CENTER *for* BIOLOGICAL DIVERSITY

THE JOHN MUIR PROJECT *of* EARTH ISLAND INSTITUTE

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Re: Forest Plan Revision

Dear Forest Plan Revision Team:

On behalf of the Center for Biological Diversity and John Muir Project of Earth Island Institute, we submit the following comments regarding the "Detailed Proposed Action in Support of the Need to Change Items in the Notice of Intent for Forest Plan Revision for the Inyo, Sequoia and Sierra National Forests."

Our organizations have been participating in the plan revision process, including the submission of extensive written comments regarding the Science Synthesis, the Bio-regional Assessment, the Natural Range of Variation reports, each Forest-specific Assessment (Inyo, Sequoia, and Sierra National Forests), the Need to Change, and the Draft Desire Conditions. Our comments were detailed and contained numerous scientific citations that directly pertain to the Sierra Nevada ecosystem, especially as to wildlife conservation. Those comments are attached with these comments and incorporated by reference because they must be addressed (and have not yet been) by the Forest Service if the agency is to meet its obligations to adhere to the best available science.

The Proposed Action does not contain the type of detail necessary to protect wildlife on the Sierra, Sequoia, and Inyo National Forests. This is especially true of wildlife associated with dense, mature conifer forest and/or post-fire dense mature conifer forest, as well as wildlife associated with aquatic and riparian areas. Likewise, wildlife impacts from grazing are not yet adequately addressed. As described below, we have significant concerns about both the content and scope of the Proposed Action, and these issues must be addressed going forward.

A. Wildlife Diversity and Conservation

In addition to the best available science standard (219.3), section 219.9 of the 2012 Planning Rule, titled "Diversity of plant and animal communities," states that a Plan must contain "components, including standards or guidelines, to maintain or restore the ecological integrity of terrestrial and aquatic ecosystems and watersheds in the plan area, including plan components to maintain or restore their structure, function, composition, and connectivity." Similarly, the Plan must include "components, including standards or guidelines, to maintain or restore the diversity of ecosystems and habitat types throughout the plan area. In doing so, the plan must include plan components to maintain or restore: (i) Key characteristics associated with terrestrial and aquatic ecosystem types; (ii) Rare aquatic and terrestrial plant and animal communities; and (iii) The diversity of native tree species similar to that existing in the plan area." The Forest Service must "determine whether or not the plan components . . . provide the ecological conditions necessary to: contribute to the recovery of federally listed threatened and endangered species, conserve proposed and candidate species, and maintain a viable population of each species of conservation concern within the plan area." If not, "then additional, species-specific plan components, including standards or guidelines, must be included in the plan to provide such ecological conditions in the plan area." Finally, if "it is beyond the authority of the Forest Service or not within the inherent capability of the plan area to maintain or restore the ecological conditions to maintain a viable population of a species of conservation concern in the plan area, then the responsible official shall: (i) Document the basis for that determination (§ 219.14(a)); and (ii) Include plan components, including standards or guidelines, to maintain or restore ecological conditions within the plan area to contribute to maintaining a viable population of the species within its range."

In regard to aquatic ecosystems, the 2012 Rule further requires Plans "to identify priority watersheds for maintenance or restoration." In addition, Plan components are "required for the maintenance and restoration of the ecological integrity of riparian areas," especially "land and vegetation within approximately 100 feet of all perennial streams and lakes."

The management direction in the existing forest plans has not resulted in a reversal of declining trends (population and/or habitat) for a variety of at-risk species, including California spotted owl, fisher, Yosemite toad, Sierra yellow-legged frogs, and post-fire specialists such as the black-backed woodpecker and olive-sided flycatcher. Ecosystem components that are critical to species like owls and fishers – such as snags (especially large snags), mistletoe, and dense canopy – have been neglected and/or intentionally reduced. Moreover, rare species like the black-backed woodpecker are themselves of particular importance in creating/maintaining ecosystem components and their crucial roles in the ecosystem have not yet been adequately acknowledged and addressed (e.g., BBWOs create cavities that other species rely upon because those species cannot create cavities themselves).

The treatment of at-risk species in the Proposed Action does almost nothing to change the problems of the past, such as logging in mature conifer forest, especially in owl, fisher, and woodpecker habitat, both pre fire and post fire. The habitat needs and life requirements for species are not integrated into plan components that address terrestrial and aquatic ecosystems. As a result, the PA does not identify the proper suite of plan components to "provide the ecological conditions necessary to: contribute to the recovery of federally listed threatened and endangered species, conserve proposed and candidate species, and maintain a viable population of each species of conservation concern within the plan area." 36 CFR 219.9. Furthermore, there is substantial contradiction currently between the PA and wildlife needs. For example, the plan components for Fire Management conflict with providing ecosystem integrity and species viability – based on a GIS analysis, the Community and General WPZs significantly overlap with the range of the spotted owl and fisher, as well as the ponderosa pine and mixed conifer forest types. For instance, of the 216 spotted owl Protected Activity Centers (PAC) on the Sierra National Forest, 144 (67 percent) have more than 25 percent of their PAC area within one of these two zones, and approximately 50 percent of the mixed conifer and 70 percent of the ponderosa pine vegetation types are within these zones. If wildlife conservation obligations are to be met, specific standards and guidelines will be necessary to ensure protection of dense mature conifer forest (e.g., canopy cover, snags, downed wood, understory, shrubs, small, medium and large trees) from logging activities, including post-fire.

Dense, Mature, Conifer Forest (both Unburned and Burned)

Rare, declining, and imperiled species – such as the California spotted owl, Pacific fisher, pine marten, northern goshawk, black-backed woodpecker, and olive-sided flycatcher – are all associated with dense, mature conifer forest. The Proposed Action, however, contains no standards or guidelines to adequately protect the wildlife associated with this forest type, whether it be unburned or burned (i.e., burned forest that pre-fire was dense mature conifer forest). This must be corrected going forward in order to comply with the wildlife aspects of the 2012 Rule.

Mature forests contain specific characteristics/complexity that must be provided for such as downed wood, snags, canopy cover, shrubs, and understory. It is also essential to explicitly recognize the importance of mature forest after it has burned – at all severities – to species like spotted owls, fishers, and black-backed woodpeckers. Otherwise, we risk repeating the same mistakes of the past in which unburned forest is mechanically treated in ways it shouldn't be and burned forest is salvaged logged.

California Spotted Owl

The Forest Service considers suitable California spotted owl habitat as forest stands represented by CWHR classes 4M, 4D, 5M, 5D, and 6 in mixed conifer, red fir, ponderosa pine/ hardwood, foothill riparian/hardwood, and east-side pine forests. The last time the Forest Service formally adopted a definition of suitable habitat for spotted owls was in 2004, as part of the 2004 SNFPA. The SFNPA states the following as to suitable habitat:

> California spotted owl protected activity centers (PACs) are delineated surrounding each territorial owl activity center detected on National Forest System lands since 1986. Owl activity centers are designated for all territorial owls based on: (1) the most recent documented nest site, (2) the most recent known roost site when a nest location remains unknown, and (3) a central point

based on repeated daytime detections when neither nest or roost locations are known.

PACs are delineated to: (1) include known and suspected nest stands and (2) encompass the best available 300 acres of habitat in as compact a unit as possible. The best available habitat is selected for California spotted owl PACs to include: (1) two or more tree canopy layers; (2) trees in the dominant and co-dominant crown classes averaging 24 inches dbh or greater; (3) at least 70 percent tree canopy cover (including hardwoods); and (4) in descending order of priority, CWHR classes 6, 5D, 5M, 4D, and 4M and other stands with at least 50 percent canopy cover (including hardwoods). Aerial photography interpretation and field verification are used as needed to delineate PACs.

Desired Conditions

Stands in each PAC have: (1) at least two tree canopy layers; (2) dominant and co-dominant trees with average diameters of at least 24 inches dbh; (3) at least 60 to70 percent canopy cover; (4) some very large snags (greater than 45 inches dbh); and (5) snag and down woody material levels that are higher than average.

…

A home range core area is established surrounding each territorial spotted owl activity center detected after 1986. The core area amounts to 20 percent of the area described by the sum of the average breeding pair home range plus one standard error. Home range core area sizes are as follows: 2,400 acres on the Hat Creek and Eagle Lake Ranger Districts of the Lassen National Forest, 1,000 acres on the Modoc, Inyo, Humboldt-Toiyabe, Plumas, Tahoe, Eldorado, Lake Tahoe Basin Management Unit and Stanislaus National Forests and on the Almanor Ranger District of Lassen National Forest, and 600 acres of the Sequoia and Sierra National Forests.

Aerial photography is used to delineate the core area. Acreage for the entire core area is identified on national forest lands. Core areas encompass the best available California spotted owl habitat in the closest proximity to the owl activity center. The best available contiguous habitat is selected to incorporate, in descending order of priority, CWHR classes 6, 5D, 5M, 4D and 4M and other stands with at least 50 percent tree canopy cover (including hardwoods). The acreage in the 300-acre PAC counts toward the total home range core area. Core areas are delineated within 1.5 miles of the activity center.

When activities are planned adjacent to non-national forest lands, circular core areas are delineated around California spotted owl activity centers on non-national forest lands. Using the best available habitat as described above, any part of the circular core area that lies on national forest lands is designated and managed as a California spotted owl home range core area.

HRCAs consist of large habitat blocks that have: (1) at least two tree canopy layers; (2) at least 24 inches dbh in dominant and co-dominant trees; (3) a number of very large (greater than 45 inches dbh) old trees; (4) at least 50 to 70 percent canopy cover; and (5) higher than average levels of snags and down woody material.

Because the Forest Service relies on the 2004 SNFPA for its management direction, the U.S. Forest Service has never recognized the foraging habitat suitability of severely burned (and not salvage logged) forest stands for spotted owls and, in fact, regularly re-draws Protected Activity Centers (PACs), or even removes them from the PAC system, after severe fire to exclude these areas. The 2004 SNFPA facilitates this due to two key factors 1) its definition of suitable habitat and 2) because it explicitly states: “PACs are maintained regardless of California spotted owl occupancy status. However, after a stand-replacing event, evaluate habitat conditions within a 1.5-mile radius around the activity center to identify opportunities for re-mapping the PAC. If there is insufficient suitable habitat for designating a PAC within the 1.5-mile radius, the PAC may be removed from the network.” The result is a lack of protection for suitable burned foraging habitat close to nests/roosts, which in turn allows this suitable foraging habitat to be open to post-fire salvage logging, which in turn may adversely affect occupancy. This is a major issue, given that a disproportionately large amount of foraging occurs within a 1500-meter radius of nest/roost trees (Bond et al. 2009, Fig. 1). As we have pointed out to the Forest Service many times, Bond et al. 2009, Bond et al. 2010, Bond et al. 2013, Lee et al. 2012, and Clark et al. 2013 all show the importance of protecting owls from salvage logging and yet this science continues to be ignored because it does not fit the Forest Service’s desire to log in dense mature post-fire forest. At the very least, standards, such as precluding salvage logging within 1.5 km of spotted owl core sites (Bond et al. 2009), and protecting burned (of all severities) CWHR 4M, 4D, 5M, 5D, and 6 conifer forest, are necessary to protect post-fire owl habitat.

Bond et al. (2009) quantified habitat selection, which is how much owls used forest that burned at a particular severity compared with the availability of that burn severity. The authors banded and radio-marked 7 California spotted owls occupying the McNally Fire in the Sequoia National Forest four years after fire, and radio tracked them throughout the breeding season. Males and females forage independently, and analyses compared each bird’s foraging locations with random locations within their own foraging ranges. Furthermore, all owls had unburned, low, moderate and highly burned patches of forest in their foraging ranges from which to choose, so the authors could quantify whether owls selected or avoided any of these burn intensities. This is the first study to specifically examine foraging habitat selection by spotted owls in burned forests that were not subjected to substantial post-fire logging. Spotted owls used all burn severities for foraging, but the probability of an owl using a site for foraging was strongest in severely burned forests, after accounting for distance from nest (see Figure 1below). Selection for a particular burn class occurred within 1.5 km from the nest.

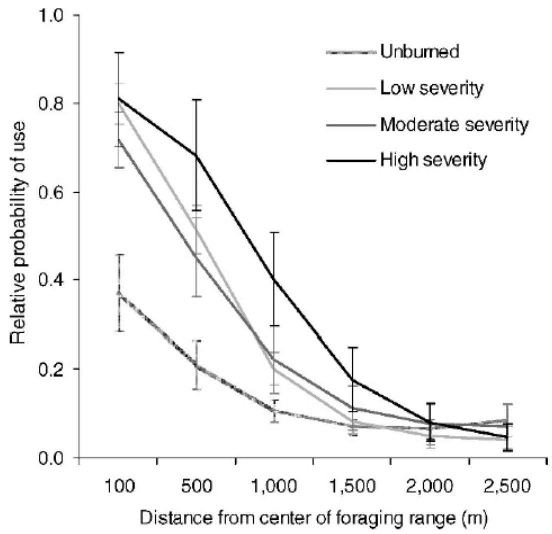

Figure 1. Relative probability of use of a site for 7 California spotted owls foraging at different distances from the center of the breeding range in forest burned at different intensities in the McNally Fire, Sequoia National Forest, 2006. From Bond et al. 2009; Figure 1 on page 1,121.

Bond et al. (2009) also measured vegetation and found that high-intensity burned sites had the greatest herb and shrub cover and basal area of snags. This result suggests that snags, herb, and shrub cover are important components of a post-fire forest that supports foraging habitat for spotted owls. Because severely burned, non-salvage-logged forests can offer suitable habitat for foraging spotted owls, the authors of Bond et al. 2009 recommended "that burned forests within 1.5 km of nests or roosts of California spotted owls not be salvage-logged until long-term effects of fire on spotted owls and their prey are understood more fully."

Post-fire logging has a harmful effect on California spotted owls because it eliminates or degrades habitat that would otherwise be used. For example, Lee et al. (2012) reported that mixed-severity fire, averaging 32% high-severity fire effects, did not reduce occupancy of California spotted owl sites in the Sierra Nevada, and even most territories with >50% high-severity fire remained occupied (at levels of occupancy comparable to unburned forests). This, however, was not the case in salvage-logged sites, as every site that was salvage logged lost occupancy, even though they were occupied after the fire but before the salvage logging (Lee et al. 2012). Specifically, post-fire logging occurred on eight of the 41 burned sites; seven of the eight sites were occupied immediately after the fire but none were occupied after post-fire logging. While Lee et al. 2012 notes that this particular "sample size was too small for this effect to be included as a covariate," the results nonetheless are best available data regarding post-fire logging and California spotted owls. Moreover, a study of northern spotted owls is also illustrative: Clark et al. (2013) found post-fire salvage logging in high-severity fire areas was a factor in territory extinction of northern spotted owls (*S. o. caurina*) in southwestern Oregon ("Our results also indicated a negative impact of salvage logging on site occupancy by spotted owls. We recommend restricting salvage logging after fires on public lands within 2.2 km of spotted owl territories (the median home range size in this portion of the spotted owl's range) to limit the negative impacts of salvage logging.")

The Plan revision must also keep in mind that California spotted owls are in a steep decline and therefore their viability is at extreme risk and clearly past management has failed. While this is just one reason that dense mature conifer forest needs detailed protections – both in its unburned and burned (all severities – low, moderate, and high) form – with specific standards/guidelines, it is an extremely important one. Now outdated studies of California spotted owls strongly suggested population declines, but statistical power was too low to provide solid evidence. Recent scientific studies, however, using additional data and robust statistical methodology have very clearly demonstrated that California spotted owl populations are declining throughout the range of the subspecies (Connor et al. 2013; Tempel and Gutierrez 2013). The new science also shows that the declines are associated with areas characterized by past and ongoing extensive mechanical thinning and post-fire logging. Over the past 18 years, a spotted owl population in the logged Lassen National Forest declined by 22% and another population in the logged Sierra National Forest declined by 16% (Conner et al. 2013). By contrast, in the same 18-year period a population in the unlogged national parks of Sequoia and Kings Canyon increased by 22%. In the logged Eldorado National Forest, the number of territories occupied by spotted owls declined over 18 years to less than 70% occupancy as compared to over 90% at the beginning of the study (Tempel and Gutiérrez 2013). None of these demography study areas experienced significant levels of fire during the study periods, thus fire could not be implicated as a factor in the population declines. These studies demonstrate that the California spotted owl is currently on a trajectory towards extinction on our public forest lands in the Sierra Nevada. Current regulatory mechanisms on public forest lands have permitted harmful forest management practices, such as mechanical treatments and salvage logging in owl habitat, and have proven inadequate to stabilize or reverse the population declines. The data therefore indicate that the California spotted owl is imperiled throughout most of its range, and logging in National Forest lands is an example of why local populations are threatened with extirpation and the entire subspecies may be on a trajectory towards range-wide extinction. Thus, standards and guidelines that explicitly protect spotted owl habitat are plainly needed to reverse the current downward trend, especially standards that protect post-fire owl habitat.

Moreover, this issue is especially urgent in light of recent logging projects in the Sierras such as the Rim Project, the Aspen Project, and the Big Hope Project, all of which promoted logging of post-fire CSO habitat. An analysis of the 2014 Rim fire survey forms shows that 33 spotted owl pairs, and 6 spotted owl singles, were detected by the Forest Service during the spring and summer of 2014 within the Rim Fire area, demonstrating that the Rim Fire area, and post-fire landscapes in general, need explicit standards/guidelines in order to protect these extensively occupied areas from logging. Again, the best available published science (Bond et al. 2009) regarding California spotted owl use of burned forest landscapes shows that the owls not only use unlogged burned forest within 1.5 km of their nests/roosts, they preferentially select it. This is why Bond et al. 2009 states that post-fire logging should not occur within 1.5 km of owl core-use sites. Moreover, because is it known that spotted owls rely on much more than Protected Activity Centers (PACs) for their life needs (nesting, roosting and foraging), it is necessary for the Forest Service to not only protect PACs and HRCAs from logging, but to also protect owl home ranges, including severely burned forest in home ranges. Therefore, the Plan revisions must address this fact and ensure protection of all owl habitat, not just some, in order to maintain viability. Further, most home-range estimates and studies of foraging habitat selection are from the breeding season only. Some California spotted owls are known to expand their movements during the winter (Bond et al. 2010), which represents the most energetically costly and dangerous time for owl survival. Thus, the protection of potentially important habitat should extend to habitat used during the overwinter season as well.

The California spotted owl uses or selects, for nesting and roosting, conifer and mixed conifer-hardwood forested habitats that have structural components of old forests, including large trees >61 cm diameter at breast height (Call et al. 1992, Gutiérrez et al. 1992, Moen and Gutiérrez 1997, Bond et al. 2004, Blakesley et al. 2005, Seamans 2005); multi-layered canopy/complex structure (Gutiérrez et al. 1992, Moen and Gutiérrez 1997); high canopy cover (> 40 percent and mostly > 70 percent; Bias and Gutiérrez 1992, Gutiérrez et al. 1992, Moen and Gutiérrez 1997, Bond et al. 2004, Blakesley et al. 2005, Seamans 2005); abundant snags (Bias and Gutiérrez 1992, Gutiérrez et al. 1992, Bond et al. 2004); and downed logs (Gutiérrez et al. 1992). Logging older forest is a threat to California spotted owl occupancy. For example, in a long-term demography study of color-banded California spotted owls in the central Sierra Nevada, Seamans and Gutiérrez (2007) found that the probability of territory colonization decreased significantly with as little as 20 hectares of logging, and territory occupancy was significantly decreased with as little as 20 hectares of logging. Further, the probability of breeding dispersal away from a territory was related to the area of mature conifer forest in a territory and increased when ≥20 hectares of this habitat was altered by logging. Moreover, in a very recent paper, Stephens et al. 2014 (in press), titled “California spotted owl, songbird, and small mammal responses to landscape fuel treatments,” the owl analysis found a 43% loss of California spotted owl occupancy, as well as colonization by barred owls (Strix varia) (which are larger and more aggressive, and strongly tend to lead to further extirpations of spotted owls), within just several years after mechanical thinning and group selection logging occurred on the Plumas National Forest. This study further highlights the need for explicit standards/guidelines to protect California spotted owl habitat from mechanical treatments. Tempel et al. (2014) also provides evidence that mechanical thinning is significantly harming California spotted owls. The authors found that the amount of mature forest with high canopy cover (70-100%) was a critical variable for California spotted owl viability (survival, territory extinction rates, and territory colonization rates), and determined that “medium-intensity” logging significantly adversely affects California spotted owls at all spatial scales by targeting dense, mature forests with high canopy cover, degrading the quality of such habitat by reducing it to moderate canopy cover. This is adversely affecting California spotted owl reproduction (Tempel et al. 2014). The authors noted specifically that

> only 42.8% of medium-intensity harvests occurred in high-canopy forests; thus, over half of these harvests occurred in habitats that might be less important to spotted owls (Fig. 5c). When medium-intensity harvests *were* implemented within high-canopy forests, they reduced the canopy sufficiently for mapped polygons to be reclassified into a lower-canopy vegetation class in 90.1% of these treated areas (Fig. 5d). … such changes were associated with reductions in survival and territory colonization rates, as well as increases in territory extinction rates. As a result, we believe the most appropriate inference about the influence of medium-intensity harvesting practices is that they appear to reduce reproductive potential, and when implemented in high-canopy forests, likely reduce survival and territory occupancy as well.

Tempel et al. (2014) found no effect of wildland fire on spotted owl reproduction, survival, occupancy, or territory extinction. They did report an adverse effect of fire on territory colonization and, based upon this fact, the authors predicted (using modeling assumptions) that if fire doubled, it would adversely affect occupancy. However, the fire covariate was "unestimable" due to very small sample size, meaning that no result can be determined, statistically. The authors noted that territory colonization was low in fire-affected areas for two reasons: 1) in the largest fire that accounted for most of the fire-affected territories, 5 of the 9 territories remained occupied in every single year after the fire, thus "colonization could not occur by definition"; and 2) the authors noted that the main reason that the "effect of wildfire on territory colonization was strongly negative" was "due to a high-severity fire that occurred on our study area in 2001 and completely burned two territories, which were subsequently never colonized by owls", and two other territories had very low post-fire occupancy and colonization. Though the study hinted at the fact that intensive post-fire logging had occurred in these burned territories, the modeling result of the study did not account for the fact that the permanent loss of occupancy (and no colonization) in the two "completely burned" territories, and the two other territories with very low post-fire occupancy/colonization, was associated with intensive logging after the fire (see, e.g., *Sierra Club v. Eubanks*, 335 F.Supp.2d 1070, 1075 (E.D. Cal. 2004) [noting that all of the heavily burned forest in the Star fire of 2001 had been subjected to post-fire logging on public and private lands outside of the Duncan Canyon Inventoried Roadless Area, which is the portion of the Star fire that is outside of the Tempel et al. 2014 study area]). Google Earth imagery also clearly shows heavy post-fire logging within 1.5 kilometers (and much closer) of the two territories that completely lost occupancy (PLA055 and PLA075) and the two with near-complete loss of occupancy and colonization post-fire (PLA016 and PLA099) (see Appendix A). Tempel et al. 2014 further demonstrates the need for Plan revisions that protect owls from mechanical treatments and from salvage logging.

To provide adequate protections for this rare and declining raptor, it is necessary to recognize that standards/guidelines must be established that a) account for the importance of both burned and unburned mature conifer forest, b) protect owls from mechanical treatments (which not only do not mimic fire, there is an entire body of data that shows that mechanical treatments are a primary driver of the California spotted owl declines that have been observed on all Forest Service-managed lands in the Sierra Nevada over the past 20+ years), and c) protect owls from salvage logging (which generally targets their preferred foraging habitat in a post-fire landscape and has been documented as contributing to owl habitat loss and only occurs in places where owls are declining).

Based on the declines in spotted owl populations on Forest Service lands and the correlation of the decline to fuels treatments and salvage logging (despite the protections afforded to the species through the existing forest plans in the form of Protected Activity Centers and Home Range Core Areas), it is clear that the Forest Service should take this opportunity to change the current plan components to protect spotted owls from the adverse effects of mechanical treatments and salvage logging.

Pacific fisher

Like with the CSO, the 2004 Framework FEIS (pp. S-15, 138, 243, and 246) assumed that mixed-severity fire, including higher-severity fire patches, was a primary threat to Pacific fishers, and the Framework FEIS (p. 242) did not include density of small/medium-sized trees among the important factors in its assessment of impacts to fishers. Thus, the Plan revisions must provide standards/guidelines that recognize and protect a) unburned dense mature conifer forest, and b) burned dense mature conifer forest (i.e., burned areas that pre-fire consisted of dense mature conifer forest).

The data indicate that one of the top factors predicting fisher occupancy is a very high density of small/medium-sized trees, including areas dominated by fir and cedar, and that Pacific fishers may benefit from mixed-severity fire. For example, Underwood et al. 2010's results show that fishers are selecting the densest forest, dominated by fir and cedar, with the highest densities of small and medium-sized trees, and the highest snag levels. Hanson 2013 found that Pacific fishers are using pre-fire mature conifer forest that experienced moderate/high-severity fire at about the same levels as they are using unburned mature conifer forest. Moreover, Hanson 2013 found that when fishers are near fire perimeters, they strongly select the burned side of the fire edge. More recently, Hanson (see attached Powerpoint) has also found documented fisher use of large patches of high-severity fire (up to thousands of hectares in size). Garner 2013 found that fishers actively avoided mechanically thinned areas when the scale of observation was sufficiently precise to determine stand-scale patterns of selection and avoidance—generally less than 200 meters. Zielinski et al. 2006 found that the two most important factors associated with fisher rest sites are high canopy cover and high densities of small and medium-sized trees less than 50 cm in diameter [Tables 1 and 3]. And Zielinski et al. 2013 investigated fisher occupancy in three subpopulations of the southern Sierra Nevada fisher population: the western slope of Sierra National Forest; the Greenhorn mountains area of southwestern Sequoia National Forest; and the Kern Plateau of southeastern Sequoia National Forest area, using baited track-plate stations. The Kern Plateau area is predominantly post-fire habitat [mostly unaffected by salvage logging] from several large fires occurring since 2000, including the Manter fire of 2000 and the McNally fire of 2002. The baited track-plate stations used for the study included these fire areas [Fig. 2]. Mean annual fisher occupancy at detection stations was lower on Sierra National Forest than on the Kern Plateau. Occupancy was trending downward on Sierra National Forest, and upward on the Kern Plateau, though neither was statistically significant, possibly due to a small data set.

Together, this data makes plain that in order to protect the fisher and its habitat, standards/guidelines are necessary to protect both burned and unburned dense mature conifer forest, including dense mature conifer that is severely burned forest (greater than 50% basal are mortality).

Black-backed woodpecker

The black-backed woodpecker is a potential species of conservation concern due to being highly associated with severely burned forest and its avoidance of salvaged logged areas as described below. Moreover, it is a keystone species providing, for example, cavities that other wildlife relies upon for nesting, resting, or denning. We of course, believe that the BBWO must be designated as a SCC as it is extremely rare and not only is its habitat largely unprotected from logging, the Forest Service currently seeks to reduce BBWO habitat on the landscape via mechanical treatments and salvage logging. Furthermore, the importance of the BBWO as a keystone species is yet another reason to monitor and protect it as a species of conservation concern.

Ecological Conditions Necessary for Persistence and Viability:

- **High post-fire snag density** (which generally correlates with areas that a) were pre-fire dense, mature conifer forest, and b) burned at moderate to high intensity [greater than 50% basal area mortality]): "As snag basal area increased, home-range sizes exponentially decreased" (Tingley et al. 2014); "an average snag basal area > 17 meters squared per hectare may represent a benchmark for minimum habitat needs in postfire stands" (Tingley et al. 2014); "Our results, in combination with studies that have shown that black-backed woodpeckers are extremely sensitive to salvage logging (Hutto 2008, Saab et al. 2009), suggest that currently the best strategy for protecting black-backed woodpecker habitat is to maintain large patches of high snag densities (Dudley and Saab 2007, Russell et al. 2007)" (Tingley et al. 2014); "The average snag density of points with Black-backed Woodpeckers (30 m2/ha) was the highest of all species" (Siegel et al. (July 22) 2014); "The strength of the association of Black-backed Woodpeckers with unlogged postfire snag conditions makes it a useful indicator species for wildlife associated with this habitat." (Hanson and North 2008)

- **Elevation** is also an important consideration: "Elevation and snag density remain the strongest two predictors of Black-backed Woodpecker occurrence at the point level" (Siegel et al. (July 22) 2014).

- **Foraging habitat/Roosting habitat**: "Our past findings (Siegel et al. 2013) show that Black-backed Woodpeckers in burned forests of California preferentially select larger, dead trees in more severely burned areas for foraging; our findings here extend those same habitat selection criteria to another aspect of Black-backed Woodpecker habitat selection: roosting habitat." (Siegel et al. (July 16) 2014).

- **Food:** "Black-backed Woodpeckers foraging in burned forests feed primarily on wood-boring beetle larvae (Villard and Beninger 1993, Murphy and Lehnhausen1998, Powell 2000), although some studies have also reported or inferred foraging on bark beetle larvae (Lester 1980, Goggans et al. 1988). Bark beetles and wood-boring beetles share important life-history characteristics (both spend a prolonged portion of their life-cycle as larvae inside dead or dying trees) but also exhibit differences that may be important in their ecological interactions with Black-backed Woodpeckers. Bark beetles are small (generally <6 mm in length), numerous, often able to attack live trees, and generally remain as larvae in bark less than a year before emerging as adults (Powell 2000). In contrast, wood-boring beetles have much larger larvae (up to 50 mm long), are less numerous, and can remain as larvae in dead wood for up to three years (Powell 2000).

Additionally, most wood-boring beetles are unable to attack living trees, and concentrate heavily in fire-killed wood . . . .” (Siegel et al. (July 22) 2014).

- **Nesting habitat**: “For the 31 nests, the mean number of snags/plot was 13.3 (SD ¼ 7.6, range ¼ 1–29 snags/plot), whereas the mean number of snags on plots at randomly selected trees was 5.0 (SD ¼ 5.2, range ¼ 0–35 snags/plot). In both the Cub Fire and Moonlight Fire sites, black-backed woodpeckers preferred nest trees located in areas with high snag densities (Fig. 3).” (Seavy et al. 2012); “None of the cavities were re-used between years and each appeared to have been freshly excavated in the year of its use.” (Seavy et al. 2012); “For the 31 nest trees measured, the mean dbh was 33 cm (SD ¼ 7, range ¼ 18–50)” (Seavy et al. 2012);

Important Factors:

- **Colonization and extinction**: “The average probability of colonization by Black-backed Woodpeckers at a previously unoccupied point in any given year was modeled to be 6.5%, while the average probability that an occupied site would go extinct in any given year was 72%. The probability of extinction had no clear covariate relationships, with moderate support for negative relationships with increased burn severity – extinction occurred less frequently at survey points with greater burn severity. Colonization, however, had very strong relationships to two covariates. Colonization was more likely at early post-fire points and at points with higher densities of snags. The strong support for fire age as a covariate of colonization but not extinction implies a fundamentally different dynamic governing Black-backed Woodpecker occupancy than previously considered: Black-backed Woodpeckers do not necessarily abandon sites because they are too old, but that old sites are less likely to be colonized by constantly shifting woodpecker populations.” (Siegel et al. (July 22) 2014)

- **Home Range size**: “we found that home-range size varied by an order of magnitude, from 24.1 to 304.1 ha, as measured by movement-based kernel estimation” (Tingley et al. 2014); “Black-backed Woodpecker home ranges within our 3 fires varied by approximately an order of magnitude, and this variation was explained in large part by a single resource characteristic: mean snag basal area” (Tingley et al. 2014); “However, size appears to vary with habitat type and time since fire (Dudley and Saab 2007, Rota et al. 2014). As populations of wood-boring beetle larvae decrease during the years after fire (McCullough et al. 1998), it is believed that Black-backed Woodpeckers enlarge their home ranges before eventually abandoning individual burned areas altogether (Dudley and Saab 2007, Rota et al. 2014).” (Tingley et al. 2014)

- **Habitat Connectivity:** There exists a large area in the central Sierra without significant BBWO presence. (See maps at page 23-24 of Siegel et al. (July) 2014). This is relevant to the Sierra NF especially as it represents a potential serious gap in the range of the species.

<u>CSO, Fisher and BBWO</u>

These three species are collectively assessed in light of their association with dense mature conifer forest and their declining or rare status.

- **Trend of Habitat Condition:** In light of the lack of fire on the landscape in this region, the substantial salvage logging that still occurs on Forest Service and private land, the current desire by the Forest Service to avoid moderate and high severity fire (via mechanical treatments in unburned dense mature conifer forest), habitat conditions will likely deteriorate further.

- **Significant Stressors Leading to Trend:** Reductions in stand density/canopy cover/forest complexity/snags from mechanical treatments in unburned forest, fire suppression, and salvage logging.

None of the standards or guidelines in the Proposed Action would ensure that the ecological conditions necessary for persistence and viability of these species would be provided (and Strategies do not have any regulatory significance). To address the problem, proposed standards/guidelines are as follows:

1. <u>Except where such trees pose an imminent hazard to publicly-maintained roads or human structures, maintain large snags (15 inches dbh or greater) wherever they occur as they provide essential habitat.</u>
2. <u>When vegetation management occurs in CWHR 4M, 4D, 5M, 5D, or 6 conifer forest, canopy cover shall not be reduced by more than 10% and trees over 12 inches dbh shall not be removed. Hand thinning of trees up to 16 inches in diameter within 300 feet of homes or administrative structures is allowed, and elsewhere prioritize prescribed fire, managed wildland fire, active snag and downed log creation (via girdling and felling, e.g.), and logging road decommissioning/revegetation.</u>
3. <u>Maintain as unlogged (other than for hazard tree felling on ML 3,4, and 5 roads) at least 90% of the post-fire landscape that was pre-fire CWHR 4M, 4D, 5M, 5D, or 6 conifer forest, including at least 90% retention of pre-fire CWHR 4M, 4D, 5M, 5D, 6 conifer forest that experienced 50-100% basal area mortality in the fire (i.e., complex early seral forest). This 90% shall prioritize maintaining areas with the highest snag density. In addition, other than for hazard tree felling on ML 3,4, and 5 roads, 100% retention of pre-fire CWHR 4M, 4D, 5M, 5D, 6 conifer forest that experienced 50-100% basal area mortality in the fire (i.e., complex early seral forest) shall be maintained within at least 1.5 km of California spotted owl core sites.</u>

<u>Additional Comments Regarding Old Forest, CESF, Fire, Ecological Integrity, and At-risk Species</u>

The lack of specificity and precision as to old forests and complex early seral forest in the Proposed Action will only lead to confusion and likely harm to wildlife. The details are important because in the past the Forest Service has used general/generic language to argue, for example, for logging post-fire early seral areas under the guise of more quickly returning the areas to "old forest." That approach is not scientifically sound as it does not acknowledge that the journey is just as important as the destination in regard to forest succession (e.g., Donato et al. 2012). Old forest derives from early forest in the sense that important components, like snags, downed wood, shrubs, and natural heterogeneity (from natural regeneration) derive, in large part, from complex early seral forest (e.g., Swanson et al. 2011, DellaSala et al. 2014). Put another way, it does not make sense to achieve ecological integrity by destroying complex early seral forest to more quickly achieve old forest – instead, both are damaged ecologically in such an effort.

Similarly, the desired conditions and creation of broad fire zones within which to achieve these desired conditions are not in sync with conservation of wildlife that relies on mature conifer forest (burned and unburned). Thus, it is crucial that the Forest Service establish explicit standards and guidelines that conserve wildlife habitat, especially a) dense, closed-canopy, complex green forest and b) high snag density, complex, post-fire forest. Again, examples of such standards/guidelines are ones that explain how both unburned and burned conifer forest that is/was CWHR 4M, 4D, 5M, 5D, or 6 will be protected for species like owls, fisher, and woodpeckers.

Unfortunately, there also continues to be a generic argument that severe fire is to blame for loss of old forest. There is no basis for this argument as severe fire is currently in a deficit in the Sierras and is especially lacking on the Sierra, Sequoia, and Inyo Forests. Severe fire is also not an either/or. For many species, while severe fire changes their landscape, it can nonetheless continue to provide key habitat, albeit in a different form. For example, California spotted owls have been found, on the Sequoia National Forest after the McNally Fire, to preferentially select the mature conifer forest that burned severely for their foraging needs. Similarly, fishers have been found on the Sequoia National Forest to use severely burned mature conifer forest (Hanson 2013). And, of course, many species, such as the black-backed woodpecker, rely on these severely burned forests for high quality habitat, and are keystone species in that they create cavities for other birds and animals to use down the line (Manley and Tarbill 2012, Tingley et al. 2014, Siegel et al. 2014a, 2014b). In fact, many of the fires that the Forest Service points to as being uncharacteristic are fires that have been found to support great biodiversity, except in or near to areas where salvage logging has occurred – e.g., the Angora, the Storrie, the Moonlight, the McNally. There is strong evidence for this, namely, Bond et al. 2009, 2013; Buchalski et al. 2013; Burnett et al. 2010, 2012; Hanson and North 2008; Hanson 2013; Malison and Baxter 2010; Manley and Tarbill 2012; Seavey et al. 2012; Siegel et al. 2011, 2013, 2014a, 2014b. Thus, again, it is essential, in order to meet NFMA's best available science standard, in order to meet NFMA's ecological integrity standard, in order to ensure viability per NFMA, in order to protect at-rick species per NFMA, that standards and guidelines be set forth that protect both unburned and burned mature conifer forest such as what we have proposed.

Also neglected is the fact that conifer forests of the Sierra Nevada rely on fire of all severities to maintain ecosystem integrity and wildlife diversity, but currently, Sierra forests are in an extreme fire deficit of all severities. (See, e.g., Miller et al. 2012, Odion and Hanson 2013, Mallek et al. 2013, Hanson and Odion 2014, Odion et al. 2014, Baker 2014.) This fire deficit means that, generally speaking, when fires do occur in the Sierras, they are <u>restorative</u> events because they return fire and its ecological value to the landscape, providing, for example, essential (and very rare) wildlife habitat (see, e.g., Bond et al. 2009, 2013; Buchalski et al. 2013; Burnett et al. 2010, 2012; Hanson and North 2008; Malison and Baxter 2010; Manley and Tarbill 2012; Seavey et al. 2012; Siegel et al. 2011, 2013, 2014a, 2014b, Tingley et al. 2014). In addition, because they burn in a mosaic of severities, fires increase forest heterogeneity at multiple scales (stand, watershed, and landscape scales, for example), an outcome that the Forest Service often states it desires (and thus should welcome). And, contrary to assumptions, large, high-severity fire patches are not homogenous—rather, they can contain stand level heterogeneity because they vary in size and importantly, contain within them high levels of variation in regard to post-fire vegetation and snags.

Mallek et al. (2013, Table 3), found in its results that we now have less low, moderate, and high-severity fire than we did historically in the Sierra Nevada, and estimated that we have a little over half as much high-severity fire now compared to historical levels in the following forest types: oak woodlands, dry mixed conifer, moist mixed conifer, yellow pine, and red fir (8,693 hectares annually now versus 15,569 hectares historically (see AAHS = annual area of high-severity fire, Table 3 of Mallek et al. 2013)). However, it is important to note that Mallek et al. was based upon a modeling assumption of only 6% high-severity fire effects in historical mixed-conifer and yellow pine forests, borrowing from a similar modeling assumption in Stephens et al. (2007). The empirical studies that Mallek et al. (2013, Table 2) used for all other historical fire parameters, such as Beaty and Taylor (2001) and Bekker and Taylor (2001), concluded that historical high-severity fire percentages in these forest types were generally in the range of 20-35% (and often higher). Thus, while even Mallek et al. (2013) found significant deficits of all severities of fire, it greatly underestimates the magnitude of the current deficit of high-severity fire (see also Baker 2014, Odion et al. 2014).

The fire deficit has resulted in a deficit of post-fire wildlife habitat. In other words, even setting aside salvage logging for the moment, there is already a substantial deficit of post-fire wildlife habitat in the Sierras due to the lack of all severities of fire on the landscape. There is no basis, therefore, for the assertion that fire/burned forest is the threat to old forest when in fact there is an extreme deficit of fire/burned forest and when it does occur, the Forest Service logs substantial portions of it.

Current plan direction has promoted salvage logging, with no limitations (other than LOPs and minimal retention [e.g. 4-6 snags per acre]) in complex early-seral habitat, to the detriment of owls, woodpeckers and myriad other species found, post-fire, over time, in severely burned areas. For example, Siegel et al. (2011) explains that not only black-backed woodpeckers, but many other species, are utilizing complex early seral forest left unlogged: "Many more species occur at high burn severity sites starting several years post-fire, however, and these include the majority of ground and shrub nesters as well as many cavity nesters. Secondary cavity nesters, such as swallows, bluebirds, and wrens, are particularly associated with severe burns, but only after nest cavities have been created, presumably by the pioneering cavity-excavating species such as the Black-backed Woodpecker. Consequently, fires that create preferred conditions for Black-backed Woodpeckers in the early post-fire years will likely result in increased nesting sites for secondary cavity nesters in successive years." Similarly, Burnett et al. (2012) found that "while some snag associated species (e.g. black-backed woodpecker) decline five or six years after a fire [and move on to find more recent fire areas], [species] associated with understory plant communities take [the woodpeckers'] place resulting in similar avian diversity three and eleven years after fire (e.g. Moonlight and Storrie)." Burnett et al. (2012) also noted that "there is a five year lag before dense shrub habitats form that maximize densities of species such as Fox Sparrow, Dusky Flycatcher, and MacGillivray's Warbler. These species have shown substantial increases in abundance in the Moonlight fire each year since 2009 but shrub nesting species are still more abundant in the eleven year post-burn Storrie fire. This suggests early successional shrub habitats in burned areas provide high quality habitat for shrub dependent species well beyond a decade after fire." And Manley and Tarbill (2012) found, in the post-fire area of the Angora fire, that woodpeckers play a keystone role that can only be accomplished when post-fire habitat is maintained, not logged:

> Although woodpecker species differed in their influence on recovery of birds and small mammals, all three species observed in our study played an important role in supporting the cavity-dependent community through habitat creation for nesting, resting, denning, and roosting. The Black-backed Woodpecker was a significant contributor to the establishment of bird and small mammal species and communities in areas with high burn intensities, and it appeared to have a more narrow range of suitable habitat conditions for nest site selection compared to the Hairy Woodpecker. Thus, the habitat requirements of the Black-backed Woodpecker serve as a useful threshold for managing burned sites for wildlife recovery.

It is therefore imperative that Plans, as required, establish plan components, including standards or guidelines, to conserve the ecological integrity of post-fire, complex early seral habitat, especially the key characteristics, such as high snag density, extensive shrub cover, downed wood, and natural conifer regeneration.

New literature continues to demonstrate our points. Baker 2014 – "Historical forest structure and fire in Sierran mixed-conifer forests reconstructed from General Land Office survey data" – using a large historical U.S. government field data set, and employing an extensively accuracy-checked method to infer past fire intensity patterns from forest structure in this field data from the mid/late-1800s, combined with extensive additional cross-checking against spatially-explicit U.S. government fire intensity mapping from the late 1800s, determined the following: a) historical ponderosa pine and mixed-conifer forests had far more variability in forest density and composition than has previously been assumed based upon spatially-limited data sets, and most forests were denser than previously assumed; b) the historical fire regime was mixed-intensity, with an average of 31-39% high-intensity fire effects, and 13-26% low-intensity fire (with the remainder mixed); c) high-intensity fire rotation intervals were 281-354 years in these forests (much shorter than current rotation intervals); and d) high-intensity fire patches over 200 hectares were common in historical ponderosa pine and mixed-conifer forests of the western Sierra Nevada, with a number of patches over 1,000 hectares, and some as large as approximately 8,000 to 9,000 hectares. This new paper demonstrates further that the Forest Service's generic assumptions about historical forest density and fire severity, and appropriate current forest density and fire severity, are misinformed and must be revisted especially in light of the importance of dense mature conifer forest to wildlife.

In Hanson 2014, “Conservation concerns for Sierra Nevada birds associated with high-severity fire,” the analysis found that all of the native Sierra Nevada birds positively associated, in the published scientific literature, with post-fire habitat created by high-intensity fire, and which have statistically significant population trends (Breeding Bird Survey), are experiencing persistent and ongoing declines. These declines of high-intensity fire associates are affecting all nesting guilds, including cavity nesters, canopy nesters, and shrub/ground nesters, the latter of which comprised the largest number of declining species. The study identified post-fire logging, and subsequent removal/eradication of native shrubs (through mechanical means and spraying of toxic herbicides) and artificial conifer plantation establishment, as well as ongoing fire suppression and mechanical thinning designed to further suppress fire, as serious threats and recommended a major change in current management direction to conserve these species and their habitat. **This new published science shows that in addition to the black-backed woodpecker, which is slated to become a Species of Conservation Concern, additional species that rely on post-fire habitat should also be designated Species of Conservation Concern.**

In DellaSala et al. 2014. “Complex early seral forests of the Sierra Nevada: what are they and how can they be managed for ecological integrity?” the authors synthesized and summarized the existing scientific literature, and recommended that “Complex Early Seral Forest” (CESF) be recognized as an ecologically distinct forest habitat type, and that CESF should be mapped and monitored, and protected from post-fire logging. The authors also found that the Black-backed Woodpecker should be designated as a Species of Conservation Concern under the revised forest plans, due to its extreme rarity and vulnerability to further fire suppression and post-fire logging operations. Additionally, the authors recommended an expansion of mixed-intensity managed wildland fire to restore CESF on the landscape, given that the current science shows CESF to be in a substantial deficit relative to historical levels. This study provides important guidance for the Forest Service as to CESF.

This new science, and the many studies we have presented already, should not be brushed aside – they are directly relevant to the issues at stake and go to the heart of how to plan for the future. It is therefore imperative that the Forest Service not continue to arbitrarily pick and choose what to incorporate into the plan revision process. Doing do is illegal, but just as importantly, it violates the integrity of the process and the ability of the public to understand fully the situation and what is at stake.

In light of the fact that most of our comments have not been incorporated or addressed thus far, we reiterate some of them here again:

- In order to achieve more fire on the Sierra landscape, the Forest Service can do the following:

    - Identify constraints on prescribed fire and managed wildland fire (e.g., air quality; personnel availability; monetary resources; weather windows);

    - Set guidelines to assist in avoiding the identified constraints;

- Remove all currently existing Plan restrictions (e.g., restrictions on the use of managed wildland fire outside of Wilderness) that prohibit or inhibit managed wildland fire or prescribed fire and instead set guidelines for how to achieve more prescribed fire and managed wildland fire;

- Increase education regarding effective home protection from fire and, in regard to protecting human communities from fire, focus resources on making homes and structures fire resilient; For example, Gibbons et al. 2012 found that defensible space work within 40 meters [about 131 feet] of individual homes effectively protects homes from wildland fire. The authors concluded that the current management practice of thinning broad zones in wildland areas hundreds, or thousands, of meters away from homes is ineffective and diverts resources away from actual home protection, which must be focused immediately adjacent to individual structures in order to protect them.

- In order to maintain the ecological value of fire:

  - In addition to prohibiting salvage logging as described above, the Forest Service should acknowledge and promote the importance of natural regeneration. Post-fire areas that are manipulated by salvage logging and/or by reforestation efforts are, from an ecological perspective, no longer as valuable as post-fire areas; rather, post-fire salvage logging and reforestation substantially reduce, and often locally eliminate, wildlife species strongly associated with the forest habitat created by moderate and high-severity fire patches (Hanson and North 2008, Hutto 2008, Burnett et al. 2011, 2012, Seavy et al. 2012, Siegel et al. 2012, 2013). Time since fire also provides important insights into the need to protect post-fire areas from manipulation. There is a continuum of use of post-fire areas over time by different species. Black-backed woodpeckers, for example, are well known to require areas with very high snag densities immediately post-fire – i.e., mature forest that has very recently experienced higher-severity fire, and has not been salvage logged (Hanson and North 2008, Hutto 2008, Saab et al. 2009, Seavy et al. 2012, Siegel et al. 2010, 2011, 2012, 2013). However, "while some snag associated species (e.g. black-backed woodpecker) decline five or six years after a fire [and move on to find more recent fire areas], [species] associated with understory plant communities take [the woodpeckers'] place resulting in similar avian diversity three and eleven years after fire (e.g. Moonlight and Storrie)." (Burnett et al. 2012). Burnett et al. (2012) also noted that "there is a five year lag before dense shrub habitats form that maximize densities of species such as Fox Sparrow, Dusky Flycatcher, and MacGillivray's Warbler. These species have shown substantial increases in abundance in the Moonlight fire each year since 2009 but shrub nesting species are still more abundant in the eleven year post-burn Storrie fire. This suggests early successional shrub habitats in burned areas provide high quality habitat for shrub dependent species well beyond a decade after fire." (Burnett et al. 2012). Raphael et al. (1987) found that at 25 years after high-severity fire, total bird abundance was slightly higher in snag forest than in unburned old forest in eastside mixed-conifer forest of the northern Sierra

Nevada; and bird species richness was 40% higher in snag forest habitat. In earlier post-fire years, woodpeckers were more abundant in snag forest, but were similar to unburned forest by 25 years post-fire, while flycatchers and species associated with shrubs continued to increase to 25 years post-fire (Raphael et al. 1987). In ponderosa pine and Douglas-fir forests of Idaho at 5-10 years post-fire, levels of aquatic insects emerging from streams were two and a half times greater in high-severity fire areas than in unburned mature/old forest, and bats were nearly 5 times more abundant in riparian areas with high-severity fire than in unburned mature/old forest (Malison and Baxter 2010). Schieck and Song (2006) found that bird species richness increased up to 30 years after high-severity fire, then decreased in mid-successional forest [31-75 years old], and increased again in late-successional forest [>75 years]).

  - It is imperative that "salvage" logging not be equated with ecological restoration, or forest management objectives other than economically-motivated multiple use.

- Post-fire landscapes, especially post-moderate/high severity fire landscapes, must be acknowledged as creating high bio-diversity and essential habitat for many species (e.g., Raphael et al. 1987, Burnett et al. 2010, Burnett et al. 2012, Hanson and North 2008, Hutto 2008, Saab et al. 2009, Swanson et al. 2011, Seavy et al. 2012, Buchalski et al. 2013, Siegel et al. 2010, 2011, 2012, 2013, 2014). For example, in the Moonlight Fire area, researchers explained that "[i]t is clear from our first year of monitoring three burned areas [Cub, Moonlight and Storrie Fires] that post-fire habitat, especially high severity areas, are an important component of the Sierra Nevada ecosystem." (Burnett et al. 2010). They also found that "[o]nce the amount of the plot that was high severity was over 60% the density of cavity nests increased substantially," and that "more total species were detected in the Moonlight fire which covers a much smaller geographic area and had far fewer sampling locations than the [unburned] green forest." (Burnett et al. 2010);

- Regarding fire size and fire intensity trends in the Sierras, Hanson and Odion (2014) conducted the first comprehensive assessment of fire intensity since 1984 in the Sierra Nevada using 100% of available fire intensity data, and using Mann-Kendall trend tests (a common approach for environmental time series data – one which has similar or greater statistical power than parametric analyses when using non-parametric data sets, such as fire data). They found no increasing trend in terms of high-intensity fire proportion, area, mean patch size, or maximum patch size. Hanson and Odion checked for serial autocorrelation in the data, and found none, and used pre-1984 vegetation data (1977 Cal Veg) in order to completely include any conifer forest experiencing high-intensity fire in all time periods since 1984 (the accuracy of this data at the forest strata scale used in the analysis was 85-88%). Hanson and Odion also checked the results of Miller et al. (2009) and Miller and Safford (2012) for bias, due to the use of vegetation layers that post-date the fires being analyzed in those studies. Hanson and Odion found that there is a statistically significant bias in both studies ($p = 0.025$ and $p = 0.021$, respectively), the effect of which is to exclude relatively more conifer forest experiencing high-intensity fire in the earlier years of the time series, thus creating the false appearance of an increasing trend in fire severity. Miller et al. (2012a), acknowledged the potential bias that can result from using a vegetation classification data set that post-dates the time series. In that study, conducted in the Klamath region of California, Miller et al. used a vegetation layer that preceded the time series, and found no trend of increasing fire severity. Miller et al. (2009) and Miller and Safford (2012) did not, however, follow this same approach. Hanson and Odion also found that the regional fire severity data set used by Miller et al. (2009) and Miller and Safford (2012) disproportionately excluded fires in the earlier years of the time series, relative to the standard national fire severity data set (www.mtbs.gov) used in other fire severity trend studies, resulting in an additional bias which created, once again, the inaccurate appearance of relatively less high-severity fire in the earlier years, and relatively more in more recent years.

- Resilience requires reestablishing the ecological disturbances that forests and wildlife evolved with. For example, wildlife evolved with fire, not mechanical treatments, and therefore resilience is achieved through management that seeks to put fire back on the landscape such as via prescribed fire and managed wildland fire. Mechanical thinning, on the other hand, does not mimic natural wildlfire and can eliminate or reduce the value of mature forest habitat by eliminating or reducing structural complexity (which many rare wildlife species preferentially selects for). Structural complexity is key for species like the California spotted owl, Pacific fisher, and black-backed woodpecker, and therefore, mechanical thinning, when used in dense mature forest habitat, can eliminate or reduce the value of that habitat for these species, and reduce ecological resilience (see, e.g., Zielinski et al. 2006, Purcell et al. 2009, Bond et al. 2009, Hanson 2013).

B. Riparian and Aquatic Areas

It is essential that riparian areas receive utmost attention and protection in the Plan revision process in light of the many species associated with it, including rare and imperiled frogs, toads, and fish.

Even where wildfire burns in riparian areas with sometimes high severity—a completely natural occurrence in the Sierra Nevada (Frissell et al. 2012) – it is fully compatible with ecological restoration and aquatic species recovery. Roads on the other hand intrinsically bring a host of harms to water quality and wildlife habitat (e.g., Trombulak and Frissell 2000, Gucinski et al. 2001), hence reconfiguration of existing forest road networks has been long recognized by the Forest Service and the scientific community as absolutely central for restoration and recovery of a broad range of ecosystem values and species (Pacific Rivers Council 2010, and sources therein, Switalski et al. 2004). If the Proposed Action passively affirms existing roads as, e.g., essential for wildfire management, without meaningful consideration of and accounting for the multitude of harms those roads cause by virtue of location, design, condition, and management, this is not a defensible action. It is critical for the Forest Service to recognize that many existing roads are highly undesirable both with regard to the many environmental consequences, and with regard to allowing wildfire to "burn in its characteristic pattern" on the landscape (Morrison 2007). Alternative road locations and lower-density, better-managed road networks can serve environmental and watershed restoration, wildfire management, and forest restoration purposes far better than existing roads (Pacific Rivers Council 2010, McCaffrey et al. 2007, Switalski et al. 2004). This needs to be front and center in forest plans for the Sierra Nevada, and because the environmental consequences of roads are so manifest, it must be recognized and operationalized in planning. The Forest Service needs to aggressively seek out opportunities for realigning and downsizing existing road networks to better serve all affected purposes and needs—not just fire management, or any other single action (Pacific Rivers Council 2012). Furthermore, after large wildfires, reconfiguration of the road system, including decommissioning and drainage improvement, are among the most urgent and effective of post-fire management actions (Beschta et al. 2004)

The Forest Service, at Standard 1 (p. 45), prescribes using "creeks" as fire control lines. This is a bad idea that poses high risks to water quality and aquatic resources. If managing fire control lines includes the usual suite of actions, including cutting snags, removing understory vegetation, scraping soil surfaces to reduce ground fuel continuity, digging firelines, and applying fire retardant, this standard is highly likely to result in severe, direct impact to riparian and near-stream vegetation and soils, with resultant adverse impacts to aquatic habitat and biota. This level of disturbance, particularly of soils but also of vegetation from fire suppression actions often exceeds the intensity and persistence of impacts caused by fire alone (Beschta et al. 2004). The manipulation of vegetation and soils in streamside areas, wetlands, and "creeks" for fire control purposes would prevent these important habitats from achieving their ecological outcomes. Slopes, riparian vegetation, seasonal wetlands within 100 m of surface channels, ponds, wetlands, and lakes should not be actively managed as fire control boundaries. However, passive reliance on streams, lakes and wetlands as fire control zones, without direct manipulation of soils and vegetation to control fire activity, is certainly acceptable.

Recognizing recharge areas for segments of designated and eligible wild and scenic rivers is good step forward from existing policy. Per number 5, conservation of biological diversity and recovery of native species should be recognized among the vital ecosystem services of watersheds. This will better integrate protection of watershed functions and water quality with the biological elements of the Aquatic/Riparian Ecosystems and Streams criteria.

Monitoring is absolutely necessary to attain most of the goals identified in this section of the document, yet there is no reference to monitoring of watershed and water quality conditions here. The scope and objectives of monitoring need to be identified relative to assuring that desired conditions are being attained and standards are being met, but it is equally important to identify triggering criteria that tie monitoring results to decisions on agency actions. The feedback loop from monitoring results to action decisions must essentially recognize the intrinsic time lags and potentially irreversible harms can result from some actions and conditions, and therefore they should be specifically structured to avoid the accrual of time-lagged and catchment-wide cumulative impacts.

While flooding and drought are of course important (and it's excellent that flooding is specifically recognized here), natural forest disturbances, including fire, insects and disease outbreaks, and windthrow are also expected and key elements shaping ecosystem and habitat dynamics in watersheds, riparian, and streams. Disturbances of vegetation, soils, and hydrologic processes, whether they are expressed as fine-grained, smaller scale dynamics, or as coarse-grained influences at larger scales of the landscape, are known to be vital in contributing to and sustaining the long-term structural and functional complexity of physical and biological systems in riparian areas and streams (PRC 2012, Malison and Baxter 2010, Rhodes 2007, Bisson et al. 2003, Minshall et al. 1997, Reeves et al. 1995). Hence it is a critical oversight to not include maintaining and restoring the natural role of fire and other disturbances in sustaining riparian and stream ecosystem conditions and functions. This should be rectified. It is also important to recognize that many, perhaps most of these habitats are moderately to severely degraded by past multiple forest uses including grazing, mining, logging, roads, changes in wildlife and associated herbivory and trophic influences, and in some cases, fire suppression. Therefore “retention” of their present values and functions is far from sufficient; management must be designed to passively and, where needed, actively restore these values and functions.

Frissell et al. (2014) offers a wide range of argument and scientific citation to support the need to increase the spatial extent of riparian management and conservation areas, and narrow the range of actions allowed within these areas, so that persistence and restoration of natural processes that produce passive restoration of aquatic and riparian functions and values can be ensured.

Strategy 6 appears designed to facilitate harmful practices in sensitive riparian areas, with the assumption that such practices will occur and that their adverse effects should be “considered.” This strategy offers no real protection for streams and aquatic ecosystems, and in fact undermines some protections that are extant under current plans.

Mechanized treatments in riparian areas can disturb vegetation and soils in close proximity to surface waters, where the risk of sediment delivery and other impacts is demonstrably high (Rashin et al. 2006, Dwire et al. 2010). Logging activity that disturbs soils within riparian buffers can also reduce the buffer’s effectiveness to retain sediment and nutrients delivered from upslope sources. Thinning or other disturbance of coniferous or deciduous trees and shrubs within riparian and wetland areas can cause decades of diminished summer low flows (after an initial few years during which low flows may increase), as a consequence of increased water demand by rapidly re-growing vegetation (Hicks et al. 1991, Moore and Wondzell 2005). In addition, thinning and yarding of logs from near-stream areas requires or encourages the construction of roads in close vicinity to streams, where the likelihood of sediment delivery and other impact from roads is increased (Luce et al. 2001).

Mechanized thinning and fuels operations usually require higher-density road access to be feasibly implemented (Rhodes 2007). Mechanical treatments for fuels reduction are particularly problematic because recurring entries at roughly 10-year intervals are necessary to sustain the desired conditions (Martinson and Omi 2013); such a forest management regime strongly favors, if not requires, a permanent, high-density road network. Many thinning projects involve road and landing construction and reconstruction, as well as elevated haul and other use of existing roads, all of which significantly contribute to watershed and aquatic degradation. Even if constructed roads and landings are deemed “temporary,” their consequent impacts to watersheds and water bodies are long lasting or permanent. The hydrological and ecological disruptions of road systems and their use (Jones et al. 2000, Trombulak and Frissell 2000, Gucinski et al. 2001, Black et al. 2013), exacerbated by other effects of vehicle traffic, will likely outweigh any presumed restorative benefit to streams and wetlands accruing from thinning and fuels reduction. In recent years, the prospect of future thinning or fuels reduction projects often has become the basis for the USFS or BLM to avoid or delay decommissioning environmentally harmful roads, even when fiscal resources were available for the work. Prescribed fire without extensive mechanical treatment is of much less concern, as it is more feasible to apply in sparsely-roaded wildlands, entails far less soil disturbance, and if conducted in proper times and places it can more adequately mimic the ecological effects of natural wildfire.

Strategy 8 (p.5) for meadows is very weakly formulated. It mentions prioritization and use of best available science, but says nothing that describes the existing condition of meadows or mandates how and why they should be restored. Without a recognition of their current condition, threats, and restoration needs and opportunities, language about prioritization is disembodied, uninformed, and unlikely to lead to material benefit to meadow-dependent natural resources. PRC (2012) provides active and specific strategic language to address meadow protection and restoration in the Sierra Nevada.

Strategy 13 (p.52) states "consider opportunities to manage vegetation in upland areas to restore and maintain water tables. Consider the latest science." Does this strategy refer to ongoing research primarily by UC Merced into the hypothesis that stream flows might increase in response to aggressive forest thinning? The Forest Service needs to recognize the long history of scientific inquiry into this hypothesis, and the fact that science has rejected this hypothesis as a feasible means of increasing water supply through forest management (Rhodes and Purser 1998, Rhodes 2007). Claims of increased water yield from forest harvesting are always complicated by several generally recognized hydrologic factors, including that partial vegetation removal results in increased water use (and growth) by remaining vegetation, transient benefits of increase base flow that is lost or reversed as forests rapidly regrow after thinning, the fact that most increased flow is realized under peak flow conditions where it is more likely to contribute to flooding than to sustained streamflow or water supply, and that increased erosion and sediment caused by the vegetation reduction actions and road networks and road use necessary to sustain them pollutes the resulting streamflows, and this pollution often far outlasts any flow benefit. It is grossly insufficient to consider "that latest science," when a large body of extant science illuminates the problems with the notion that logging can produce streamflow or "water table" benefits. The "best available scientific information" must be considered.

Standard 1 (p.52) establishes some dimensions for riparian management areas to provide protection of streams and other surface waters from upslope management actions. Frissell (2014) provides a recent review of available literature pertaining to riparian forest buffer distances needed to mitigate the effects of various upslope disturbances. The proposed distances are inadequate for protection of seasonally flowing streams. Moreover, the inner gorge slope break should not itself be the boundary of the protection zone. Uncertainty as to the exact topographic slope break location, and vulnerability of this convex slope location to erosion and slope failure means that the inner gorge slope break should itself be buffered by an additional 150 to 300 feet. This is a necessity to guard against erosion increases in this highly sensitive part of the landscape, where any erosion stands a high chance of contributing sediment or blockages to streams.

The freshwater fauna of California has been severely affected by water and land use, as well as fish stocking and introduction and invasion by nonnative species. Numerous species are recognized as in states of decline, endangerment, or increased vulnerability to future endangerment as a result of past actions and ecosystem changes. Public lands will play a crucial role in determining the future of many of these species, even some that historically occurred predominantly in lower-elevation lands and waters in non-federal ownership. To fulfill the mandates of the National Forest Management Act, Endangered Species Act, and/or Clean Water Act, forest plans should establish a framework and standards for forest and rangeland management that by design ensures protection and recovery of endangered, threatened, sensitive aquatic and riparian species. Deferral of strategic conservation actions to consultations and recovery planning for individual species and locations is unwise and costly, ineffective then previous or ongoing programmatic determinations cause repeated or widespread conflict with conservation needs, and can lead to actions that harm one sensitive species with the intent of benefitting another. Because the fate of aquatic species is determined by the status and condition of aquatic habitats, and in turn aquatic habitats are strongly determined by conditions and actions of land and water use across the whole watershed, aquatic species conversation begins and is very strongly determined by programmatic decisions about land use, water use, and transportation systems across the national forests, and on other ownerships in a watershed.

PRC (2012) summarized the presence of known endangered, threatened, special concern, and sensitive fishes and amphibians in Sierra Nevada national forests. It is disconcerting that few of these species are mentioned or even generally considered in the Detailed Proposed Action document as warranting special or specific attention in forest plans. The Yosemite toad and yellow-legged frog received brief mention in the Scoping document, but the remaining some two dozen fish and amphibian species were not mentioned either specifically or in aggregate. The PRC document offers the following information about the occurrence of fish and amphibian species in the three forests included in this Scoping:

<u>Inyo National Forest:</u>

Owens pupfish *Cyprinodon radiosus*
Owens speckled dace *Rhinichthys osculus* ssp.
Owens tui chub *Gila bicolor snyderi*
Owens Valley web-toed salamander *Hydromantes sp.*
Kern Plateau salamander *Batrachoseps robusts*
Inyo Mountains salamander *Batrachoseps campi*
Yosemite toad *Bufo canorus*
Mountain yellow-legged frog *Rana muscosa*
Sierra Nevada yellow-legged frog *Rana sierrae*
Yosemite toad *Anaxyrus canorus* (*Bufo canorus)*

<u>Sequoia National Forest:</u>

Little Kern golden trout *Oncorhyncus mykiss whitei*
Kern River rainbow trout *Oncorhynchus mykiss gilberti*
Kern brook lamprey *Lampetra hubbsi*
Pacific lamprey *Lampetra tridentate tridentate*
Riffle sculpin *Cottus gulosus*
Sacramento hitch *Lavinia exilicauda exilcauda*

Sacramento tule perch *Hysterocarpus traski traski*
San Joaquin roach *Lavinia symmetricus* spp.
Kern Plateau salamander *Batrachoseps robusts*
Kern Canyon slender salamander *Batrachoseps simatus*
Inyo Mountains salamander *Batrachoseps campi* (uncertain presence?)
Breckenridge Mt. slender salamander *Batrachoseps* spp. (possibly extinct)
Tehachapi slender salamander *Batrachoseps stebbinsi*
Mountain yellow-legged frog *Rana muscosa*

<u>Sierra National Forest:</u>

Kern brook lamprey *Lampetra hubbsi*
Pacific lamprey *Lampetra tridentate tridentate*
Riffle sculpin *Cottus gulosus*
Sacramento hitch *Lavinia exilicauda exilcauda*
Sacramento tule perch *Hysterocarpus traski traski*
San Joaquin roach *Lavinia symmetricus* spp.
Limestone salamander *Hydromantes brunus*
Sierra Nevada yellow-legged frog *Rana sierrae*
Yosemite toad *Anaxyrus canorus* (*Bufo canorus)*

On p. 28 of the Detailed Proposed Action document the Forest Service states with regard to the federally listed Yosemite toad, mountain yellow-legged frog, and Sierra yellow-legged frog that "Current forest plan direction specific to these species will be retained." Considering that inadequacy of current forest plan direction and past national forest management and monitoring actions for conservation of these two species on national forests lands were identified by the US Fish and Wildlife Service as factors threatening the species (USFWS 2014, identified threats include grazing, logging, mining, dams and diversions, fuels and fire management, and inadequate monitoring on national forest lands), this is inadequate. Forest plans should by design incorporate goals, strategies, and standards necessary to ensure conservation and promote recovery of listed species, in keeping with the best available scientific information pertinent to these.

In addition to the species identified above, the most widespread fish species of concern in streams and rivers throughout the three forests is the native rainbow (Moyle et al. 2011 and references therein). Its status remains uncertain because of the lack of genetic surveys and a partly unknown history of fish stocking and possible introductions of non-native rainbow trout stocks in the project area. However, in general, like other salmonids, rainbow trout are highly likely to be adversely affected by post-fire logging and road construction/road operations (Beschta et al. 2004, Karr et al. 2004). Forest plans must explicitly account for the potential effects of salvage logging and road construction on retention and future formation of near-surface groundwater and channel and valley conditions conducive to hyporhic flows. Conversely, true active restoration measures that reduce impacts of existing roads and stream crossings could prioritize these locations and benefit trout and other coldwater species in the post-fire environment.

In addition to vertebrates, there is information about historical and present day occurrence of aquatic invertebrates such as mussels (PRC 2012 p.59, Howard 2010, Nedeau et al. 2009, Lydeard et al. 2009, Mehlhop and Vaughan 1994, Williams et al. 1993). Scientific information not only indicates large and lasting declines from historical distribution and abundance of mussel species, but helps point out where relict populations remain that clearly must be prioritized for conservation if declines are to be stemmed and reversed. Forest plans should at least identify general criteria and standards for protection and restoration that will apply in the areas where known populations remain.

Although not specifically cited in the Scoping documents as a basis for actions, in the Sierra Nevada Forests hydrophobicity of soils is commonly cited as a justification for post-fire logging. Because it is routinely cited to justify risky post-fire salvage logging in the face of scientific literature that advises against such actions, this subject should be addressed in the forest plans.

Any assessment of existing or potential future occurrence of hydrophobic (aka water repellant) soils must do so within the framework of six critical contexts. First, fire, even when it is of high severity, does not consistently cause hydrophobicity (Beschta et al. 2004). Second, field evidence demonstrates that hydrophobicity in forest soils occurrence is commonly unrelated to fire (Doerr et al. 2009). Regarding the occurrence of these soils, Doerr et al. (2009) noted:

> [H]igh levels of repellency have also been reported under vegetation types not affected by fire, and the question arises to what degree the water repellency observed at burnt sites actually results from fire…'Natural background' water repellency… was detected…at 75% of all sites examined irrespective of dominant tree species (Pinus ponderosa,Pinus contorta, Picea engelmanii and Pseudotsuga menziesii). These findings demonstrate that the soil water repellency commonly observed in these forest types following burning is not necessarily the result of recent fire but can instead be a natural characteristic. The notion of a low background water repellency being typical for long unburnt conifer forest soils of the north-western USA is therefore incorrect. It follows that, where pre-fire water repellency levels are not known or highly variable, post-fire soil water repellency conditions are an unreliable indicator in classifying soil burn severity.

These findings indicate that burn severity is an unreliable predictor of hydrophobic soils and that the existence of hydrophobic soils after fire cannot be reliably ascribed to fire impacts.

Third, post-fire hydrophobic soil conditions are transient, abating once soils are wetted, sometimes lasting only a few months, and seldom lasting more than two years. Hydrophobicity declines with time and moisture content.

Fourth, in contrast to hydrophobic soils, reductions in infiltration rates due to compaction on roads and landings are highly persistent, never recovering for as long as roads and landings exist. Even several years after subsoiling, infiltration rates remain severely reduced relative to undisturbed soils (Foltz et al, 2007). Reductions in infiltration rates due to compaction by grazing are also highly persistent (CWWR, 1996; USFS and USBLM, 1997; Beschta et al., 2004; 2012). Infiltration rates are unlikely to begin to recover until grazing is ceased.

Fifth, available data indicate that grazing and roads not only reduce infiltration rates more persistently than fire sometimes might, but that grazing and roads cause far larger reductions in infiltration rates than do hydrophobic soils. Severe fire can temporarily reduce infiltration rates by about 50% if hydrophobic soils develop in response to fire (Wondzell and King, 2003). In contrast, grazing and roads persistently reduce infiltration rates by about 85% and 95-99%, respectively. Due to the extremely low infiltration rates on roads, they generate surface erosion and runoff in response to frequent, low-intensity rainfall and snowmelt events, for as long as the road exists, resulting in persistent and chronic degradation of water quality and aquatic habitats. This is not the consistent case when fire causes hydrophobic soils to develop temporarily (Wondzell and King, 2003) and fire does not always cause hydrophobic soils (Wondzell and King, 2003; Beschta et al., 2004; Doerr et al., 2009).

Sixth, hydrophobicity does not reduce available water storage and infiltration rates in soils via compaction, as grazing (Kauffman et al., 2004), landings, and roads do. Full recovery from soil compaction typically requires 50-80 years after the complete cessation of impacts (USFS and USBLM, 1997a; Beschta et al., 2004). It is likely that infiltration rate and soil water storage capacity reductions related to compaction require a similar time period for full recovery.

As noted in Beschta et al. (2004) and Karr et al. (2004), measures can include aggressive efforts to reduce existing management-induced impacts, such as eliminating/curtailing livestock grazing, obliterating and decommissioning roads, rehabilitating firelines, removing stream crossings and other obstructions to the connectivity of aquatic populations, while avoiding: ground based logging, all logging in riparian areas and on steep slopes and areas burned at higher severity, planting, and construction or reconstruction of landings and roads.

Roads may be highly correlated with watershed condition, but it is important to recognize that such a correlation does not necessarily mean that “fixing” roads will alleviate all of the correlated effects. Road density integrates at least two major and separate categories of phenomena that contribute to erosion and sediment delivery (Trombulak and Frissell 2000). The first is erosion and sediment that is generated by the road itself and operations on it, and runs off into surface waters. In this category we can include secondary hydrophysical effects of roads, including landsides and gullies that initiate because roads disturbed natural drainage pattern, and maintenance-related runoff. This first category is targeted by road remediation and mitigation measures that reduce erosion or sediment delivery to streams from roadways. The second category is indirect: the erosion and sedimentation that are generated by land use actions and practices that are either supported by or incidental to the road network. Those phenomena in the second category that pertain to dispersed erosion and sediment delivery in forested watersheds are the subject of this memo: primarily, they are direct ground disturbance from felling and yarding, accelerated windthrow around cutting unit margins, and channel extension, gullying, and bank erosion initiating as a consequence of catchment-wide vegetation removal. These erosion and sediment sources are not mitigated by road management measures.

The Aquatic Conservation Strategy of the Northwest Forest Plan is a unique, comprehensive, and integrated management and planning strategy designed by the Forest Ecosystem Management Assessment Team (FEMAT), a multidisciplinary team of scientists and resource specialists from the agencies and universities. Since FEMAT was convened in 1993-94, there has been no equivalent major scientific synthesis leading to adoption of a specific planning and management framework for conservation and management of riparian areas, watersheds, and aquatic ecosystems on federal lands. FEMAT and the Aquatic Conservation Strategy of the NW Forest Plan have withstood many tests and trials, and still stand among multiple federal agencies as the accepted benchmark for species recovery, biodiversity protection watershed restoration, and compliance with clean water mandates and goals.

The Sierra Nevada Ecosystem Project reviewed science relevant to the Sierra Nevada national forests and its recommendations echoed many of the key elements of the Northwest Forest Plan. However, SNEP recommended some departures from the Northwest Forest Plan Aquatic Conservation Strategy largely with respect to expanded protection for headwater streams, recognizing both the increased importance and increased vulnerability of such headwaters to disturbance in steeper lands of the Sierra Nevada (Appendix 3. Management and land use buffers. Sierra Nevada Ecosystem Project Final Report to Congress, Vol. III, pp. 270-273. Wildland Resources Center Report No. 39, University of California, Davis.). The primary results and recommendations of SNEP pertaining to aquatic and riparian resource conservation were recently re-examined and largely affirmed in a scientific workshop sponsored by the Pacific Rivers Council at UC Davis in 2011 (Frissell, C.A., M. Scurlock, and R. Kattelmann. 2012. SNEP Plus 15 Years: Ecological & Conservation Science for Freshwater Resource Protection & Federal Land Management in the Sierra Nevada. Pacific Rivers Council Science Publication 12-001. Portland, Oregon, USA. 39 pp. http://www.sierraforestlegacy.org/Resources/Conservation/FireForestEcology/ThreatenedHabitats/Aquatic/RETROSNEP_PRC_Report_2012.pdf). Further, the Pacific Rivers Council (2012) made a comprehensive slate of specific recommendations for objectives, standards, and guidelines to more closely align existing Sierra Nevada forest plan elements, the recommendations in SNEP and widely accepted elements of the NW Forest Plan Aquatic Conservation Strategy, and with new and emerging science. Finally, a recent science panel review of new science pertaining to the NW Forest Plan Aquatic Conservation Strategy echoed the SNEP recommendations in calling for increased protection of smaller headwater streams (Frissell, C.A., R.J. Baker, D.A. DellaSala, R.M. Hughes, J.R. Karr, D. A. McCullough, R.K. Nawa, J. Rhodes, M.C. Scurlock, and R.C. Wissmar. 2014; Conservation of Aquatic and Fishery Resources in the Pacific Northwest: Implications of New Science for the Aquatic Conservation Strategy of the Northwest Forest Plan. Report prepared for the Coast Range Association, Corvallis, OR. 35 pp, http://coastrange.org/documents/ACS-Finalreport-44pp-0808.pdf).

Therefore, the Forest Service should recognize its own history, and adopt the Northwest Forest Plan Aquatic Conservation Strategy, revised with respect to the findings and recommendations of the SNEP project, as a rational and scientifically and technically defensible benchmark for aquatic and riparian, and watershed protection and restoration in the three Sierra Nevada Forest Plans. We request that the agency explicitly adopt the NW Forest Plan Aquatic Conservation Strategy and relevant SNEP recommendations as a principal benchmark of its NEPA analysis. In so doing the Forest Service should identify and document with citations to scientific papers or published reports and explain the reasoned basis for each departure from this benchmark proposed in the Sierra Nevada forest plans. In this way, the Forest Service's proposal for forest plans and its implications for aquatic, riparian, and watershed resources can be clearly understood by the interested scientific and resource conservation professional community and by the public.

C. Grazing

The Forest Plan revision must address livestock grazing for several key reasons. First, livestock grazing is pervasive on Sierra Nevada national forests, conveying numerous adverse impacts on ecosystems at a large scale (Kondolf et al., 1996; Kattelmann, 1996; Rhodes, 2007; Beschta et al., 2013). All three of the national forests proposed for plan revision are extensively grazed by livestock. Second, grazing and related impacts are particularly concentrated in riparian areas along streams, as legions of studies and assessments have documented (e.g., Kattelmann, 1996; Kondolf et al., 1996; Belsky et al., 1999: Beschta et al., 2013). The resulting grazing impacts on riparian area conditions are significant because riparian area conditions strongly affect stream conditions, including water quality and fish habitats (Rhodes et al., 1994; CWWR, 1996), as the USFS has repeatedly acknowledged (USFS et al., 1993; USFS and USBLM, 1997a: b). As a result, livestock grazing causes numerous types of havoc for riparian-dependent and aquatic species, streams, water quality, and downstream beneficial uses.

Grazing damages stream banks via reduced vigor and cover of deep-rooted vegetation and trampling of shearing of streambanks (Kattelmann, 1996; Kondolf et al., 1996; Belsky et al., 1999: Beschta et al., 2013). Bank damage from trampling and vegetation loss reduces bank stability by leaving remaining banks oversteepened, devegetated, and highly vulnerable to additional erosion and loss by streamflow (Kondolf et al., 1996). As a BLM publication (Cowley, 2002) on bank alteration by livestock noted,

> It is well documented that large herbivores such as cattle, horses, sheep, bison, elk, and moose can alter the physical dimensions (e.g., increasing the bankfull width) of stream channels by bank trampling and shearing…Increasing the bankfull width makes the stream shallower, increases sediment, decreases the floodplain, increases temperature, and increases the adverse [effects on] the physical functioning of a stream, its associated riparian area, and aquatic habitat.

Bank damage from livestock trampling also destroys overhanging banks, reducing their extent and frequency in an irretrievable manner. This is a significant negative impact because overhanging banks are important to the survival of adult and juvenile salmonids (Kondolf et al., 1996, Beschta et al., 2013). The loss of bank stability caused by trampling and the loss of deep-rooted vegetation also cause the direct loss of stable overhanging banks, an important component of salmonid habitat, and thwarts their development (Platts, 1991; Fleischner, 1994; Rhodes et al., 1994; Kondolf et al., 1996; Beschta et al., 2013).

The loss of riparian vegetation and bank stability caused by grazing often leads to gullying and elevated stream erosion, which contributes to significant increases in downstream sediment delivery. Grazing also significantly elevates soil erosion and sediment delivery by reducing vegetative cover and compacting soils, causing increased surface runoff (Kondolf et al., 1996; Beschta et al., 2013).

These grazing impacts significantly increase soil erosion and sediment delivery, which degrades water quality by increasing suspended sediment, turbidity, and fine sediment levels in streams (Kattelmann, 1996; Kondolf et al., 1996; Belsky et al., 1999: Beschta et al., 2013). The degraded water quality by sediment from grazing adversely affect fish and water use, including downstream reservoirs, as a USFS researcher has acknowledged (Reid, 1999).

The increases in sediment delivery from grazing contribute to the adverse modification of stream channels via sedimentation, which reduces the frequency, depth, and quality of pools which are important to many aquatic biota, and increases the width/depth of streams, contributing to elevated temperatures. As USFS and USBLM (1997) noted:

> Grazing is a major nonpoint source of channel sedimentation (Dunne and Leopold 1978; MacDonald and others 1991; Meehan 1991; Platts 1991). Grazed watersheds typically have higher stream sediment levels than ungrazed watersheds (Lusby 1970; Platts 1991; Rich and others 1992; Scully and Petrosky 1991). Increased sedimentation is the result of grazing effects on soils (compaction), vegetation (elimination), hydrology (channel incision, overland flow), and bank erosion (sloughing) (Kauffman and others 1983; MacDonald and others 1991; Parsons 1965; Platts 1981a; 1981b; Rhodes and others 1994). Sediment loads that exceed natural background levels can fill pools, silt spawning gravels, decrease channel stability, modify channel morphology, and reduce survival of emerging salmon fry (Burton and others 1993; Everest and others 1987; MacDonald and others 1991; Meehan 1991; Rhodes and others 1994).

The increased delivery of sediments to streams caused by grazing, including that from increased surface erosion on bare, compacted soils and accelerated bank and channel erosion, has many negative impacts on aquatic systems. Notably, elevated sediment delivery is the one of the most widespread water quality problems in the streams draining Sierra Nevada national forests (Centers for Water and Wildland Resources (CWWR), 1996).

Livestock grazing also degrades water quality by increasing water temperatures in several ways. It elevates water temperature via the loss and suppression of riparian vegetation that provides stream shade increases (Kondolf et al., 1996; Kattelmann, 1996; Beschta et al., 2013). Livestock grazing also widens channels due to bank damage from trampling and sedimentation, which also contributes to water temperature increases (Bartholow, 2000; Kondolf et al., 1996; Kattelmann, 1996; Cowley, 2002; Beschta et al., 2013), even in the absence of shade loss (Rhodes et al., 1994; Bartholow, 2000). This is a serious impact because elevated water temperature adversely affects numerous aquatic stenotherms, particularly salmonids (McCullough, 1999). These effects on water temperatures are significant because elevated water temperature is a widespread water quality problem in many streams draining USFS lands in California.

Livestock grazing also degrades water quality by elevating coliform levels (Kattelmann, 1996), as studies on USFS lands in the Sierra Nevada have repeatedly documented (Derlet et al., 2008; 2010; 2012; Myers and Kane, 2011 Myers and Brenda, 2012). Grazing also contributes to biological water contamination by Giardia (Kattelmann, 1996). This biological pollution of drinking water supplies by widespread grazing on these three national forests poses a significant threat to human health.

Livestock grazing also reduces water quality by elevating nutrients levels due to animal wastes deposited or washed in to streams (Derlet et al., 2010). This degradation of water quality contributes to the eutrophication of affected water bodies (Derlet et al., 2010), which is likely to accelerate with on-going climate change (CCSP, 2008). Eutrophication is a significant concern for drinking water because algal blooms also pose a health hazard (Derlet et al., 2012).

Grazing also adversely impacts local and downstream hydrology in several ways. The loss of bank-stabilizing vegetation and bank stability causes stream incisement, especially in meadows (Kondolf et al., 1996). Stream incisement cause drops in water tables, desiccating meadows. Viers et al. (2013) noted that lowered water tables in Sierra Nevada meadows contribute to additional stream incisement and the loss of meadow functionality. The reduction in base flow contributions to streams due to lowered water tables adds additional stress to imperiled aquatic biota, including salmonids and amphibians (Viers et al., 2013; Beschta et al., 2013).

The hydrologic alteration of ecologically important wet meadows, such as fens, by grazing, adversely impacts their functionality (Sikes et al., 2013). Grazing of fens is a major cause of their degradation in the Sierra Nevada and fen meadows in poor condition that are subject to stock grazing are likely to be further damaged or prevented from recovering. Sikes et al. (2013) noted regarding fen meadows in the Sierra Nevada that "it is likely that even relatively light grazing will maintain degraded sites in a degraded condition for many decades."

Grazing extensively and profoundly alters the ability of soils to absorb, store, and release water, cumulatively affecting water quantity, especially during summer low flows. Trampling by livestock inevitably compacts soils and damages ground vegetation. This is because the hoof of a 1,000 pound cow exerts more than five times the pressure on soils than does an extremely large bulldozer that weighs about 50 tons (Cowley, 2002).

The loss of the ability of soils compacted by grazing to store and ultimately release water is highly significant, because it reduces low streamflows which harms fish. Kauffman et al. (2004) estimated that soils compacted by grazing lost the ability to store about 121,000 liters of water per hectare (or about 13,000 gallons per acre) in just the top four inches of soil in riparian meadows. This is an extremely significant impact, because water stored in soils is an important source of the water for plants and the generation of streamflow during dry periods. These effects of soil compaction from livestock are likely some of the reasons that cessation of livestock grazing in riparian areas has been shown to increase summer streamflow (Ponce and Lindquist, 1991, Reeves et al., 1991, Rhodes et al., 1994). Cessation of livestock grazing is one of the most promising means for increasing/restoring low flows in streams (Ponce and Lindquist, 1991; Rhodes et al. 1994; Beschta et al., 2013). Continued livestock grazing inevitably contributes in multiple ways to reductions in summer streamflows. These reductions contribute to elevated water temperatures (Rhodes et al., 1994) which, in turn, contribute to reductions in the survival and production of trout, and other aquatic stenotherms.

Importantly, the soil compaction inexorably caused by grazing is extremely persistent, requiring several decades for full recovery (USFS and USBLM, 1997). Thus, soil compaction from livestock grazing is highly cumulative over time and persistently contributes to the loss of plant growth and summer streamflow which adversely affects fish. Soil compaction also persistently reduces soil productivity (USFS and USBLM). Notably, soil compaction and its resultant adverse ecological impacts are pervasive problems in the Sierra Nevada, particularly in areas subjected to livestock grazing (CWWR, 1996).

Third, grazing impacts must be thoroughly examined and curbed in the proposed Forest Plan revision because these impacts profoundly impact aquatic species and the beneficial uses of water. Numerous studies have repeatedly shown that elevated sediment delivery caused by grazing reduces the survival and production of salmonids in several ways, including by infilling pools, widening streams, and elevating fine sediment levels and water temperature (Platts, 1991; USFS et al., 1993; Rhodes et al., 1994; Kondolf et al., 1996; USFS and USBLM, 1997; Buffington and Montgomery, 1999; Kappesser, 2002; Beschta et al., 2013). Additionally, livestock also trample amphibians (Kondolf et al., 1997). Therefore, adequate protection of aquatic species requires curbing the pervasive harms caused by existing livestock grazing on the three forests. Protecting and restoring water quality and the beneficial uses of water also requires diminution of many extensive impairments of water quality caused by the three forests' grazing pogroms. Similarly, proper assessment of the proposed revised plan's cumulative impacts on aquatic systems, including water quality, riparian areas, fish, amphibians, water quantity, stream conditions, and beneficial uses of water requires an in-depth adequate analysis of grazing impacts on the three forests.

Fourth, grazing impacts must be fully assessed and made known because these impacts combine with those from existing roads and will combine with any logging as well to cumulatively affect aquatic conditions. Grazing has numerous impacts that combine with the impacts of roads, logging, and landings on watershed and aquatic resources (Reid, 1993; Rhodes et al., 1994; Henjum et al., 1994). For instance, reasonable assessment of cumulative soil impacts requires examination of those from livestock impacts, logging, and roads because all of these activities persistently afflict soils in several ways. Grazing, logging, landings, and roads all severely compact soils (Platts, 1991; Rhodes et al., 1994; CWWR, 1996; USFS and USBLM, 1997; Kauffman et al., 2004). This cumulative soil compaction reduces soil productivity and profoundly alters the hydrologic properties of soils. In particular, compaction severely reduces the ability of soils to absorb and store water which serves as an important source of summer streamflows.

Livestock grazing, logging, landings, and roads also severely degrade soil productivity by greatly elevating soil erosion (Platts, 1991; USFS and USBLM, 1997; Rhodes et al., 1994). Loss of topsoil due to erosion causes permanent loss of soil productivity (Karr et al., 2004; Beschta et al., 2004). This loss of productivity is cumulatively affected by all causes of soil loss (USFS and USBLM, 1997). Thus, the credible evaluation of cumulative effects on soil, which is a keystone element of ecosystems, requires the assessment of the combined impacts that will accrue from the three forests' grazing activities combined with the immoderate logging and road activities associated with proposed logging. The existing and on-going grazing impacts on soil erosion must be assessed and disclosed, together with those from roads, landings, and logging, in order to reasonably disclose the cumulative impacts of the alternatives on soil erosion and soil productivity. Otherwise, the three forests will have failed to reasonably make known the cumulative effects of Plan revision on soils.

Similarly, prodigious elevated sediment delivery caused by grazing combines with that from logging, roads, and landings to cumulative a host of sediment related conditions in streams, including channel form, pool conditions, fine sediment levels, fish habitats, turbidity, suspended sediment and the downstream sedimentation of reservoirs. Therefore, the cumulative effects of proposed road, landing, logging, and grazing actions on sediment delivery at the scale of watersheds must be fully assessed in order to reasonably examine impacts on sediment-related aquatic conditions and beneficial uses.

Roads and landings in riparian areas significantly degrade riparian areas and their functions, as does grazing. Further, the proposed changes to existing anemic riparian protections under the SNFPA are plainly aimed at allowing greater riparian degradation via logging under the rubric of fuel treatments. Therefore, grazing, roads, landings, and logging will cumulatively degrade riparian areas, which are essential to important aquatic functions. This means the combined impacts of logging, grazing, landings, and roads must be assessed under the Plan revision and made known in order to reasonably determine cumulative impacts on aquatic systems, including water quality, channel form, and fish habitats.

Grazing impacts on water temperature also combine with the impacts of logging, roads, and landings in riparian areas on water temperature, cumulatively affecting aquatic stenotherms, such as salmonids. These combined impacts from these activities include those due to the loss of stream shade and channel widening from cumulative sediment delivery and decreased bank stability. For these reasons, it is essential that the three forests properly assess and make known the cumulative effects of grazing, logging, landings, and roads on water temperatures under the revised Plan.

Other impacts of grazing that combine with those of roads and logging on watershed conditions and functions include weed spread and increased peak flows. Therefore, these combined impacts must also be properly assessed.

Importantly, the Equivalent Roaded Area (ERA) method used by many national forests in USFS Region 5 as a surrogate for credible cumulative effects assessment of management-induced watershed damage is inadequate with respect to accounting for the pervasive and significant cumulative watershed damage caused by livestock grazing. The ERA method does not incorporate the cumulative watershed impacts caused by livestock grazing in estimating ERA levels (Reid, 1993; Menning et al., 1996). Therefore, the ERA cannot be used to assess the combined impacts of grazing, logging, landings, and roads on watershed and aquatic resources. The three forests must, instead, use credible methods to assess the combined impacts of logging, roads, and grazing on soils, erosion, sediment delivery, water temperature, stream conditions, and sediment-related water quality impacts.

Last, addressing grazing is necessary to achieve several of the avowed Desired Conditions in the NOI, such as:

- Aspen and oak sprouts are well distributed in areas where they occur. (NOI, p. 6)
- Aspen is successfully regenerating and growing into larger trees. (NOI, p. 8)

- Sagebrush ecosystems are resilient to fire, disturbances (e.g., grazing, recreation), invasive species (including cheatgrass) and climate change. (NOI, p. 24)
- Pinyon-juniper types have a mosaic of trees and open areas that provide wildlife habitat, contribute to functional soils, and are resilient to disturbances such as fire, invasive species and climate change. (NOI, p. 24)
- Adequate quantity and timing of water flows support ecological functions, including aquatic species and riparian vegetation consistent with existing water rights and claims. Affects to quantity and timing from climate change, such as changes in runoff timing and patterns, should be taken into account…Water quality is sustained at a level that retains the biological, physical and chemical integrity of aquatic systems and benefits the survival, growth, reproduction and migration of native aquatic and riparian species. Water quality meets or exceeds…water quality standards, and supports designated beneficial uses in light of atmospheric deposition of nitrogen…Watersheds with recharge areas for segments of designated and eligible wild and scenic rivers retain water quality and recharge to those segments…Groundwater quantity and quality in aquifers are sustained…Watersheds are fully functioning, are resilient and recover rapidly from natural and human disturbances, and have a high degree of hydrologic connectivity laterally across the floodplain and valley bottom, and vertically between surface and subsurface flows. Physical (geomorphic, hydrologic) connectivity and associated surface processes, such as runoff, flood-pulse, in-stream flow regime, erosion and sedimentation are maintained…Watersheds provide important ecosystem services such as high quality water, recharge of streams and aquifers, maintenance of riparian communities, moderation of climate change and atmospheric deposition. Watersheds maintain long term soil productivity…Soil and vegetation functions in upland and riparian settings are retained or enhanced. Resilient landscapes provide forage for browsing and grazing animals, timber production and recreation opportunities without adversely affecting soil and water productivity. (NOI, pp. 47-48)
- Stream ecosystems, riparian corridors and associated stream courses are functioning properly and are resilient to natural disturbances (e.g., flooding) and climate change, promote the natural movement of water, sediment and woody debris and provide habitat for native aquatic species….Stream ecosystems, including ephemeral watercourses, exhibit full connectivity where appropriate to maintain aquatic species diversity…Ephemeral watercourses provide for dispersal, access to new habitats, and perpetuation of genetic diversity, as well as nesting and foraging for special status species…Flooding is the primary disturbance. Streams and rivers maintain a natural hydrograph, or water flow, over time, including periodic flooding, which promotes natural movement of water, sediment, nutrients and woody debris. Flooding creates a mix of stream substrates for fish habitat, including clean gravels for fish spawning, large wood structures and sites for germination and establishment of riparian vegetation…Where possible, native fish, amphibians and other native aquatic species are present within their historic distribution, and habitat conditions support self-sustaining populations. Fish aquatic species habitat includes deep pools and overhanging banks, structure provided by large wood, off channel areas and cover. Woody and herbaceous overstory and understory regulate stream temperatures…Species composition and structural diversity of plant and animal communities in riparian areas, wetlands and meadows provide habitat and promote ecological processes…Wetlands and groundwater-

> dependent ecosystems, including springs, seeps, fens, wet meadows, and associated wetlands or riparian systems support stable herbaceous and woody vegetative communities that are resilient to drought, climate change and other stressors. Root masses stabilize stream channels, shorelines and soil surfaces. The natural hydrologic, hydraulic and geomorphic processes in these ecosystems function at a level that allows retention of their unique functions and biological diversity…Native riparian vegetation is diverse, provides the structure and composition to function within their natural potential and provides food and cover for wildlife...Soil function is sustained to infiltrate and disperse water properly, withstand accelerated erosion and cycle nutrients. Associated water tables support riparian vegetation and restrict non-riparian vegetation…Meadows have ground cover and species composition as represented by condition class (e.g., good to excellent), species richness and diversity...Fens and meadows are in proper functioning condition or improving. Fens and meadows are resilient to climate change and disturbances. Development of fens continues. Necessary soil, hydrologic regime, vegetation, and soil and water characteristics sustain that system's ability to support unique physical and biological attributes…Springs provide sufficient water to maintain healthy habitats for native riparian and aquatic species … Springs are resilient to natural disturbances and changing climate conditions and function within their type and capability. Soil, water and vegetation attributes sustain healthy springs. Water flow, recharge rates…are similar to historic levels and persist over time. (NOI, pp. 49-50)

As previously discussed, livestock grazing interferes with the attainment of most of the foregoing desired conditions. Grazing severely damages soils, soil productivity and soil hydrologic functions. Soil compaction by grazing reduces infiltration and subsequent water recharge to watersheds (Kauffman et al., 2004; Beschta et al., 2014). These impacts also compound drought stress and contribute to reductions in low flows. Grazing elevates water temperatures in many ways and impedes the recovery of healthy riparian vegetation (Platts, 1991; Kondolf et al., 1996; Belsky et al., 1999; Beschta et al., 2013). Grazing impacts contribute significantly to reductions in the survival and production of salmonids. Grazing has been shown to be a major cause in the loss of aspen recruitment (Beschta et al., 2013). Grazing is a major threat to ecologically important fen meadow systems in the Sierra Nevada (Sikes et al., 2010). Grazing is a major cause of cheatgrass spread and establishment in sagebrush ecosystems (Beschta et al., 2013; Reisner et al., 2013). Grazing compounds the adverse impacts of climate change and renders ecosystems less resilient to climate-driven impacts (Beschta et al., 2013; Hughes, 2014). Therefore, a major reduction in grazing impacts is a vital step towards attainment of the avowed "Desired Conditions" in the NOI.

As just discussed, livestock grazing damages a host of watershed and aquatic elements and processes in ways that combine with impacts of roads, logging, and climate change to cumulatively harm aquatic populations, water quality, and water quantity. For these reasons, the forthcoming environmental analyses must reasonably assess and make known the existing conditions[1] and likely future impacts on these elements processes under the grazing pogrom allowed under the Plan revision.

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[1] As other USFS environmental analyses (e.g., MHNF, 2013) have noted: "In order to understand the contribution of past actions to the cumulative effects of the proposed action and alternatives, this analysis relies on current environmental conditions as a proxy for the impacts of past actions. This is because existing conditions reflect the

The following basic attributes of grazing must be assessed and made known both at the scale of the forests and watersheds:

- number, location, and area of allotments;
- total number and area of allotments;
- stocking levels and season of grazing in each allotment;
- time since last revision of allotment management plan;

The environmental analyses must examine and make known that existing conditions have been affected by grazing and cumulatively affect aquatic systems and water quality in combination with impacts from logging, roads, and climate change. These existing conditions include the following for all grazing-affected streams and watersheds:

- riparian conditions, including seral state, and stream shade;
- bank stability;
- extent of overhanging banks;
- width/depth ratio;
- pool frequency;
- fine sediment levels and fine sediment storage in pools (V*) in streams (V*)
- turbidity
- watershed sediment delivery;
- location and extent soil compaction[2] and attendant loss of soil productivity, soil moisture storage, and low flow;
- location and extent of bare soils;
- elevation of peak flows;
- the location and extent of xerified meadows due to stream incisement;
- miles of streams affected by grazing at the watershed scale;
- nutrient loading and concentrations;
- biological contamination (e.g., coliform, Giardia, etc.) loading and concentrations;
- locations of lotic and lentic algal blooms;
- water temperatures;
- status of beneficial uses affected by the foregoing, including those downstream.

Since grazing under the revised Plan will continue to affect the foregoing processes and elements, the environmental analyses for the Plan revision must also credibly estimate the effect of grazing management on these elements and processes, together with the effects of climate change and proposed logging, landing, and road activities.

As part of the assessment of grazing-related impacts, the environmental analyses must disclose that elimination of grazing would result in the rapid improvement of many conditions damaged

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aggregate impact of all prior human actions and natural events that have affected the environment and might contribute to cumulative effects."

[2] The area exposed to grazing provides an index of soil compaction, because it is likely that the entire area exposed to grazing is compacted due to the pressure exerted by livestock hooves and the persistent nature of soil compaction.

by grazing, including most of the aforementioned processes and element, as has been repeatedly documented in numerous assessments (Platts, 1991; Rhodes et al., 1994; Fleischner, 1994; Knapp and Matthews, 1996; Magilligan and McDowell, 1997; McDowell, and Magilligan, 1997; Belsky et al., 1999; Kauffman et al., 2002; Nagle and Clifton, 2003; Kauffman et al., 2004; Coles-Ritchie et al., 2007; Hough-Snee et al., 2012; Beschta et al., 2013; Beschta et al., 2014). These studies have documented that in riparian areas and streams that have not been subjected to grazing for several years have narrower channel width, higher streambank stability, higher levels of overhanging streambanks, less bare ground, less compacted soils with higher infiltration rates, more wet-site vegetation, better water quality, and higher levels of canopy cover from desirable, deep-rooted vegetation than comparable areas that continue to be grazed. These beneficial effects have also been repeatedly documented on the Inyo National Forest (Knapp and Matthews, 1996; Herbst et al., 2012).

Even in the case of soil compaction, which recovers slowly in the absence of impacts, research has shown that the elimination of grazing results in considerable recovery over the course of a couple decades in comparison with areas that are continued to be grazed (Kauffman et al., 2004). This recovery from compaction in the absence of grazing results in profoundly improved ability of soils to absorb, store, and release water during low flow periods (Kauffman et al., 2004; Beschta et al., 2013). A no-grazing approach is the only type of grazing management that is compatible with the protection and restoration of aquatic systems (Platts et al., 1991). The elimination of livestock grazing is crucial step in increasing the resilience of public land ecosystems to ongoing climate change effects (Beschta et al., 2013). The foregoing beneficial effects of grazing elimination on public land ecosystems must be assessed and made known in the environmental assessment for the Plan revision.

In order to provide the public with a reasonable context regarding the efficacy, costs, and benefits of proposed management under the Plan revisions, the environmental analyses for the Plan revision must also make known the following:

- grazing has no beneficial effects on watersheds and aquatic resources;
- in contrast, wildfire has numerous ecological benefits for watersheds and aquatic systems;
- Logging to reduce fuels, especially in riparian areas, has numerous inevitable adverse impacts on watersheds and aquatic systems;
- the elimination of grazing is consistently highly effective in restoring watershed and aquatic systems and confers no adverse ecological impacts;
- the elimination of grazing not only has low fiscal costs to taxpayers, but would result in net savings to the public.

The three forests must curb the pervasive damage to the public's watershed and aquatic resources by grazing. Therefore, environmental analyses for the proposed revision must include at least one alternative for detailed analysis that has standards that ensure that grazing damage is consistently reduced on the three forests.

Scientific assessments, including those of the USFS, have repeatedly noted that a key method for reducing grazing damage is to require grazing suspension for many years in following areas where grazing prevents ecological recovery and/or will inevitable cause significant watershed and aquatic damage. Most widely used grazing management practices are incompatible with the recovery of degraded riparian areas (Platts, 1991; Belsky et al., 1999). The recovery of degraded riparian areas, which is essential to reducing water quality impacts, is highly unlikely without significant reductions in the number of livestock and duration of grazing (Ohmart and Andersen, 1986). In ecologically important fen meadows, even relatively light grazing prevents ecological recovery (Sikes et al., 2010). Grazing in wet areas inevitably causes considerable damage because wet soils are particularly susceptible to compaction. Further, wet areas are often hydrologically connected to streams, which results in a high degree of nutrient and biological contamination of streams and downstream water bodies.

The suspension of livestock grazing is the only grazing management strategy that is completely compatible with protection and restoration of riparian areas and water quality, as many assessments of grazing impacts have repeatedly concluded (e.g. Anderson et al., 1993; Platts, 1991; Rhodes et al., 1994; Spence et al., 1996; Belsky et al., 1999). Elmore and Kauffman (1994) noted, regarding available information on the effect of grazing on riparian recovery, which is essential to restoration of water quality, "livestock exclusion has consistently resulted in the most dramatic and rapid rates of ecosystem recovery."

Numerous assessments have repeatedly recommended the temporary or permanent elimination of grazing in order to restore degraded riparian areas and thereby reduce water quality impacts from livestock grazing (Clary and Webster, 1989; Platts et al., 1991; Beschta et al., 1991; Anderson et al., 1993; Henjum et al., 1994; Rhodes et al., 1994; Leonard et al., 1997; Beschta et al., 2004; Karr et al., 2004; Spence et al., 1996; Beschta et al., 2013; Hughes, 2014). For example, a USFS and USBLM publication (Leonard et al., 1997) states (emphasis added):

> Livestock grazing in riparian areas, however, may not always be entirely compatible with other resource uses or values. Where soils in riparian areas are unstable, the vegetation complex is fragile, threatened and endangered plants and/or animals are affected, aquatic or recreation values are high, municipal watersheds are involved, etc., **special livestock management prescriptions** must be applied. In some cases, **excluding livestock grazing may be the most logical and responsible course of action** (at least for a time sufficient to achieve a level of recovery and stability that can support grazing in the context of the management objectives).

The conditions under which a no-grazing BMP is necessary to protect and restore water quality are well documented and include:

- degraded watersheds, streams and riparian areas, such as those with low levels of stream shade and vegetation, degraded bank stability, widened channels, elevated water temperatures, depressed pool frequency, elevated fine sediment levels, elevated turbidity, elevated biological contamination, elevated algal blooms, incised channels, degraded meadows, and/or elevated nutrient levels, (Clary and Webster, 1989; Platts et al., 1991; Beschta et al., 1991; Anderson et al., 1993; Henjum et al., 1994; Rhodes et al., 1994; Leonard et al., 1997; Spence et al., 1996; Beschta et al., 2013);
- Fragile streams and wetlands that cannot be grazed without incurring damage that

elevates water pollution (Rhodes et al., 1994; Beschta et al., 2013); such vulnerable areas include perennially-saturated riparian areas and streams with banks comprised of cohesionless soils lacking deep-rooted vegetation (Rhodes et al., 1994; USFS 2000; Beschta et al., 2013) and fens (Sikes et al., 2010);

- Recently burned landscapes (Beschta et al., 2004; Karr et al., 2004; Beschta et al., 2013);
- Areas where the condition of watersheds, riparian zones, water quality, and the effects of grazing upon them have not been adequately assessed (Henjum et al., 1994; Rhodes et al., 1994).
- Watersheds and other large areas containing a variety of ecotypes to capture the significant benefits of more resilient and healthy ecosystems in the face of climate change (Beschta et al, 2013)
- Areas where grazing extend beyond the immediate site (e.g., wetlands and riparian areas impact many wildlife species and ecosystem services with cascading implications beyond the area grazed) (Beschta et al., 2013)
- Rare ecosystem types (e.g., perched wetlands) or locations with imperiled species (e.g., aspen stands and understory plant communities, endemic species with limited range), including fish and wildlife species adversely affected by grazing and at-risk and/or listed under the ESA (Rhodes et al., 1994; Beschta et al., 2013);
- numerous representative exclosures for the purposes of monitoring recovery in the absence of grazing in comparison to conditions and trends in comparable grazed areas (Bock et al., 1993; Anderson et al., 1993; Rhodes et al., 1994; Coles-Ritchie et al., 2007; Beschta et al., 2013)

For these reasons, the environmental analyses for the proposed plan revision must include at least one alternative that requires grazing elimination in the foregoing areas. This is not only necessary to curb the extensive and significant impairment of watershed and aquatic processes and resources, but also to provide a reasonable range of alternatives. Further, such an alternative is necessary to provide a valid comparison between responsible land management and the three forests irresponsible current grazing management.

The environmental analyses for the Plan revisions must also include an alternative that prohibits late-season grazing because such grazing is incompatible with riparian protection and restoration Numerous evaluations, including those by land management agencies, of grazing impacts on riparian, watershed, and aquatic systems, have repeatedly noted that late season grazing is particularly incompatible with the protection and restoration of aquatic ecosystems. Late-season (summer and fall) grazing is damaging because cattle and their impacts tend to be particularly concentrated in riparian areas during the late summer and fall, as many assessments have noted, including those of the USFS (Platts et al., 1991), BLM (Leonard et al., 1997), and National Marine Fishery Service (Murray et al., 2004). Thus, late-season livestock grazing allowed under the 2004 SNFPA thwarts or impedes the recovery of streambanks and riparian and stream conditions amenable to fish survival (Platts et al., 1991; Kovalchik and Elmore, 1991; Elmore, 1992; Leonard et al., 1997). For similar reasons, season-long grazing is also incompatible with the recovery of riparian and stream conditions amenable to unimpaired fish survival (Platts et al., 1991; Kovalchik and Elmore, 1991; Elmore, 1992; Leonard et al., 1997). Therefore, it is clear that the S&Gs for the 2004 SNFPA related to grazing are inadequate to ensure that livestock grazing does not harm aquatic systems, fish habitats, and fish populations in an irreparable manner.

Scientific assessments of public land management have repeatedly stressed the need to properly assess the impacts of grazing on water quality *prior* to the continuation of grazing (Henjum et al., 1994; Rhodes et al., 1994). Key attributes that must be monitored in order to assess grazing effects on water quality and the effectiveness of grazing BMPs include the condition of riparian areas, stream shade, channel width and depth, bank stability, bank damage from trampling, the extent of overhanging banks, water temperature, and fine sediment levels in streams (Rhodes et al., 1994; USFS and USBLM, 1995a; b; Coles-Ritchie et al., 2007; Burton et al., 2008; Beschta et al., 2013). Adequate monitoring of grazing impacts is requisite, if management is to be credible. Therefore, at least one alternative must require annual monitoring of key attributes affected by grazing in order for grazing to occur.

Credible monitoring of grazing impacts requires the establishment of well-distributed grazing exclosures in all areas with active grazing. The establishment and monitoring of such exclosures are critical for several reasons. First, in many ecotypes, it is unlikely that there are sizable watersheds and streams that are completely unaffected by livestock grazing. Exclosures at least provide some sort of reference for comparison of the effects of grazing versus no-grazing on reach-level conditions that affect water quality, such as bank conditions, channel width, soil properties, and riparian vegetation (Bock et al., 1993; Anderson et al., 1993; Rhodes et al., 1994; Kondolf et al., 1996; Knapp and Matthews, 1996; Magilligan and McDowell, 1997; Kauffman et al., 2002; Kauffman et al., 2004; Coles-Ritchie et al., 2007).

Second, monitoring in and outside of exclosure provides means of assessing the effectiveness of grazing BMPs for reach-level conditions that affect water quality. This is a critical need, because many of the grazing BMPs are ineffective in many situations.

Third, monitoring conditions and trends in and outside of exclosures is critical to assessing if grazing complies with USFS standards and objectives related to grazing, which USFS (2011) acknowledges are part of the BMP approach for grazing. For instance, standards in PACFISH and INFISH (USFS and USBLM1995a; b), the Northwest Forest Plan (USFS et al., 1994), the forest plans for several other national forests, such as the Klamath and Mendocino National Forest, require the elimination or modification of livestock grazing that retards attainment of plan standards for water quality and aquatic systems. Assessment of compliance with these standards requires the assessment of differences in trends, with and without grazing, in conditions that affect plan standards for water quality, such as streambanks, soils, vegetation, and stream attributes. This is necessary because even when livestock grazing does not continue to worsen conditions that affect water quality, it prevents or seriously impedes the recovery of attributes that affect water quality and related standards. Data and studies have repeatedly demonstrated that in comparison to comparable riparian areas that have not been grazed for several years, areas with continued livestock grazing have wider streams, lower levels of streambank stability, lower levels of overhanging streambanks, more bare ground, more compacted soils, less wet-site vegetation, and lower levels of canopy cover from desirable, deep-rooted vegetation (Platts, 1991; Rhodes et al., 1994; Fleischner, 1994; Knapp and Matthews, 1996; Magilligan and McDowell, 1997; Kauffman et al., 2002; Kauffman et al., 2004; Coles-Ritchie et al., 2007) indicating that continued grazing prevents or retards recovery of these attributes that affect water quality and beneficial uses. Scientific assessments have repeatedly recommended establishing exclosures and monitoring conditions in and outside of them in order to assess differences in the trends between grazed and ungrazed areas (Bock et al., 1993; Anderson et al., 1993; Rhodes et al., 1994; Kauffman et al., 2002; Coles-Ritchie et al., 2007). For these reasons, the environmental analyses for the Plan revision must include an alternative that requires the establishment and monitoring of well-distributed representative exclosures in all areas with active grazing.

Importantly, if any of the alternatives in the environmental analyses rely on the "proper functioning condition" (PFC) assessment method for assessing grazed areas, the environmental analyses must make known that PFC is inadequate to assess riparian conditions and water quality impacts from grazing. There are several reasons why PFC is not adequate to credibly assess riparian conditions and water quality impacts from livestock grazing.

First, PFC lacks scientific rigor and is highly subjective, rendering it prone to error and abuse. The National Research Council (2002) noted that the PFC approach "…is qualitative, PFC is vulnerable to subjective application…" Aquatic experts from the USFS and USBLM concluded that PFC is poorly defined (Sedell et al., 1997). The PFC method involves no measurement of any stream or riparian attribute.

This assessment that PFC is qualitative is not confined to external evaluations of it. The National Riparian Service Team (NRST, 1999), which developed and provides training in PFC, states (emphasis added) that "PFC is: A *qualitative* assessment based on quantitative science." NRST (1999) also notes that "PFC is not: A replacement for quantitative inventory or monitoring protocols."

Independent evaluations (Stevens et al., 2002) of the PFC method documented several deficiencies and flaws in the method. These defects include the failure to consider and incorporate water quality and the inability of the method to provide a means to quantitatively assess trends or reliably compare conditions among locations (Stevens et al., 2002). For these combined reasons, the PFC is not at an adequate surrogate for properly assessing water quality and riparian conditions affected by grazing.

D. Alternatives to Consider in DEIS

At the very least, the Forest Service should develop an alternative to the PA that addresses the issues we have identified as necessary for wildlife conservation, for protecting riparian areas, and for addressing the impacts of grazing. Again, however, standards and guidelines for owls, fishers, woodpeckers, and the myriad other species that rely on dense, mature, conifer forest (both pre-fire and post-fire) are absolutely necessary in any Final Plan in order to ensure ecological integrity and the conditions necessary for wildlife viability.

We appreciate the opportunity to comment on the NOI and supporting package. If you have questions about these comments or would like to discuss them in more detail, please contact us. Thank you for your time, and we look forward to achieving a forest plan revision process that addresses all the necessary issues and incorporates the data and science we have presented.

Sincerely,

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