservation Strategy 5 (Direct Management): Restore native species; manage invasive species and restore/maintain native fish populations in target streams.

Objective(s):
- Remove non-native trout species from select streams (tributaries of the Carson and East Carson Rivers).
- Implement BMPs to prevent future contamination by invasive species.
- Restore native fish to target streams.

Targeted pressure(s): Invasive plants/animals; introduced genetic material.

Conservation action(s):
- Update data on extent and distribution of native and non-native species in the Carson Basin.
- Non-native trout removal strategy from selected waters developed.
- Coordinate with USFS, BLM, County and private landowners.
- Conduct post-treatment monitoring.
- Develop reintroduction and genetic management plan for native species.
- Initiate long-term monitoring and implement management plan.
- Link to education and outreach strategy.

Conservation Strategy 6 (Direct Management): Enhance habitat, improve water quality and temperature consistent with the Basin Plan, and coordinate water storage and timing of release between CDFW and water agencies to benefit fish habitat and water users.

Objective(s):
- Water quality and temperature are improved and consistent with the Basin Plan.
- Water storage and timing of release is coordinated by water agencies and CDFW to benefit fish habitat and water users.

Targeted pressure(s): Dams and water management/use.

Conservation action(s):
- Conduct temperature modeling to determine optimal flows.
- Coordinate with USFS, BLM, Alpine County, and private landowners.
- Coordinate water releases from Red, Heenan, Lost, and Kinney Lakes.

Conservation Strategy 7 (Direct Management): Manage dams and other barriers to fish passage.

Objective(s):
- Fish barriers are removed on private lands and water agencies agree to increase bypass flows based on gains made through water conservation.

Targeted pressure(s): Dams and water management/use.

Conservation action(s):
- Coordinate with USFS, BLM, Alpine County and private landowners.
- Inventory barriers and assess flow and water condition.
- Obtain funding for CDFW management plan.
- Implement water conservation flow.

Conservation Strategy 8 (Direct Management): Reintroduce Lahontan cutthroat trout and Paiute cutthroat trout to their historic ranges.

Objective(s):
- Reintroduce native fisheries of Lahontan cutthroat trout and Paiute cutthroat trout to their historic ranges.

Targeted pressure(s): Strategy acts directly on target.

Conservation action(s):
- Conduct feasibility analysis to identify target streams.
- Identify source population or propagate.
- Evaluate eradication methods for non-native species.
- Develop reintroduction plan including post treatment monitoring.
- Coordinate with agencies and NGOs.

Conservation Strategy 9 (Management Planning): Develop basin management plans.

Objective(s):
- Develop and implement a basin-wide fisheries management plan.

Targeted pressure(s): Invasive plants/animals; introduced genetic material.

Conservation action(s):
- Coordinate with USFS, BLM, Alpine County, and CDFW Fisheries Branch.
- Facilitate regional sub-committee to develop plan.
- Conduct stakeholder meetings.
- Implement trout management plan.

Conservation Strategy 10 (Training and Technical Assistance): Provide training to staff and managers on non-native genetic issues, invasive species management and control techniques, and fish identification.

Objective(s):
- Introduction of non-native genetic material is in the Carson River Basin.
- Staff has knowledge and skills on techniques for modeling, invasive species management/control techniques, and fish identification.

Targeted pressure(s): Invasive plants/animals; introduced genetic material.

Table 5.4-14 Stresses and Pressures for Carson River Native Fish Assemblage										
	Stresses									
	Geophysical and Disturbance Regimes		Hydrology and Water Characteristics				Ecosystem Conditions and Processes			
Priority Pressures	Change in sediment erosion-deposition regime	Change in natural fire regime	Change in runoff and river flow	Change in water temperature	Change in nutrients	Change in pollutants	Change in spatial distribution of habitat types	Change in community structure or composition	Change in biotic interactions (altered community dynamics)	Habitat fragmentation
Agricultural and forestry effluents	X				X	X		X		
Annual and perennial non-timber crops	X		X	X	X	X	X	X	X	X
Dams and water management/use	X		X	X			X	X	X	X
Fire and fire suppression	X	X	X							X
Household sewage and urban waste water	X		X		X	X				
Housing and urban areas	X	X	X			X	X	X		X
Introduced genetic material							X	X	X	
Invasive plants/animals		X					X	X	X	X
Livestock, farming, and ranching	X	X	X	X	X		X			
Mining and quarrying	X					X	X			X
Roads and railroads	X			X		X	X	X		

Target: Walker River Native Fish Assemblage

Goals:
- By 2025, miles of streams with target fish population (SGCN) are increased by at least 5 percent from 2015 miles.
- By 2025, miles of river where native species are dominant are increased by at least 5 percent from 2015 miles.
- By 2025, miles connected (i.e., past barriers) are increased by at least 5 percent from 2015 miles.
- By 2025, miles with desired stream stage (mimics natural hydrograph) are increased by at least 5 percent from 2015 miles.
- By 2025, miles with desired level of water quality (meeting TMDL standards) are increased by at least 5 percent from 2015 miles.
- By 2025, miles with desired age class heterogeneity are increased by at least 5 percent from 2015 acres.

Conservation Strategy 1 (Data Collection and Analysis): Collect data on the impacts of diversions, water management, water use, and the distribution of introduced genetic material on the native fish community.

Objective(s):
- Understand the impacts of diversions, water management and water use to the native fish community.
- Understand the distribution of introduced genetic material and impacts to the native fish community within the hydrologic unit.

Targeted pressure(s): Introduced genetic material; invasive plants/animals; dams and water management/use.

Conservation Strategy 2 (Outreach and Education): Provide outreach and education on native aquatic resource conservation efforts.

Objective(s):
- Ensure that the public is aware, concerned, and participating in native aquatic resource conservation efforts within the hydrologic unit.

Targeted pressure(s): Invasive plants/animals.

Conservation Strategy 3 (Law and Policy): Implement effective enforcement of laws.

Objective(s):
- Increase Law Enforcement Division capacity to allow greater enforcement of water laws.

Targeted pressure(s): Dams and water management/use.

Conservation action(s):

- Identify laws and regulations governing riparian areas and work with governing agencies to apply effectively.
- Design and implement instream flow studies to collect empirical evidence to support/defend enforcement actions to protect aquatic public trust resources.
- Increase the number of branch and regional scientific staff working on water rights and instream flow studies.
- Make recommendations to enhance enforcement of existing laws and regulations.
- Provide law enforcement with maps of critical problem areas.
- Provide funding for CDFW enforcement to enforce laws protecting streams and flows.
- Develop Law Enforcement Division Academy curriculum emphasizing water law.
- Conduct Office of Training and Development (OTD) training for non-enforcement water policies.

Conservation Strategy 4 (Direct Management): Manage water for beneficial uses by native aquatic species.

Objective(s):

- State and federal agencies manage water for beneficial uses by native species (e.g., provide adequate water for species survival). Engage with the Walker Lake Acquisition/Transfer Program under desert terminal lakes program.

Targeted pressure(s): Dams and water management/use; recreational activities; invasive plants/animals.

Conservation action(s):

- Coordinate with water agencies.
- Identify/coordinate with key stakeholders.
- Collaborate with state and federal agencies for management plan development and review.
- Identify and quantity water needs for native SGCN, non-SGCN, and introduced trout species.
- Evaluate existing occupied habitats.

Conservation Strategy 5 (Direct Management): Translocate or reintroduce native fish species.

Objective(s):

- Establish self-sustaining and genetically viable native fish populations in the basin.

Targeted pressure(s): Dams and water management/use; recreational activities; invasive plants/animals.

Conservation actions:

- Identify source populations.
- Remove invasive or problematic species from historic native fish habitat.

- Create georeferenced map/data base for native fish habitats.
- Complete basin-wide native fish surveys, and develop basin plan for native fish management.
- Obtain funding for strategy implementation.
- Coordinate management actions with natural resource agencies, NGOs and private landowners.
- Collect/analyze genetic data to define priorities.

Conservation Strategy 6 (Direct Management): Remove introduced brook trout in the context of recovery of listed Lahontan cutthroat trout.

Objective(s):
- The extent and distribution of invasive species are known and a plan is developed by federal agencies and land owners to remove or control invasive species within the hydrologic unit.

Targeted pressure(s): Invasive plants/animals.

Conservation action(s):
- Update data on extent and distribution of native and non-native species.
- Develop strategy for removal.
- Coordinate with USFS and private landowners.
- Secure permits and conduct environmental review.
- Conduct post-treatment monitoring.
- Initiate long-term monitoring and management plan.
- Monitor for re-establishment of invasive species.
- Develop a management and control plan for invasive species.

Conservation Strategy 7 (Direct Management): Implement direct management activities to restore aquatic habitats and ensure that SGCN are maintained or enhanced.

Objective(s):
- Direct management activities to restore aquatic habitats are implemented to ensure SCGN are maintained or enhanced within hydrologic unit.

Targeted pressure(s): Introduced genetic material.

Conservation Strategy 8 (Management Planning): Ensure that planning and decision-making processes support the conservation of stream habitats and flows as a result of CDFW input.

Objective(s):
- Ensure that planning and decision-making processes support the conservation of stream habitats and flows as a result of CDFW input.

Targeted pressure(s): Dams and water management/use.

Conservation Strategy 9 (Management Planning): Develop or update and implement grazing BMPs.

Objective(s):
- Land managers within the hydrologic unit implement BMPs for grazing practices that reduce impacts to aquatic habitats.

Targeted pressure(s): Livestock, farming, and ranching.

Conservation action(s):
- Identify partners and stakeholders.
- Identify and review existing grazing management policies.
- Develop MOU/MOA between partners.
- Schedule regular working group meetings.
- Develop BMPs including enforcement policy.
- Provide input to land management agencies on grazing policies.
- Link to education and outreach strategy.

Conservation Strategy 10 (Management Planning): Reduce impacts to native fish as a result of roads and railroads and invasive species through development and use of BMPs.

Objective(s):
- Land managers implement BMPs to reduce impacts to native fish community from roads and railroads.
- BMPs for road and rail maintenance activities are established and used by land managers to reduce impacts to native fish community from invasive species.
- When Caltrans is currently implementing best management practices (BMPs), look for opportunities for alignment of BMPs through the implementation of SWAP strategies and existing processes such as those in place at Caltrans.

Targeted pressure(s): Invasive plants/animals; roads and railroads.

Conservation action(s):
- Collaborate with partner in development of BMPs.
- Collaborate with state and federal agencies and land owners.
- Identify existing BMPs, develop BMPs database.
- Establish working group to define BMPs.

Conservation Strategy 11 (Partner Engagement): Establish and develop co-management partnership to affect change in dams and/or water management and use following interagency agreement.

Objective(s):
- Establish a joint partnership to affect change in dams and/or water management and use following interagency agreement.

Targeted pressure(s): Dams and water management/use.

Table 5.4-15	Stresses and Pressures for Walker River Native Fish Assemblage											
Priority Pressures	**Stresses**											
	Geophysical and Disturbance Regimes		Hydrology and Water Characteristics					Ecosystem Conditions and Processes				
	Change in sediment erosion-deposition regime	Change in natural fire regime	Change in runoff and river flow	Change in water chemistry	Change in water levels and hydroperiod	Change in groundwater tables	Change in nutrients	Change in spatial distribution of habitat types	Change in community structure or composition	Change in biotic interactions (altered community dynamics)	Change in succession processes and ecosystem development	Habitat fragmentation
Dams and water management/use	X		X	X	X	X	X	X	X	X	X	X
Introduced genetic material								X	X	X		X
Invasive plants/animals		X	X	X	X	X	X	X	X	X	X	X
Livestock, farming, and ranching	X	X	X	X			X				X	X
Roads and railroads	X		X	X	X	X						X

Target: San Joaquin Native Fish Assemblage

Goals:
- By 2025, connected miles of native fish habitat are increased by at least 5 percent from 2015 miles.
- By 2025, miles of river where native species are dominant are increased by at least 5 percent from 2015 miles.
- By 2025, miles with desired level of water yield (flow) are increased by at least 5 percent from 2015 miles.
- By 2025, miles of streams with target fish population are increased by at least 5 percent from 2015 miles.
- By 2025, acres/miles of native fish habitat with desired temperature are increased by at least 5 percent from 2015 acres/miles.

Conservation Strategy 1 (Data Collection and Analysis): Gather and analyze data; establish baseline inventory of SGCN and habitat, and pressure distributions.

Objective(s):
- Establish baseline inventory of SGCN and habitat, and threat distributions.

Targeted pressure(s): Household sewage and urban waste water; invasive plants/animals.

Conservation Strategy 2 (Outreach and Education): Provide outreach and education for the conservation of natural resources.

Objective(s):
- Raise public awareness and support for native fish restoration projects.
- Educate the public on the risks of invasive species.
- Educate the public on the importance of aquatic biodiversity management plans.

Targeted pressure(s): Recreational activities; invasive plants/animals.

Conservation action(s):
- Coordinate with federal and county resource agencies, agricultural organizations, and NGOs.
- Install and maintain signs along sensitive areas that receive high recreational use.

Conservation Strategy 3 (Law and Policy): Advocate for effective enforcement of laws related to protection of significant riparian areas.

Objective(s):
- Fewer significant riparian areas are impacted by waste and disturbance.

Targeted pressure(s): Household sewage and urban waste water.

Conservation action(s):
- Identify laws and regulations governing riparian areas and work with governing agencies to apply effectively.
- Make recommendations to enhance enforcement of existing laws and regulations.
- Provide law enforcement with maps of critical problem areas.
- Create an ACE database viewable by all CDFW staff.
- Develop baseline inventory.

Conservation Strategy 4 (Direct Management): Protect and restore floodplain function; implement and maintain priority floodplain restoration projects.

Objective(s):
- Align policies, regulations, and planning and agency coordination to support multi-benefit floodplain management.
- Implement and maintain priority floodplain restoration projects.

Targeted pressure(s): Dams and water management/use.

Conservation Strategy 5 (Direct Management): Restore natural flows.

Objective(s):
- Identify streams/stream reaches in greatest need of flow remediation and create a plan for restoration.
- Restored stream reaches will be monitored for recolonization and translocation will be implemented, as necessary, to reestablish populations.

Targeted pressure(s): Dams and water management/use.

Conservation action(s):
- Conduct flow compliance monitoring.
- Conduct fish population monitoring.

Conservation Strategy 6 (Direct Management): Improve fish passage: assess, prioritize, and remove/modify fish passage barriers.

Objective(s):
- Assess, prioritize, and remove/modify fish passage barriers.

Targeted pressure(s): Dams and water management/use.

Conservation action(s):
- Develop barrier assessment protocols.
- Develop barrier removal guidelines, BMPs, and plan to monitor barrier removal effectiveness.
- Coordinate with state, federal agencies, local government, and private landowners.

Conservation Strategy 7 (Direct Management): Control invasive species: assess, map, and develop control plans for invasive aquatic species.

Objective(s):
- Comprehensively assess and map aquatic invasive species distributions and develop an integrated control plan for each.

Targeted pressure(s): Invasive plants/animals.

Conservation action(s):
- Develop Invasive Species Coordination Group to streamline and coordinate current agencies, organizations, and activities.
- Implement priority species control plans.
- Prioritize species to focus on.
- Implement top-priority control plans.
- Monitor invasive species and continue removal efforts as needed to control populations.
- Provide outreach and education specific to spread of invasive species.

Conservation Strategy 8 (Management Planning): Provide input on local planning; engage in local planning to encourage the use of bio(soft) engineering for flood control, retention of functional floodplains, and deterrence and capture of waste and pollution.

Objective(s):
- Channel incision is reduced and riparian vegetation is increased in floodplain.
- Fewer significant riparian areas are impacted by waste and disturbance.
- No more than two horizontal interspersion and vertical biotic structure levels are missing for each alliance.
- SGCN diversity improves to historic/normal levels.
- There is a reduction to area that has non-native invasive plant infestations and/or invasive animal species.
- Ephemeral and permanent surface water flows are restored to mimic historic patterns of flooding and low flow patterns (+/- 25 percent). An adequate low flow is maintained to sustain dependent aquatic life.

Targeted pressure(s): Housing and urban areas.

Conservation action(s):
- Encourage use of biofilters for urban runoff.
- Maintain treated effluent flows into riparian.
- Engage in development and implementation of IRWMPs.
- Direct increased resources/staffing towards engagement in local planning.
- Encourage appropriate site-specific native riparian plants for adjacent landscaping.
- Communicate BMPs to local planners.

Table 5.4-16	Stresses and Pressures for San Joaquin Native Fish Assemblage					
	Stresses					
	Geophysical and Disturbance Regimes	Hydrology and Water Characteristics			Ecosystem Conditions and Processes	
Priority Pressures	Change in natural fire regime	Change in runoff and river flow	Change in flood occurrence, frequency, and intensity	Change in groundwater tables	Change in community structure and composition	Habitat fragmentation
Annual and perennial non-timber crops	X	X	X	X	X	X
Dams and water management/use		X	X	X	X	X
Household sewage and urban waste water	X	X			X	
Housing and urban development	X	X	X	X	X	X
Invasive plants/animals	X			X	X	
Marine and freshwater aquaculture					X	
Recreational activities	X				X	

Target: Upper Kern River Native Fish Assemblage

Goals:

- By 2025, miles of streams with target fish populations are increased by at least 5 percent from 2015 miles.
- By 2025, miles with desired age class heterogeneity are increased by at least 5 percent from 2015 acres.
- By 2025, miles of river where native species are dominant are increased by at least 5 percent from 2015 miles.
- By 2025, acres with desired fire regime are increased by at least 5 percent from 2015 acres.
- By 2025, acres/miles with desired concentrations of pollutants are increased by at least 5 percent from 2015 acres/miles (consistent with TMDL).
- By 2025, acres/miles with total dissolved solids are decreased by at least 5 percent from 2015 acres.
- By 2025, miles with desired stream stage are increased by at least 5 percent from 2015 miles.

Conservation Strategy 1 (Data Collection and Analysis): Conduct research on SGCN; update genetic status for golden trout; refine distribution for hardhead and Kern River rainbow trout.

Objective(s):

- Natural Resource Management staff understands mountain whitefish, mountain sucker, and other SGCN distribution and abundance.
- The susceptibility to invasive species is understood.

Targeted pressure(s): Introduced genetic material; invasive plants/animals.

Conservation Strategy 2 (Outreach and Education): Conduct outreach; inform public of issues related to introduced genetic material, risks of invasive species, and importance of aquatic and riparian habitat restoration.

Objective(s):

- Introduced genetic material is reduced.
- The public is knowledgeable about the importance of aquatic biodiversity management plans (ABMP) and risks of invasive species.

Targeted pressure(s): Invasive plants/animals; introduced genetic material.

Conservation Strategy 3 (Land Acquisition/Easement/Lease): Purchase land and/or acquire easements.

Objective(s):
- Acquire (by CDFW and partners) water rights by purchasing lands, acquiring conservation easements to protect riparian areas.

Targeted pressure(s): Livestock, farming, and ranching; housing and urban areas.

Conservation action(s):
- Develop CAPP.
- Survey the interests from willing sellers.
- Partner with land trusts or NGOs for acquisition and management.
- Partner with Sierra Nevada Conservancy and TNC.

Conservation Strategy 4 (Direct Management): Restore native species; manage invasive species, and remove non-native trout from target streams.

Objective(s):
- Remove non-native trout species from select streams (tributaries of the Upper Kern River).
- Implement BMPs to prevent future contamination by invasive species.
- By 2025, restore native fish to target streams.

Targeted pressure(s): Invasive plants/animals; introduced genetic material.

Conservation action(s):
- Update data on extent and distribution of native and non-native species in the Upper Kern River.
- Utilize existing golden trout Conservation Assessment and Strategy and genetics management plans to develop non-native trout removal strategies for selected waters.
- Coordinate with USFS, NPS, County and private landowners.
- Implement chemical treatments and/or mechanical treatments.
- Conduct pre- and post-treatment monitoring.
- Implement reintroductions using genetic management plans for native species.
- Initiate long-term monitoring and implement Conservation Assessment Strategy and management plans.
- Link to education and outreach strategy.

Conservation Strategy 5 (Direct Management): Restore and enhance meadow habitat; improve water quality and temperature consistent with the Basin Plan.

Objective(s):
- Water quality and temperature are improved and consistent with the Basin Plan.
- Water storage and timing of release is coordinated by water agencies and CDFW to benefit fish habitat and water users.

Targeted pressure(s): Livestock, farming, and ranching; dams and water management/use.

Conservation action(s):
- Conduct temperature modeling to help prioritize habitat restoration.
- Coordinate with USFS and engage in Forest Plan revision process and grazing management allotment planning process.
- Support habitat restoration projects with USFS, NGOs and volunteers; support seeking grants for restoration.

Conservation Strategy 6 (Direct Management): Reintroduce golden trout to its historic range.

Objective(s):
- Restore native fisheries of golden trout to its historic range.

Targeted pressure(s): Strategy acts directly on target.

Conservation action(s):
- Conduct feasibility analysis and prioritize target streams.
- Coordinate with agencies and NGOs.
- Conduct environmental review and obtain permits.
- Evaluate eradication methods for non-native species and hybrid golden trout and implement treatments.
- Utilize guidance in genetics management plants to develop reintroduction plans.
- Develop monitoring plan to evaluate reintroductions.

Conservation Strategy 7 (Management Planning): Develop new or revised management plans for native fish and implement existing Conservation Assessment and Strategy for golden trout.

Objective(s):
- Develop and implement a basin-wide fisheries management plan.

Targeted pressure(s): Invasive plants/animals; introduced genetic material.

Conservation action(s):
- Coordinate with USFS, NPS, Tulare County, and NGOs.
- Engage stakeholders in planning process.
- Collect and compile status and distribution data.
- Review/revise and implement existing golden trout Conservation Strategy.
- Develop/revise Kern River rainbow trout Conservation Strategy and revise Management/Recovery Plan for Little Kern golden trout.

Conservation Strategy 8 (Training and Technical Assistance): Provide training to staff and managers on non-native genetic issues, invasive species management, and control techniques.

Objective(s):
- Introduction of non-native genetic material is reduced in the Upper Kern River Basin
- Staff has knowledge and skills on techniques for modeling, invasive species management/control techniques, and fish identification.

Targeted pressure(s): Invasive plants/animals; introduced genetic material.

Table 5.4-17 Stresses and Pressures for Upper Kern River Native Fish Assemblage						
	Stresses					
	Geophysical and Disturbance Regimes			Ecosystem Conditions and Processes		
Priority Pressures	Change in sediment erosion-deposition regime	Change in natural fire regime	Change in runoff and river flow	Change in spatial distribution of habitat types	Change in community structure and composition	Habitat fragmentation
Housing and urban areas	X	X	X	X	X	X
Introduced genetic material				X	X	X
Invasive plants/animals		X		X	X	X
Livestock, farming, and ranching	X		X	X	X	X

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Table 5.4-18	Conservation Targets and Strategies for Central Valley and Sierra Nevada Province			
Target	**Goals[1]**	**Key Ecological Attributes (KEAs)**	**Pressures[2]**	**Strategy Categories**
American Southwest Riparian Forest and Woodland	▲ By 2025, acres of functional riparian habitat are increased by at least 5% from 2015 acres. ▲ By 2025, acres connected riparian habitat are increased by at least 5% from 2015 acres. ▲ By 2025, acres/miles with natural hydrologic regime are increased by at least 5% from 2015 acres/miles. ▲ By 2025, acres/miles with total dissolved solids (meeting TMDL) are decreased by at least 5% from 2015 acres.	▲ Area and extent of community ▲ Connectivity among communities and ecosystems ▲ Hydrological regime ▲ Soil quality and sediment deposition regime ▲ Successional dynamics ▲ Surface water flow regime	▲ Agricultural and forestry effluents ▲ Annual and perennial non-timber crops ▲ Climate change ▲ Commercial and industrial areas ▲ Dams and water management/use ▲ Household sewage and urban waste water ▲ Housing and urban areas ▲ Invasive plants/animals ▲ Livestock, farming, and ranching ▲ Logging and wood harvesting ▲ Roads and railroads ▲ Utility and service lines	▲ Data Collection and Analysis ▲ Direct Management ▲ Land Acquisition/Easement/Lease ▲ Law and Policy ▲ Management Planning ▲ Outreach and Education
Freshwater Marsh	▲ By 2025, acres of freshwater emergent wetland habitat are increased by at least 5% from 2015 acres. ▲ By 2025, miles of freshwater emergent wetland where native species are dominant are increased by at least 5% from 2015 miles. ▲ By 2025, population abundance of key species (SGCN) is increased by at least 5% from 2015 population levels. ▲ By 2025, acres/miles of freshwater emergent wetland with desired inches of groundwater are increased by at least 5% from 2015. ▲ By 2025, acres of freshwater emergent wetland with suitable soil characteristics are increased by 5% from 2015 acres. ▲ By 2025, population of key species (beaver) is increased by at least 5% from 2015 population levels. ▲ By 2025, acres of freshwater emergent wetland with desired stages of succession are increased by at least 5% from 2015 acres. ▲ By 2025, acres/miles with desired channel pattern (connected floodplains) are increased by at least 5% from 2015 acres/miles. ▲ By 2025, miles with desired level of discharge (mimicking natural flood frequency, seasonality, and magnitude) are increased by at least 5% from 2015 miles.	▲ Area and extent of community ▲ Community structure and composition ▲ Connectivity among communities and ecosystems ▲ Successional dynamics ▲ Surface water flow regime	▲ Agricultural and forestry effluents ▲ Annual and perennial non-timber crops ▲ Climate change ▲ Commercial and industrial areas ▲ Dams and water management/use ▲ Household sewage and urban waste water ▲ Housing and urban areas ▲ Invasive plants/animals ▲ Livestock, farming, and ranching ▲ Mining and quarrying ▲ Roads and railroads	▲ Economic Incentives ▲ Land Acquisition/Easement/Lease ▲ Law and Policy ▲ Management Planning ▲ Outreach and Education
Chaparral Desert Transition Chaparral Montane Chaparral California Foothill and Coastal Rock Outcrop Vegetation	▲ By 2025, acres of macrogroup habitat (target) are maintained or increased by at least 5% from 2015 acres. ▲ By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. ▲ By 2025, acres with desired structural diversity are increased by at least 5% from 2015 acres. ▲ By 2025, acres with desired stages of succession are increased by at least 5% from 2015 acres. ▲ By 2025, acres with desired connectivity are increased by at least 5% from 2015 acres. ▲ By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres.	▲ Area and extent of community ▲ Community structure and composition ▲ Connectivity among communities and ecosystems ▲ Fire regime ▲ Successional dynamics	▲ Climate change ▲ Fire and fire suppression ▲ Housing and urban areas ▲ Livestock, farming, and ranching ▲ Invasive plants/animals ▲ Renewable energy	▲ Data Collection and Analysis ▲ Direct Management ▲ Land Acquisition/Easement/Lease ▲ Management Planning ▲ Partner Engagement
California Foothill and Valley Forests and Woodlands	▲ By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. ▲ By 2025, populations of key species (oaks) are increased by at least 5% from 2015 population. ▲ By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. ▲ By 2025, miles with desired level of water yield are increased by at least 5% from 2015 miles.	▲ Community structure and composition ▲ Fire regime ▲ Soil quality and sediment deposition regime ▲ Successional dynamics	▲ Climate change ▲ Fire and fire suppression ▲ Housing and urban areas ▲ Invasive plants/animals ▲ Livestock, farming, and ranching ▲ Recreational activities ▲ Roads and railroads	▲ Direct Management ▲ Economic Incentives ▲ Land Acquisition/Easement/Lease ▲ Outreach and Education ▲ Partner Engagement
North Coastal Mixed Evergreen and Montane Conifer Forests	▲ By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. ▲ By 2025, acres with desired stages of succession are increased by at least 5% from 2015 acres. ▲ By 2025, acres with desired age class heterogeneity (increase rotation age) are increased by at least 5% from 2015 acres. ▲ By 2025, acres of habitat (with increased recruitment of oaks, aspen, and shrubs) are increased by at least 5% from 2015 acres. ▲ By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. ▲ By 2025, acres/miles with desired water yield are increased by at least 5% from 2015 acres/miles.	▲ Community structure and composition ▲ Hydrological regime ▲ Fire regime ▲ Successional dynamics	▲ Climate change ▲ Fire and fire suppression ▲ Livestock, farming, and ranching ▲ Logging and wood harvesting ▲ Renewable energy ▲ Utility and service lines	▲ Data Collection and Analysis ▲ Land Acquisition/Easement/Lease ▲ Law and Policy ▲ Management Planning ▲ Outreach and Education

Table 5.4-18   Conservation Targets and Strategies for Central Valley and Sierra Nevada Province (continued)

Target	Goals[1]	Key Ecological Attributes (KEAs)	Pressures[1]	Strategy Categories
Alpine Vegetation	▲ By 2025, acres connected are maintained within the ecoregion from 2015 acres. ▲ By 2025, acres of macrogroup (target) are maintained within the ecoregion from 2015 acres. ▲ By 2025, acres with desired plant diversity (species richness and subgroup/alliance diversity) are maintained within the ecoregion from 2015 acres.	▲ Area and extent of community ▲ Community structure and composition ▲ Connectivity among communities and ecosystems	▲ Climate change ▲ Invasive plants/animals ▲ Livestock, farming, and ranching ▲ Recreational activities	▲ Data Collection and Analysis ▲ Direct Management ▲ Management Planning ▲ Outreach and Education ▲ Partner Engagement ▲ Training and Technical Assistance
Pacific Northwest Subalpine Forest	▲ By 2025, acres of habitat are increased by at least 5% from 2015 acres. ▲ By 2025, acres with desired structural diversity are increased by at least 5% from 2015 acres. ▲ By 2025, acres with desired age class heterogeneity are increased by at least 5% from 2015 acres. ▲ By 2025, acres with desired stages of succession are increased by at least 5% from 2015 acres. ▲ By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres.	▲ Area and extent of community ▲ Community structure and composition ▲ Fire regime ▲ Successional dynamics	▲ Climate change ▲ Fire and fire suppression ▲ Parasites/pathogens/diseases ▲ Recreational activities	▲ Data Collection and Analysis ▲ Direct Management ▲ Economic Incentives ▲ Environmental Review ▲ Land Use Planning ▲ Management Planning ▲ Partner Engagement ▲ Training and Technical Assistance
Wet Mountain Meadow Western Upland Grasslands,	▲ By 2025, acres of habitat (meadows) are increased by at least 5% from 2015 acres. ▲ By 2025, populations of key species (hydrophilic vegetation for SGCNs) are increased by at least 5% from 2015 population. ▲ By 2025, acres where native species are dominant are increased by at least 5% from 2015 acres. ▲ By 2025, acres/miles with a natural hydrologic regime are increased by at least 5% from acres/miles. ▲ By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. ▲ By 2025, acres with suitable soil characteristics (reduced sediment input) are increased by at least 5% from 2015 acres. ▲ By 2025, miles with desired level of discharge are increased by at least 5% from 2015 miles.	▲ Area and extent of community ▲ Community structure and composition ▲ Connectivity among communities and ecosystems ▲ Fire regime ▲ Soil quality and sediment deposition regime ▲ Water level fluctuations	▲ Annual and perennial non-timber crops ▲ Climate change ▲ Dams and water management/use ▲ Fire and fire suppression ▲ Housing and urban areas ▲ Invasive plants/animals (non-native) ▲ Invasive plants/animals (native species) ▲ Livestock, farming, and ranching ▲ Logging and wood harvesting ▲ Parasites/pathogens/diseases ▲ Recreational activities ▲ Roads and railroads	▲ Data Collection and Analysis ▲ Direct Management ▲ Land Acquisition/Easement/Lease ▲ Management Planning ▲ Outreach and Education
Clear Lake Native Fish Assemblage	▲ By 2025, acres of habitat (wetland) are increased by at least 5% from 2015 acres. ▲ By 2025, acres of habitat (riparian) are increased by at least 5% from 2015 acres. ▲ By 2025, populations of key species (tule perch, prickly sculpin, and Clear Lake hitch) are increased by at least 5% from 2015 population. ▲ By 2025, miles of river where native species are dominant are increased by at least 5% from 2015 miles. ▲ By 2025, water flow of Adobe, Scotts, Middle, Kelsey, Cole creeks in Lake County is increased by at least 5% during spring and early summer season so that native fish species could better migrate in these creeks. ▲ By 2025, miles with desired stream stage (in Adobe, Scotts, Middle, Kelsey, Cole creeks in Lake Co. during spring and early summer season) are increased by at least 5% from 2015 miles. ▲ By 2025, miles with desired level water quality are increased by at least 5% from 2015 miles. ▲ By 2025, acres/miles with desired channel pattern are increased by at least 5% from 2015 acres/miles.	▲ Area and extent of community ▲ Community structure and composition ▲ Connectivity among communities and ecosystems ▲ Nutrient concentrations and dynamics ▲ Pollutant concentration and dynamics ▲ Soil quality and sediment deposition regime ▲ Surface water flow regime	▲ Annual and perennial non-timber crops ▲ Climate change ▲ Dams and water management/use ▲ Invasive plants/animals ▲ Mining and quarrying ▲ Recreational activities	▲ Direct Management ▲ Economic Incentives ▲ Land Acquisition/Easement/Lease ▲ Law and Policy ▲ Outreach and Education ▲ Partner Engagement

Table 5.4-18	Conservation Targets and Strategies for Central Valley and Sierra Nevada Province (continued)			
Target	Goals[1]	Key Ecological Attributes (KEAs)	Pressures[1]	Strategy Categories
Carson River Native Fish Assemblage	▴ By 2025, miles of streams with target fish population are increased by at least 5% from 2015 miles in the Carson River basin. ▴ By 2025, miles with desired age class heterogeneity are increased by at least 5% from 2015 acres. ▴ By 2025, miles of river where native species are dominant are increased by at least 5% from 2015 miles. ▴ By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. ▴ By 2025, acres/miles with desired concentrations of pollutants are increased by at least 5% from 2015 acres/miles (consistent with TMDL). ▴ By 2025, acres/miles with total dissolved solids are decreased by at least 5% from 2015 acres. ▴ By 2025, miles with desired stream stage are increased by at least 5% from 2015 miles.	▴ Area and extent of community ▴ Community structure and composition ▴ Fire regime ▴ Pollutant concentration and dynamics ▴ Soil quality and sediment deposition regime ▴ Surface water flow regime	▴ Agricultural and forestry effluents ▴ Annual and perennial non-timber crops ▴ Climate change ▴ Dams and water management/use ▴ Fire and fire suppression ▴ Household sewage and urban waste water ▴ Housing and urban areas ▴ Introduced genetic material ▴ Invasive plants/animals ▴ Livestock, farming, and ranching ▴ Mining and quarrying ▴ Roads and railroads	▴ Data Collection and Analysis ▴ Direct Management ▴ Land Acquisition/Easement/ Lease ▴ Law and Policy ▴ Management Planning ▴ Outreach and Education ▴ Training and Technical Assistance
Walker River Native Fish Assemblage	▴ By 2025, miles of streams with target fish population (SGCNs) are increased by at least 5% from 2015 miles. ▴ By 2025, miles of river where native species are dominant are increased by at least 5% from 2015 miles. ▴ By 2025, miles connected (i.e., past barriers) are increased by at least 5% from 2015 miles. ▴ By 2025, miles with desired stream stage (mimics natural hydrograph) are increased by at least 5% from 2015 miles. ▴ By 2025, miles with desired level of water quality (meeting TMDL standards) are increased by at least 5% from 2015 miles. ▴ By 2025, miles with desired age class heterogeneity are increased by at least 5% from 2015 acres.	▴ Area and extent of community ▴ Community structure and composition ▴ Connectivity among communities and ecosystems ▴ Surface water flow regime ▴ Water quality	▴ Climate change ▴ Dams and water management/use ▴ Introduced genetic material ▴ Invasive plants/animals ▴ Livestock, farming, and ranching ▴ Roads and railroads	▴ Data Collection and Analysis ▴ Direct Management ▴ Law and Policy ▴ Management Planning ▴ Outreach and Education ▴ Partner Engagement
San Joaquin Native Fish Assemblage	▴ By 2025, miles connected native fish habitat are increased by at least 5% from 2015 miles. ▴ By 2025, miles of river where native species are dominant are increased by at least 5% from 2015 miles. ▴ By 2025, miles with desired level of water yield (flow) are increased by at least 5% from 2015 miles. ▴ By 2025, miles of streams with target fish population are increased by at least 5% from 2015 miles. ▴ By 2025, acres/miles of native fish habitat with desired temperature are increased by at least 5% from 2015 acres/miles.	▴ Area and extent of community ▴ Community structure and composition ▴ Connectivity among communities and ecosystems ▴ Hydrological regime ▴ Surface water flow regime ▴ Water level fluctuations ▴ Water quality ▴ Water temperature and chemistry	▴ Annual and perennial non-timber crops ▴ Climate change ▴ Dams and water management/use ▴ Household sewage and urban waste water ▴ Invasive plants/animals ▴ Marine and freshwater aquaculture ▴ Recreational activities	▴ Data Collection and Analysis ▴ Direct Management ▴ Law and Policy ▴ Management Planning ▴ Outreach and Education
Upper Kern River Native Fish Assemblage	▴ By 2025, miles of streams with target fish population are increased by at least 5% from 2015 miles. ▴ By 2025, miles with desired age class heterogeneity are increased by at least 5% from 2015 acres. ▴ By 2025, miles of river where native species are dominant are increased by at least 5% from 2015 miles. ▴ By 2025, acres with desired fire regime are increased by at least 5% from 2015 acres. ▴ By 2025, acres/miles with desired concentrations of pollutants are increased by at least 5% from 2015 acres/miles (consistent with TMDL). ▴ By 2025, acres/miles with total dissolved solids are decreased by at least 5% from 2015 acres. ▴ By 2025, miles with desired stream stage are increased by at least 5% from 2015 miles.	▴ Area and extent of community ▴ Community structure and composition ▴ Fire regime ▴ Soil quality and sediment deposition regime ▴ Surface water flow regime	▴ Climate change ▴ Introduced genetic material ▴ Invasive plants/animals ▴ Livestock, farming, and ranching	▴ Data Collection and Analysis ▴ Direct Management ▴ Land Acquisition/Easement/ Lease ▴ Management Planning ▴ Outreach and Education ▴ Training and Technical Assistance

[1] The goals are set initially at 5 percent, but will be refined over time using the adaptive management process described in Chapter 8.

[2] Pressures can be positive or negative depending on the intensity, timing, and duration of the action on the target habitat.