STRUCTURAL DIVERSITY OF FORESTS AND ADJACENT HABITATS

ISSUE STATEMENT

Habitat complexity has long been associated with greater species diversity and abundance (Urban and Smith 1989, Halaj et al. 2000, Burnett et al. 2007). Habitat structure influences the quality of microclimate, food abundance, and cover. It is an important consideration in how Sierra Nevada shrublands and forests are managed.

Diversity of vegetative structure is created under an active fire regime, with insect and pathogen (mistletoe, fungi, root rot) activity (Spies et al. 2006), as well as fluctuations in climate, soil conditions, and position in the landscape (North et al. 2009). Natural disturbances such as fire, insects and disease also act to reduce stand density and create forest openings that support early-seral stage vegetation as well as the animals that depend on it (see Table 1). Climate change may increase the intensity of some of these disturbances; however, resilience to climate change is best arrived at by allowing fire to regulate structure and succession (Hurteau and North 2010).

Early successional forested ecosystems provide high species diversity and unique food webs and species assemblages (Swanson et al. 2010). For example, almost a quarter of breeding birds in the Sierra Nevada nest in shrub habitat (USDA Forest Service 2007). Migratory mule deer herds also depend on early-seral landscapes dominated by shrubs and herbaceous plants to survive winter and spring. Sierran ecosystems have also evolved with and depend on natural disturbances to create habitat in dead and dying trees. The pallid bat, Vaux's swift, fisher and black bear rely on various-sized cavities in large snags and logs. The black-backed woodpecker is a fire specialist largely restricted to burned areas. They usually nest in dense patches of small burned conifers and depend on large snags for foraging (refer to species accounts appendix for black-backed woodpecker) (Dixon and Saab 2000; Hanson and North 2008; Bond et al. 2012; Siegel et al. 2012). Unfortunately, 120 years of fire suppression in the Sierra Nevada has produced a homogenized forest structure (Beaty and Taylor 2008), eliminated large snags, and has significantly reduced chaparral (Nagel and Taylor 2005, USDA Forest Service 2007). To reverse this trend, disturbance regimes should be managed to operate within the natural range of variability to support structural and biological diversity.

Structural diversity of vegetation is achieved by varying patch size and distribution at several spatial scales. At the small scale (¼ acre to tens of acres), desired heterogeneity is expressed in clumped, unevenly aged, and irregularly distributed vegetation. At the landscape scale, heterogeneity is expressed in a patchwork or mosaic of vegetation structure, age, and type (Spies et al. 2006). Forests and shrublands in dry landscapes such as the Sierra Nevada are species rich and should contain a variety of species which may include conifers, hardwoods, shrubs and herbaceous plants. The restoration of forest structure should begin by quantifying the range of natural variability for vegetation under natural disturbance regimes (Youngblood et al. 2006). In general, more mesic forests contain multilayered canopies with shade-tolerant, fire sensitive species, high stem density, and a mixture of pine and fir species (Spies et al. 2006). Fire severity was historically greater in mesic sites, although less frequent, creating contrasting conditions of young, uniform stands and older, structurally diverse ones (*Id*). A complex, fire-adapted forest structure generally consists of 1) large diameter trees, preferably pine where appropriate for site conditions; 2) a spatially complex pattern of stand structural units (e.g., large tree groves and open areas of dense regeneration); 3) coarse wood habitats (snags and logs); 4) well-developed understory communities of herbs and shrubs; and 5) moderate tree stocking levels (Johnson et al. 2007). Timber marking guidelines should avoid even tree spacing and should carefully protect microhabitat types such as irregularities in tree structure, a variety of hardwoods, cold pool pockets and other elements, as these features are unnaturally lacking in the Sierra Nevada (North et al. 2009).

Traditional American, production-based forestry aims to create tree diameter distributions that allocate most of the growing space in a stand to the smallest trees, known as the reverse J-curve diameter distribution (O'Hara and Gersonde 2004). Thinning from below moves beyond production forestry to address ladder fuel concerns while retaining larger trees in a stand. Thinning from below is now widely practiced on public land in the Sierra Nevada, and often leaves trees spaced evenly from each other, regardless of their aspect or position on the slope. North et al. (2007) found this practice still favors the reverse-J model and does not recreate old forest conditions prevalent before logging. Historic forest conditions contained "clumps" of large trees that grow close to one another, providing important dense canopy habitat (Taylor 2004, North et al. 2007). The next step for public lands forestry is to enhance and restore important habitat structure and function by increasing heterogeneity in the retained stand structure and protect older stands and old forest ecosystems to restore what has been lost as a result of unsustainable human demand.

Simplification of Forest Structure

Intensive forestry practices such as clear-cutting and post-disturbance logging simplify forest structure and composition causing reduced ecological resilience, reduced genetic variability, and impaired function (Centers for Water and Wildland Resources 1996, DellaSala et al. 1996, Patel-Weynand 2002, Mackie et al. 2008). Forest simplification and fire suppression together contribute to greatly increased probabilities of large, uncharacteristic fires and increased frequency and severity of widespread mortality from epizootics such as bark beetles and fungal pathogens (Centers for Water and Wildland Resources 1996, DellaSala et al. 1996). Pathogens such as the introduced white pine blister rust and *Anosus* root fungus are also spread by logging. Further, soil compaction from logging and development activities can alter the pattern of natural succession. When coupled with climate change, fire suppression, and other types of habitat loss, intensive forestry practices may contribute to local extirpations of taxa associated with both early successional and old growth forests (e.g., Loft and Smith 1999; Loreau et al. 2001; Loarie et al. 2008; Mackie et al. 2008; Thompson et al. 2009; Swanson et al. 2010).

Post-fire or "salvage" logging is a long practiced yet scientifically unsupported method of forest management. Often cited as a necessary management tool for aiding in forest restoration following a wildfire, salvage logging can and often does accomplish the opposite result by increasing the fire hazard, degrading water quality, and impairing the habitat and ecological function of the forest (Beschta et al. 2004, Karr et al. 2004, Donato et al. 2006, Noss et al. 2006, Shatford et al. 2007, Thompson et al. 2007, Lindenmayer et al. 2008). Snag dependent species are also negatively impacted. In several studies, post-fire logging reduced black-backed woodpecker occupancy and reduced nesting frequency compared to unlogged burned forests (Saab and Dudley 1998; Hutto and Gallo 2006; Cahall and Hayes 2009). Tree plantations installed post-fire create a uniform forest structure that contributes to increased fire hazards throughout the Sierra Nevada, and their presence throughout the forest makes a return to the natural fire return interval difficult (Sapsis and Brandow 1997, Franklin and Agee 2003, Franklin 2004, Stephens and Moghaddas 2005a). Natural tree regeneration can be abundant after fire, and post-fire logging may actually reduce regeneration by as much as 71 percent (Shatford et al. 2007).

In 2005, a Government Accountability Office (GAO) report commissioned by Congress confirmed that the Forest Service in Regions 5 and 6 (California and Oregon) failed to move beyond outdated management standards for reforestation (Government Accounting Office 2005). According to one regional official, the Forest Service's history of timber production permeates current thinking, and many procedures do not reflect the current management emphasis on ecosystem health. The GAO reported that regional culture emphasized planting – the most expensive approach – to reforestation projects.

Wildlife species depend on habitat conditions created by high severity fire and that result in abundant standing dead trees. Meeting desired habitat conditions for some species often requires substantial areas to be protected from post-fire logging (Hutto 1995, Noss et al. 2006). Where post-fire logging is conducted, all larger diameter dead trees and logs should be retained. Snag density targets of 80-120 snags/acre may address the needs of wildlife in burned forests (Hutto 2006). Coarse woody debris should be managed to mirror levels characteristic of the natural disturbance regime. There is rarely either an ecological or economic necessity to replant, and natural regeneration after fire is preferable from an ecological standpoint (Franklin and Agee 2003, GAO 2005, Lindenmayer et al. 2008). Burned areas should be managed as opportunities to benefit biological diversity, especially snag dependent and shrub-dependent species, over a long timeframe measured in decades.

Post-fire, herbicides are used by the Forest Service on shrubs and herbaceous plants. Herbicides are also used in fuel breaks to kill unwanted vegetation. Using chemicals instead of fire to reduce fuels is highly undesirable from an ecological standpoint. This practice simplifies habitat structure, removes harmless endemic plants and important food and shelter for wildlife. The Forest Service has reforested burned areas using entirely non-chemical means[1]. This practice is effective and should be the standard approach.

Livestock grazing is another threat to the Sierra Nevada's early-seral habitats. The impacts of grazing on riparian and aquatic habitats are addressed in a separate section of this conservation strategy; however, where livestock grazing is excessive, forage can become scarce, causing livestock to consume shrubs, hardwoods, and riparian vegetation (Bunn et al. 2007). Management direction for livestock needs to address the protection of important habitats and resource staff need to be adequately trained and funded to conduct the necessary monitoring and enforcement.

Biomass removal, shredding or mastication practices can remove large amounts of understory trees and shrubs. These practices should be used carefully to retain patches of natural regeneration and structural diversity as discussed above. Managed fire that achieves a varied pattern of fire intensity is a preferred tool to reduce unnatural understory density and maintain a heterogeneous spatial pattern. Mechanical treatment of ladder fuels may be desirable in areas that have not had fire in a long time; however, managers should still ensure that variable patches of understory vegetation are left prior to reintroducing fire. These areas can be chosen from landscape features such as forest openings, rocks, riparian areas, clumps of trees, etc.

Future impacts of climate change on vegetation in the Sierra Nevada will vary. Snowpack is projected to decrease by over 40 percent in fall and nearly 70 percent in winter, reducing winter snowmelt by 54 percent compared to the late 1900s (Morelli 2009). A recent review shows that while the Douglas fir/white fir/Sierran mixed conifer and mixed chaparral/montane hardwood types have increased since 1930, blue oak, ponderosa pine, Jeffrey pine, and eastside pine have decreased significantly (Id). The impact of climate change on forests is complex and difficult to predict. While climate change may increase tree growth rates in U.S. as a result of increasing temperatures and lengthening growing seasons, this effect may be moderated by drought conditions (McMahon et al. 2010). Post-fire management must be informed by current vegetation trends and predictions rather than

[1] Source: USDA Region 5 Forest Service Pesticide Use Reports (1999–2007). On file in Pacific Southwest Region Headquarters, Vallejo, CA.

managing to historic conditions in a changing climate. In some scenarios, allowing shrubs and oaks to recover naturally after fire is not only ecologically desirable, but possibly the most viable option in mid-elevation areas where climate and vegetation models indicate pines may be replaced by hardwoods.

There is uncertainty surrounding the effectiveness of current silviculture treatments in providing or protecting structural diversity (USDA Forest Service 2001a, Volume 4, p. E-48), yet it is critical now to take steps to reverse the simplification of habitat. The forest planning process is a strategic place to frame the restoration goals for the landscape and strengthen scientifically informed goals of vegetation management using fire as a primary tool.

POLICY ACTIONS NEEDED

Proposal for Revision to Forest Plan Direction

A. Desired Condition *The following statements represent the desired future condition of the landscape and may not reflect the current conditions.*

Desired Condition DIV-1. Stands of vegetation are variable at multiple scales (not homogeneous) as a result of variation in the flora, climate, topography, and disturbance (Spies et al. 2006).

Desired Condition DIV-2. Forest stands contain adequate pine and hardwood regeneration as well as shade-tolerant tree species.

Desired Condition DIV-3. Small openings in the forest are dispersed among stands of large mature trees and vegetation with herbaceous and shrub species that are within the potential natural vegetation of the site.

Desired Condition DIV-4. Insects, disease, and tree mortality positively influence stand dynamics by creating structural complexity with pockets of mortality that allow vegetation to regenerate and provide large dead trees to enrich soils, waterways and wildlife habitat. Mortality occurs according to a range of natural variability in each forest type (Spies et al. 2006, Michel and Winter 2009) and at multiple scales (e.g., 2-5 acres, stand level and watershed or larger).

Desired Condition DIV-5. Variation in vegetation composition, aspect and slope contribute to disturbance that ranges from mild to severe (Spies et al. 2006).

Desired Condition DIV-6. Managed fire occurs across the landscape at a pace, intensity, and scale appropriate to site conditions (Fontaine et al. 2009; Scholl and Taylor 2010, Swanson et al. 2010), and functions as an ecological process that increases the resiliency and health of fire-adapted landscapes.

Desired Condition DIV-7. Areas affected by wildfire support all seral stages of vegetation including native shrub, hardwood, and herbaceous plants that would be found on the site under a natural disturbance regime. Periods of early-seral hardwood and shrub dominance following fire extend in time to reflect the pace of vegetation growth and development (Fontaine et al. 2009).

Desired Condition DIV-8. Post-fire environments provide a range of beneficial effects in fire-adapted landscapes, such as repeated burns to reduce fuels, and promotion of biodiversity and ecosystem function (Fontaine et al. 2009, Scholl and Taylor 2010, Swanson et al. 2010).

B. Objectives

Objective DIV-1. Landscape analysis identifies the locations and characteristics of the existing structural complexity, biodiversity, habitat connectivity, and natural disturbance processes to promote climate resilience and biological legacies such as old trees and snags, and identifies protection measures for these values to be incorporated into site-specific projects.

Objective DIV-2. Manage for shrubs by establishing and maintaining:

- Uneven-aged conifer stands with structural diversity including multiple canopy layers and openings that support shrub and herbaceous understory (Burnett et al. 2008);
- The long term viability of shrub habitats (Burnett et al. 2008; North personal communication 2008);
- Areas that are or have the potential to regenerate mixed species shrubfields (e.g. whitethorn, manzanita, chinquapin, gooseberry, etc.). Mixed species shrub habitats have higher diversity and abundance of shrub nesting bird species than monotypic stands (e.g. manzanita fields) (Burnett et al. 2008);
- Prescribed fire treatments in decadent shrubfields where growth and live vegetative cover are now reduced. Manage these areas for regeneration of a newly invigorated shrub community (Burnett et al. 2008);
- Dense clumps of riparian deciduous shrubs and trees interspersed with tall lush herbaceous vegetation (Burnett et al. 2008).

Objective DIV-3. Manage for hardwoods, including alder and aspen, by establishing and maintaining:

- A diversity of structural and seral conditions in landscapes in proportions that are ecologically sustainable at the watershed scale;
- Sufficient regeneration and recruitment of young hardwood trees over time to replace mortality of older trees;
- Sufficient quality and quantity of hardwood ecosystems to provide important habitat elements for wildlife and native plant species.

Objective DIV-4. Human caused and naturally ignited fires are managed to maximize ecological benefits.

Objective DIV-5. Prioritize fuel treatments in areas that historically supported more frequent fire and contain dry mixed-conifer forests with high existing levels of understory fuels.

Objective DIV-6. All land allocations in the forest plan specifically address how managed fire will be used to increase resilience and provide ecological benefits.

Objective DIV-7. Reduce forest degradation (e.g., air pollution, fragmentation, uncharacteristic fire, disease, unnecessary driving and equipment hauling, and invasive species) to minimize forest management's contribution to carbon emissions.

Objective DIV-8. Eradication or containment plans have been created for 75 percent of the area known to be affected by noxious weeds.

Objective DIV-9. Projects and decisions shall utilize the best scientific information on ecological restoration and ecological conditions, including North et al. (2009) and North (2012).

C. Standards

Standard DIV-1. Projects are designed to maintain, enhance, and not degrade structural diversity (e.g., stem density, canopy cover, snag and downed log density, hardwoods, etc.) as defined by the desired conditions in the forest plan and are guided by the desired conditions established during landscape analysis.

Standard DIV-2. Use thinning primarily to develop or protect vertical and horizontal forest structure to make forests more resistant to uncharacteristically severe fire (Youngblood et al. 2005). Where crown density needs to be reduced to restore forest structure, retain large live and dead trees, increase height to live crown, reduce fine surface fuels, retain large woody debris, and increase understory shrubs and herbaceous plants.

Standard DIV-3. Avoid the removal or damage to hardwoods that occur within conifer forest types. Exceptions may be allowed to address public safety.

Standard DIV-4. Retain felled green or hazard trees as down wood when existing levels of down wood are below desired levels for the various size or decay classes.

Standard DIV-5. Fall and remove hazard trees within tree falling distance along maintenance level 3, 4, and 5 roads and within or adjacent to administrative sites. Review by an appropriate resource specialist is required prior to falling hazard trees along maintenance level 1 and 2 roads and is generally not appropriate based upon low probably of harm. Retain large felled trees where needed to meet down woody material standards.

Standard DIV-6. Road closure on maintenance level 1 and 2 roads must be considered as an alternative to hazard tree removal in areas where the snags are below desired levels.

Standard DIV-7. All projects must assess the impact on carbon flux (i.e., the measure all carbon pools, including below ground biomass, dead wood, litter, and soil carbon and charcoal) and maintain the forest project area as a resilient carbon pool.

Standard DIV-8. Projects must include actions that facilitate or improve the ability of the forest ecosystem to respond favorably to climate change (e.g., restore and maintain habitat connectivity, maintain genetic diversity, promote species diversity, provide refugia, manage for "asynchrony").

Standard DIV-9. Design projects to reduce potential soil erosion and the loss of soil productivity caused by loss of vegetation and ground cover. Examples are activities that would: 1) provide for adequate soil cover in the short term; 2) allow native early seral vegetation to occur in burned areas; 3) reduce potential impacts of fire on water quality; 4) improve site resilience to repeated fire and drought.

Standard DIV-10. Post-disturbance reforestation projects include the following design measures:

- Plant only large seedless landscapes that were previously a conifer forest type;
- Avoid planting in poor quality planting sites such as rocky slopes, lava caps, or areas dominated by grey pine, blue oak, or chaparral;
- Avoid planting in riparian areas, fens, seeps, springs, and meadows;
- Avoid planting near mature, re-sprouting or young hardwoods, elderberry, or other desired native plants as determined by a wildlife biologist, archaeologist, hydrologist and botanist;
- Use manual removal of competing vegetation immediately around planted conifers and avoid the use of herbicides;
- Allow at least one third to one half of all seedless landscapes to transition naturally through seral stages;
- Group planted conifers in small clusters, not in rows or evenly spaced;
- Use existing roads and skid trails for management purposes;
- Construct temporary roads for reforestation purposes and close these roads following their management use.

Standard DIV-11. Reforestation plans set tree stocking and maintenance guidelines that meet the following criteria:

- Consider all vegetation cover in stocking estimates (not just conifers) including grass, shrubs, other herbaceous plants, and all non-conifer tree species;
- Plant conifers only where there is an ecological basis for establishing a forested landscape within 10-15 years;
- Encourage natural regeneration and succession whenever possible;
- Minimize the connectivity of fuels throughout the development of the planted stand;
- Facilitate the application of prescribed fire throughout the development of the planted stand;
- Minimize the risk of fire spreading from the planted stand to adjacent forest stands;

Standard DIV-12. Do not allow cattle within burned landscapes until:

- Allotment management plans are re-written to address the changed environment and include protection measures for fragile soils, riparian, spring and meadow vegetation, and rare plants;
- Post-fire field assessments for range readiness shall include a determination that the landscape can support livestock without suffering resource damage;
- There are sufficient staff and resources to continue monitoring and enforcement to avoid resource damage.

Standard DIV-13. Noxious weed assessments, including prevention and eradication measures, are included in every post-fire action including Burn Area Emergency Recovery (BAER) plans, hazard tree abatement, reforestation plans, modification of allotment management plans, and special use permit approval.

Standard DIV-14. The salvage of dead or dying trees following wildfire is limited to activity necessary to address safety concerns on level 2-5 roads and near structures.

Standard DIV-15. Projects and decisions will contribute to the maintenance or restoration of the desired condition for down wood identified during landscape analysis. The removal of down or dead wood greater than 15 inches in diameter is discouraged unless there is high risk to the public or in-woods workers.

Standard DIV-16. Implement mitigation measures when feasible to reduce the risk of losing large live and large dead trees when prescribed burning (Hood 2010).

Standard DIV-17. Projects to restore aspen and other hardwoods shall incorporate mitigation for other stressors identified in the project area, such as grazing impacts on re-established clones or seedlings, poor road placement impacting hydrology and other environmental conditions, off-highway vehicle activities, etc. See Shepard et al. (2006) for aspen management.

D. Regionwide Land Allocations

Table IV.B-1. Land allocation for which objectives for habitat structural and biological diversity differ.

Land Allocation	Definition	Management Objective
Community Zone (CZ)	The area at risk from wildfire directly adjacent to houses or communities and generally not exceeding 0.25 miles from a community.	Create defensible and resilient conditions to protect human life and property. Reduce fuel hazards within 300 feet of structures to significantly limit wildfire effects within this zone. Reduce fuel hazards adjacent to roads providing egress from structures. Suppression would be fire management response Lower priority on meeting structural and biological diversity objectives.
All other land allocations	See Section III.A. for other land allocations	Structural and biological diversity objectives and standards apply to allocations with active management. See Section III.A. for other land allocations.

Recommended Actions at the National Forest Level Not Directly Addressed in the Forest Plan

- None identified

Recommendations for New Regional Direction or Policy

- The Zone Ecologists for the Region should propose tools to support ecologically based decision making and for the design and implementation of restoration projects. Tools, such as marking guidelines for the removal of timber and other vegetation and practical photo-guides highlighting important wildlife attributes to be conserved or enhanced, should be maintained in a living library and shared with forest staff, stakeholders and other interested parties.

- A science review is conducted for the bioregional assessment that evaluates the habitat needs of snag-associated and dependent species in green and burned forests in the Sierra Nevada. This review should be critiqued by an independent panel of scientists in the fields of wildlife and aquatic ecology. The result of this review supports regional direction on snag retention in green and burned forests.

- Provide regional direction on vegetation treatments designed to protect or restore forest structural complexity and promote climate resilience, while protecting biodiversity, species viability, habitat connectivity, natural disturbance processes, and biological legacies such as old trees and snags in the short and long term.

- Evaluate the effects of thinning and burning treatments on vegetation fuels, wildfire hazard, soils, wildlife habitat and use, insect population dynamics, and ecosystem structure and process across fire-dependent ecosystems (Youngblood et al. 2006).

- Investigate the size and shape of fuels treatment units needed to influence wildfire behavior (Hummel and Barbour 2007).

- Develop regional direction and identify priority areas for reforestation. Emphasize reforestation based on climate forecasts (especially for temperature and precipitation) and other important ecological considerations such as importance of protecting riparian and meadow areas during reforestation, importance of reforesting key species such as pinyon pine following large fires because of its significance to wildlife and lack of current nursery stock (Landram 2010, personal communication), and the role of early successional forest composition in forest food webs and ecology.

- Develop regional guidelines for hazard tree marking based on wildlife requirements for Sierra Nevada ecosystems and incorporate into the forest plan to ensure consistency across the region.

- Programmatic reforestation goals recognize that closed canopy forests take a century or more to develop and are not appropriate to recreate by tightly spaced, dense plantations in post-fire early-seral habitats.

- Post-fire grazing allotment modifications are standardized under regional guidance developed by wildlife, rare plant, hydrology, soils and range staff to ensure consistency across the bioregion.

- Funding for the range program should provide for adequate enforcement and monitoring of forest plan standards and allotment management plan direction.

Additional Recommendations

- Request that California Department of Fish and Game make management recommendations during the plan revisions for early seral dependent species such as deer and song birds, sag-associated species such as pileated woodpeckers, secondary cavity nesting species, and old forest-associated species.

Table IV.B-2. Terrestrial special status species associated with early-seral habitats, hardwood, snags, burned areas, and sagebrush in the Sierra Nevada. Abbreviations: **FSSS-** R5 Forest Service Sensitive Species; **BCC**- U.S Fish and Wildlife Service Bird of Conservation Concern; **SAR-** R5 Forest Service Species at Risk (L=low vulnerability, M=moderate, H= high); **CSSC-** California State Species of Special Concern; **MIS-** R5 Forest Service Management Indicator Species; **TES-** Federally Threatened or Endangered Species; **A-** Audubon California Watch List species; **GS-** Natural Heritage Network conservation status ranking; **WL**- California Department of Fish and Game Watch List Species.

Species	Status	Early Seral	Hardwoods	Sagebrush	Burned Areas	Snags
Flammulated Owl	BCC	X (old forest pine with shrubs)	X (oak)			
Swainson's Hawk	FSSS	X (montane meadow migratory stopovers)				
Greater Sandhill Crane	FSSS	X (meadows)				
Greater Sage Grouse	FSSS, MIS	X (herbaceous cover)		X		
Black-backed Woodpecker	MIS				X	X
Lewis' Woodpecker	BCC		X (oak)			X
Nutall's Woodpecker			X			X
Hairy Woodpecker	MIS					X (old forest, closed canopy conifer)
Williamson's Sapsucker						X
Red-breasted Sapsucker			X (hardwoods, willow in montane meadows)			
White-headed Woodpecker						X (open canopy conifer)
Calliope Hummingbird	A	X (meadows, riparian, or montane chaparral)				
Vaux's Swift	CSSC					X
Wrentit	A	X (chaparral)				
California Thrasher	A	X (SN foothills chaparral)				
Nashville Warbler	MIS	X (montane meadow)	X (oaks with shrubby understory)			
Brown Creeper	MIS					X
Mountain Chickadee	WL					X
Fox Sparrow	MIS	X (dense chaparral, or riparian thickets)				
Brewer's Sparrow	CSSC	X (east-side shrublands)		X		
Sage Sparrow	CSSC	X (low dense shrubs, esp. eastside)				
Black-chinned Sparrow	CSSC	X (shublands on eastside)		X		

Species	Status	Early Seral	Hardwoods	Sagebrush	Burned Areas	Snags
Lawrence's Goldfinch	A	X (oaks bordering dry chaparral)				
Olive-sided Flycatcher	CSSC/ SAR-M					X
Mountain Quail	A/ SAR-L		X			
Sierra Nevada Mountain Beaver	CSSC	X				
Dusky-footed Woodrat	MIS	X				
Pygmy Rabbit	CSSC / SAR-H	X (dense eastside shrubs, esp. sagebrush)		X		
Sierra Snowshoe Hare	CSSC / SAR-H	X (montane riparian or shrub understory in forests)				
Black-tailed Jackrabbit	CSSC / SAR-H	X				
White-tailed Jackrabbit	CSSC / SAR-H	X (eastside SN)				
Yosemite Pika	GS= T3 vulnerable	X (montane meadow, chaparral, grassland, riparian)				
Mt. Whitney Pika	GS= T3 vulnerable	X (montane meadow, chaparral, grassland, riparian)				
Gray-headed Pika	GS= T3 vulnerable	X (montane meadow, chaparral, grassland, riparian)				
Badger	CSSC	X (generalist, shrub and grassland)				
Mule Deer	MIS	X				
Sierra Nevada Bighorn Sheep	TES	X				
Mt. Lyell Shrew	GS= G2G3-Imperiled	X (montane riparian, grass, willow)				
Pallid bat	FSSS	X (forages in open grassy areas)				X
Long-eared Myotis	CSSC, SAR-M	X (forages along forest edges)				X
Long-legged Myotis	CSSC, SAR-M	X				X

Species	Status	Early Seral	Hardwoods	Sagebrush	Burned Areas	Snags
Fringed Myotis	CSSC, SAR-M					X
Silver-haired bat	CSSC, SAR-M					X
Hoary Bat	CSSC, SAR-M	X (roosts in conifer foliage, eats mostly moths, forages along forest edges)				Hibernacula?
Western Red Bat	FSSS	X (forages in open grassland, meadow, open forest)	X (roosts in hardwood foliage)			Hibernacula?
Spotted Bat	CSSC, SAR-M					X (roosts primarily in caves and cliffs, occasionally buildings)
Western Mastiff Bat	CSSC, SAR-M	X (known to forage over meadows)				X (roosts primarily in caves and cliffs, occasionally buildings)
Townsend's Big-eared Bat	FSSS					X (roosts primarily in caves, occasionally snags and buildings)
Limestone Salamander	FSSS	X (limestone outcrops chaparral)	X (limestone outcrops in oak/grey pine)			
Tehachapi slender Salamander*	FSSS		X (very small population in So.SN; hardwood, grey pine, riparian or mixed-conifer vegetation under leaves and rocks			
Relictual Slender Salamander*	FSSS		X (southern SN in oak/pine or Sierra mixed-conifer)			
Kern Canyon Slender Salamander*	FSSS		X (in Kern River Cyn. in oak/pine or riparian hardwood vegetation			
Kern Plateau Slender Salamander*	FSSS	X Seeps/riparian in otherwise dry sagebrush habitat	X (Seeps/riparian in otherwise dry oak, fir, pinon pine)			
Kings River Slender Salamander*	G1G2: Critically Imperiled		X (in Kings River Cyn. oak/pine or higher-elevation Sierra mixed-conifer)			
Sequoia Slender Salamander*	G1G2: Critically Imperiled		X known only from Kaweah River Cyn. oak/pine or higher-elevation Sierra mixed-conifer			

Range map for all Batrachocepts: http://www.californiaherps.com/salamanders/maps/sierrabatrachoseps.jpg

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