CENTER *for* BIOLOGICAL DIVERSITY

THE JOHN MUIR PROJECT
of
EARTH ISLAND INSTITUTE

19 September 2013

Dean Gould
Forest Supervisor
Sierra National Forest
1600 Tollhouse Road
Clovis, CA 93611
Sent via email: pacificsouthwest-sierra@fs.fed.us

Re: Draft Sierra Forest Assessment

Dear Mr. Gould:

The Center for Biological Diversity and the John Muir Project appreciate the opportunity to provide feedback on the draft Sierra National Forest Assessment and offer the following comments. We have also submitted comments regarding the NRVs as they relate to yellow pine and mixed-conifer forest, red fir forest, aspen, and montane chaparral, as well as comments on the draft Science Synthesis and the draft Bioregional Assessment, and we attach some of those here as well for reference.

We organize our comments as follows: Section 1 covers general issues, and Section 2 includes responses to specific statements in the Draft Assessment.

Section 1

- There should be a much more robust acknowledgement and discussion of the existing fire deficit (see, e.g. , Stephens et al 2007, Miller et al 2012, Odion and Hanson 2013), including the existing deficit of high-severity fire (see, e.g., Miller et al 2012, Hanson and Odion 2013, Odion and Hanson 2013);

- This fire deficit should be the foundation and basis for planning for more fire on the landscape of all severities; similarly, the fear of large/intense fires is unjustified in light of the fire deficit and the literature regarding historical fire severity, and therefore can not be the basis for justification of treatments. Instead, you should acknowledge that the increased use of managed wildland fire and prescribed fire, in order to begin reducing the ongoing deficit in wildland fire in general, is ecologically appropriate and beneficial for forests and wildlife. In addition:

  - Creating more fire on the landscape must include ensuring habitat for wildlife that relies on post-fire forest that has burned at moderate/high severity in forest that pre-fire was CWHR 4D or above;

  - 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). 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);

- In order to achieve more fire:

  - 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;

- In order to maintain the ecological value of fire:

  - It is essential that you address the current lack of protection for post-fire habitat, such as CWHR 4D or above that has burned at moderate/high severity. For example, the recommendations from the completed, "A Conservation Strategy for the Black-backed Woodpecker" (Bond et al. 2012), must be incorporated into the upcoming Sierra National Forest Plan revision in order to protect wildlife that relies on burned forest habitat;

  - You should change the current inadequate standard (which protects only 10% of burned forest [note that this 10% is not specific to moderate/high severity burned areas and therefore 100% of such areas can potentially be salvaged logged under current guidelines/standards]) to protect 100% of burned forest (except for hazard tree felling - i.e., human safety exemptions would be allowed). There does not exist any ecological basis for salvage logging and this is especially so in light of the deficit of such habitat on the landscape, especially the specific kind of habitat that some species rely on (e.g., post-moderate/high severity burned forest that pre-fire was CWHR 4D or above);

- Do not use a desire for old forest conditions to drive post-fire actions – post-fire areas are complex and ecologically rich themselves, and should therefore not be seen as competition for old forest conditions. They should be allowed to regenerate on their own, especially since such areas can themselves offer the types of values associated with late seral conditions (e.g., DellaSala et al. 2013; Donato et al. 2012);

- In addition to prohibiting salvage logging (except for safety reasons), you should promote 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 not appropriate to generalize and frame current forest conditions as "forests are now too dense." Density is not the problem, the lack of fire and its associated heterogeneity is the problem. Moreover, not only is density not to be considered a generic problem, it is instead important to recognize that dense forest habitat, especially dense mature forest habitat, is critical habitat for rare species (i.e, what the literature shows they preferentially select) like the California spotted owl, Pacific fisher, and black-backed woodpecker (e.g., Zielinski et al. 2006, Purcell et al. 2009, Underwood et al. 2010). Therefore, for rare species like the owl and fisher, it is critical to acknowledge the importance of dense habitat and ensure its protection.

- The available wildlife science regarding post-fire bio-diversity shows that the mixed-severity fires that are occurring, such as the McNally Fire, are critical habitat for many rare species. In regard to the McNally Fire, for example, one study (Buchalski et al. 2013) found that most phonic groups of bats showed higher activity in areas burned with moderate to high-severity (see also Malison and Baxter 2010, finding greater bat activity was observed in high-severity burned riparian habitat within mixed-conifer forest than at unburned areas of similar habitat in central Idaho). Similarly, in the McNally area, California spotted owls were found to be preferentially selecting high-severity fire areas for foraging (Bond et al. 2009). And recent research indicates that Pacific fishers may benefit from mixed-severity fire (e.g., Hanson, C.T. (in press 2013—this is the only study to date that examines fisher response to an actual wildfire event).

    - In regard to Bond et al. 2009, the Forest Service has recently stated (in the draft Sequoia Forest Assessment) the following: "One study in a single high severity burned patch of the McNally fire (2002) showed that California spotted owls foraged at higher frequency in high severity burned areas. However, results of this study were limited (four territories) in a single high severity burned patch (Bond et al. 2009). Nesting habitat was not evaluated and may be more limiting for the 34 California spotted owl in the Sierra (Verner 1999, Keane 2013)."

        - These statements, written in an attempt to minimize the importance of the Bond study, are highly misleading and mischaracterize the existing science on California spotted owls and fire, and therefore must be corrected. First, the sampling unit of a foraging resource selection study is the individual owl, not the territory, because male and females in a pair forage independently and represent a unique dataset of foraging habitat selection. Thus, the true sample size is 7 owls, not 4 territories. Second, according to the Forest Service's own survey data from local biologists, there were 9 spotted owl territories within and adjacent to the McNally Fire. Four of the 9 territories did not have a sufficient road network for effective radio-telemetry and Bond et al. were unable to detect owls at another territory. Thus, the 4 territories where Bond et al. (2009) collected data represented all the available territories where radio-telemetry was feasible to track owls with the high degree of precision and efficient accumulation of a large data set on foraging locations that is required for a foraging resource selection study (30 – 50 foraging locations per owl). The study included 44% of all the known spotted owl territories affected by the McNally Fire and this sample included widely dispersed locations in both the Greenhorn Mountains and the Kern Plateau (a distance of ~ 13 km). The Bond et al. (2009) study included 7 independently foraging owls in 4 territories that encompassed a mosaic of hundreds of patches consisting of unburned, low-, moderate-, and high-severity burned stands over more than 1,000 hectares of forest land. Bond et al. (2009) represents the best available science on resource selection of foraging and roosting California spotted owls in burned landscapes of the Sierra Nevada. The results show that radio-marked owls foraged in many stands burned by high-severity fire over the course of the breeding season, not in "a single high severity burned patch" as the Forest Service has claimed. The results clearly indicate that California spotted owls exhibited a strong preference for foraging in high-severity burned forest patches. Furthermore, the Forest Service claims that "nesting habitat was not evaluated," when in fact, Bond et al (2009) did quantify the characteristics of the nest tree and the burn severity of the nest stand as well as of dozens of roosting locations. Additionally, a comprehensive analysis of nesting habitat and fire was done in Lee et al. (2012). That study used 11 years of nesting-site survey data from 41 California Spotted Owl territories burned in six forest fires (including the McNally fire) and 145 territories in unburned areas from throughout the Sierra Nevada, California, to compare probabilities of occupancy between burned and unburned nesting sites. Lee et al. (2012) found no significant effects of fire, suggesting that even fire that burns on average 32% of suitable forested habitat at high severity within a California Spotted Owl nest site, does not threaten the persistence of the subspecies on the landscape. Finally, Verner (1999) is not an appropriate citation. Verner (1999) is not a published study, and is a 14-year old response in a status report that was found online, and has no bearing on the statement that "nesting habitat may be more limiting for the 34 California spotted owl [sic] in the Sierra." If the Forest Service intended to cite Verner (1992), this is a general account of spotted owl biology from 20 years ago that makes a single statement that is unsupported by data or citation: "Sometimes adult birds are displaced from established territories by loss of habitat through fire, logging, or other major disturbances." Keane (2013) refers to the document "California Spotted Owl: Scientific

Considerations for Forest Planning." This citation provides a summary of the current literature regarding fire and spotted owls and concludes that owls can persist in areas affected by mixed-severity fire at least within a decade or so after fire. However, similar to Verner (1999), this document does not evaluate nesting habitat for 34 California spotted owls in the Sierra Nevada.

- Regarding fire size and fire intensity trends in the Sierras, Hanson and Odion (2013) 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).

- It is not appropriate or scientifically accurate to rely on time since fire to gauge likelihood of high-severity fire:
    - Six empirical studies have been conducted in California's forests to assess the longstanding forest management assumption that the most fire-suppressed forests (i.e., the forests that have missed the largest number of fire return intervals) burn "almost exclusively high-severity", as the 2004 Sierra Nevada Forest Plan Amendment Final EIS (Vol. 1, p. 124) presumed. These studies found that the most long-unburned (most fire-suppressed) forests burned mostly at low/moderate-severity, and did not have higher proportions of high-severity fire than less fire-suppressed forests. Forests that were not fire suppressed (those that had not missed fire cycles, i.e., Condition Class 1, or "Fire Return Interval Departure" class 1) had levels of high-severity fire similar to, sometimes lower than, and sometimes higher than, those in the most fire-suppressed forests. The findings of these six studies are detailed below:

1)

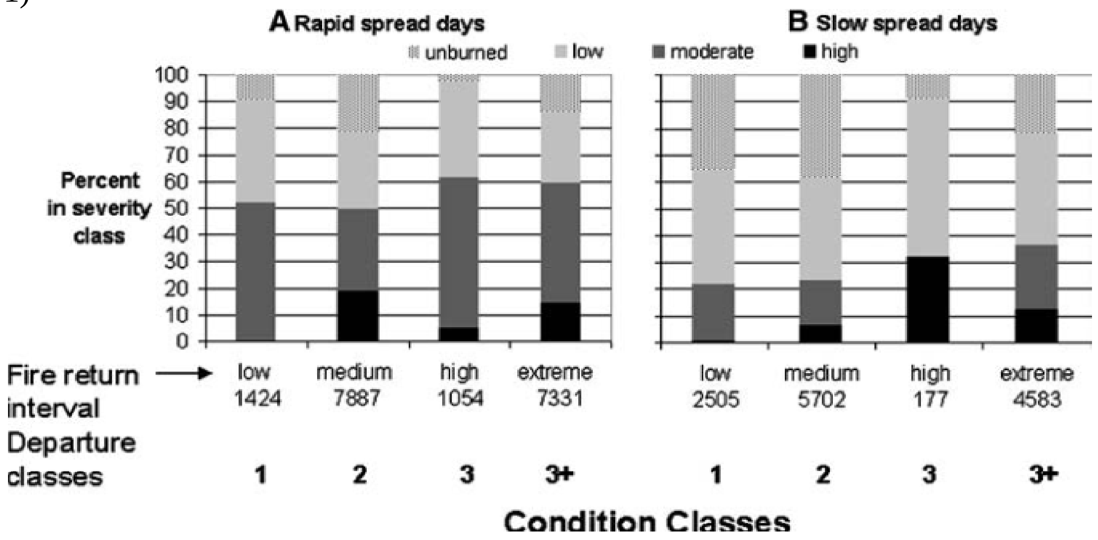

Figure 5 from Odion and Hanson (2006) (*Ecosystems*), based upon the three largest fires 1999-2005, which comprised most of the total acres of wildland fire in the Sierra Nevada during that time period (using fire severity data from Burned Area Emergency Rehabilitation (BAER) aerial overflight mapping), showing that the most long-unburned, fire-suppressed forests (Condition "Class 3+", corresponding to areas that had missed more than 5 fire return intervals, and generally had not previously burned for about a century or more) experienced predominantly low/moderate-severity fire.

2)

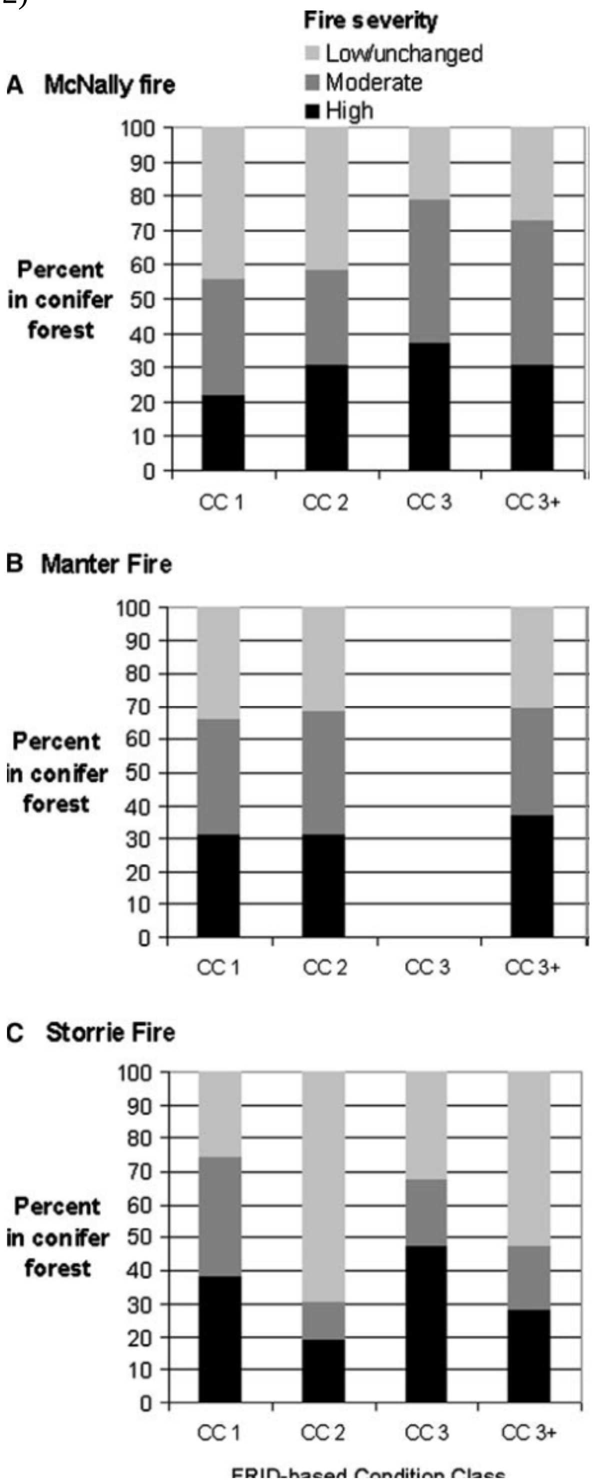

Figure 1 from Odion and Hanson (2008) (*Ecosystems*) (using fire severity data from satellite imagery for the same three fires analyzed in Odion and Hanson 2006), showing that the most long-unburned, fire-suppressed forests (no fire for a century or more) burned mostly at low/moderate-severity, and had levels of high-severity fire similar to less fire-suppressed forests (in one case, even less than Condition Class 1).

3) van Wagtendonk et al. (2012) (*Fire Ecology*), analyzing 28 fires from 1973-2011 in Yosemite National Park, found the following:

> "The proportion burned in each fire severity class was not significantly associated with fire return interval departure class…[L]ow severity made up the greatest proportion within all three departure classes, while high severity was the least in each departure class (Figure 4)."

> The most long-unburned, fire-suppressed forests—those that had missed 4 or more fire return intervals (in most cases, areas that had not burned since at least 1930)—had only about 10% high-severity fire (Fig. 4 of van Wagtendonk e al. 2012).

4) Odion et al. (2004) (*Conservation Biology*), addressing numerous wildland fires covering a 98,814-hectare area in 1987 in the California Klamath region, found that the most fire-suppressed forests in this area (areas that had not burned since at least 1920) burned at significantly *lower* severity levels, likely due to a reduction in combustible native shrubs as forests mature and canopy cover increases:

> "The hypothesis that fire severity is greater where previous fire has been long absent was refuted by our study…The amount of high-severity fire in long-unburned closed forests was the lowest of any proportion of the landscape and differed from that in the landscape as a whole (Z = -2.62, n = 66, p = 0.004)."

5) Odion et al. (2010) (*Journal of Ecology*), empirically tested the hypothesis articulated in Odion et al. (2004)—i.e., that the *reduction* in fire severity with increasing time-since-fire was due to a reduction in combustible native shrubs as forests mature and canopy cover increases—and found the data to be consistent with this hypothesis.

6) Miller et al. (2012a) (*Ecological Applications*), analyzing all fires over 400 hectares 1987-2008 in the California Klamath region, found low proportions of high-severity fire (generally 5-13%) in long-unburned forests, and the proportion of high-severity fire effects in long-unburned forests was either the same as, or *lower than*, the high-severity fire proportion in more recently burned forests (see Table 3 of Miller et al. 2012a).

- It is necessary to incorporate the following scientific information into the discussion of fire in ponderosa-pine/Jeffrey-pine and mixed-conifer forest:

    - Contrary to assumptions (e.g., the 2004 Sierra Nevada Framework), considerable data and research exists that indicates that mixed-severity fire: a) is not limited to true fir and lodgepole pine and is instead also a natural condition in ponderosa-pine/Jeffrey-pine and mixed-conifer forest; b) generally dominated pre-fire suppression fire regimes in these forest types; and c) can include a significant proportion of high-severity fire including occasional large high-severity fire patches hundreds or thousands of acres in size (Baker 2006, Baker 2012, Baker et al. 2007, Beaty and Taylor 2001, Bekker and Taylor 2001, Bekker and Taylor 2010, Brown et al. 1999, Collins and Stephens 2010, Colombaroli and Gavin 2010, Hessburg et al. 2007, Iniguez et al. 2009, Klenner et al. 2008, Leiberg 1897, 1899a, 1899b, 1899c, 1900a, 1900b, 1900c, 1902, 1903, 1904a, 1904b, Nagel and

Taylor 2005, Sherriff and Veblen 2007, Shinneman and Baker 1997, Show and Kotok, 1924, 1925, Stephenson et al. 1991, Taylor 2002, USFS 1910-1912, Whitlock et al. 2008, 2010, Williams and Baker 2010, 2011, 2012a, 2012b, Wills and Stuart 1994).

- Beaty and Taylor (2001), in the western slope of the southern Cascades in California, found that historic fire severity in mixed-conifer forests was predominantly moderate- and high-severity, except in mesic canyon bottoms, where moderate- and high-severity fire comprised 40.4% of fire effects [Table 7].

- Bekker and Taylor (2001), another study in the western slope of the southern Cascades in California, found historic fire severity to be predominantly high-severity in their study area [Fig. 2F].

- Bekker and Taylor (2010), in mixed-conifer forests of the southern Cascades, found reconstructed fire severity to be dominated by high-severity fire effects, including high-severity fire patches over 2,000 acres in size [Tables I and II].

- Outside of the Cascades, Show and Kotok (1924), in ponderosa pine and mixed-conifer/pine forests of the Sierra Nevada, found that high-severity crown fires, though infrequent on any particular area, “may extend over a few hundred acres” in patches [p. 31; see also Plate V, Fig. 2, Plate VII, Fig. 2, Plate VIII, Plate IX, Figs. 1 and 2, and Plate X, Fig. 1], with some early-successional areas resulting from high-severity fire patches covering 5,000 acres in size or more [pp. 42-43]. Within unlogged areas, the authors noted many large early-successional habitat patches, dominated by montane chaparral and young, regenerating conifer forest, and explained that such areas were the result of past severe fire because: a) patches of mature/old forest and individual surviving trees were found interspersed within these areas, and were found adjacent to these areas, indicating past forest; b) snags and stumps of fallen snags, as well as downed logs from fallen snags, were abundant in these areas; c) the species of chaparral found growing in these areas are known to sprout abundantly following severe fire; and d) natural conifer regeneration was found on most of the area [p. 42], often growing through complete chaparral cover [p. 43].

- Similarly, Show and Kotok (1925) found that within the ponderosa pine and mixed-conifer/pine belt of the Sierra Nevada, 1 acre out of every 7 on average was dominated by montane chaparral and young regenerating conifer forest following high-severity fire [Footnote 2, and Figs. 4 and 5]; and on one national forest 215,000 acres out of 660,000 was early-successional habitat from severe fire [p. 17].

- Forest Service Timber Survey Field Notes from 1910-1912 show that surveys were conducted within primary forest to evaluate timber production potential in 16.2-ha (40-acre) plots within each 259.1-ha (640-acre) section in ponderosa pine and mixed-conifer forest on the westside of the Stanislaus National Forest, using one or more 1.62-ha transect per plot. The surveyors noted that surveys for individual tree size, density and species were not conducted in areas that had experienced high-severity fire sufficiently recently such that the regenerating areas did not yet contain significant merchantable sawtimber. Surveyors also noted that the dominant vegetation cover across the majority of many 259.1-ha sections was montane chaparral and young conifer regeneration following high-severity fire. For example (from a typical township in the data set): a) T1S, R18E, Section 9 ("Severe fire went through [this section] years ago and killed most of the trees and land was reverted to brush", noting "several large dense sapling stands" and noting that merchantable timber existed on only four of sixteen 16.2-ha plots in the section); b) T1S, R18E, Section 14 ("Fires have killed most of timber and most of section has reverted to brush"); c) T1S, R18E, Section 15 (same); d) T1S, R18E, Section 23 ("Most of timber on section has been killed by fires which occurred many years ago"); T1S, R18E, Section 21 ("Old fires killed most of timber on this section and most of area is now brushland".)

- Leiberg (1902) found that, in mixed-conifer forests in the central and northern Sierra Nevada, while some of the areas were open and parklike stands dominated by ponderosa pine, Jeffrey pine, and sugar pine, the majority were dominated by white fir, incense-cedar, and Douglas-fir, especially on north-facing slopes and on lower slopes of subwatersheds; such areas were predominantly described as dense, often with "heavy underbrush" from past mixed-severity fire. Natural heterogeneity, resulting from fire, often involved dense stands of old forest adjacent to snag forest patches of standing fire-killed trees and montane chaparral with regenerating young conifers: "All the slopes of Duncan Canyon from its head down show the same marks of fire—dead timber, dense undergrowth, stretches of chaparral, thin lines of trees or small groups rising out of the brush, and heavy blocks of forest surrounded by chaparral." [p. 171] Similarly, the USDA 1910-1912 Timber Survey Field Notes found that historic ponderosa pine and mixed-conifer forests of the central/southern Sierra Nevada [western slope] varied widely in stand density and composition; open and park-like pine-dominated stands comprised a significant portion of the lower montane and foothill zones, but dense stands dominated by fir and cedar, and by small/medium-sized trees, dominated much of the middle montane zone (It should be noted that the old-growth forests chosen for study by Scholl and Taylor 2010 and Collins et al. 2011 comprised only a very small portion of the 1910-1912 Stanislaus data set).

- Nagel and Taylor (2005) noted that "[c]haparral has been replaced by forest and this vegetation change has reduced the heterogeneity of the mixed conifer forest landscapes in the Sierra Nevada. . . Our study suggests that maintenance of chaparral should be an integral part of ecosystem restoration plans for mixed conifer forest landscapes in the Lake Tahoe basin and northern Sierra Nevada."

- Black-backed Woodpeckers should be designated as a Species of Conservation Concern (SCC):

    - Black-backed woodpeckers are an at-risk species and were recently determined by the USFWS to potentially merit listing under the federal ESA (i.e., USFWS 2013 positive 90-day finding on petition to list the population in OR/CA (as well as the Black Hills of South Dakota));

    - Black-backed woodpeckers are indicators for an entire forest ecosystem – complex early seral forest – and protecting them will help ensure protection for the many other species that rely on undisturbed, post-fire habitat;

    - In the fall of 2012, the Forest Service determined that there is significant concern about the conservation of Black-backed Woodpecker populations, in light of new scientific information indicating that current populations may be dangerously low and that populations are at risk from continued habitat loss due to fire suppression, post-fire logging, and mechanical thinning. The Conservation Strategy that was issued provides for key conservation measures to mitigate impacts to the population (Bond et al. 2012). The Conservation Strategy, and its measures, should be incorporated into the National Forest Plan as bare minimum standards for protecting this at-risk species. See Bond, M.L., R.B. Siegel, and D.L. Craig. 2012. A Conservation Strategy for the Black-backed Woodpecker *(Picoides arcticus*) in California—Version 1.0. The Institute for Bird Populations, Point Reyes Station, California, For: U.S. Forest Service, Pacific Southwest Region, Vallejo, CA (Conservation recommendations include: a) identify the areas of the highest densities of larger snags after fire, and do not salvage log such areas (Recommendation 1.1); b) in areas where post-fire salvage logging does occur, do not create salvage logging patches larger than 2.5 hectares in order to maintain some habitat connectivity and reduce adverse impacts on occupancy (Recommendation 1.3); c) maintain dense, mature forest conditions in unburned forests adjacent to recent fire areas in order to facilitate additional snag recruitment (from beetles radiating outward from the fire) several years post-fire, which can increase the longevity of Black-backed Woodpecker occupancy in fire areas (Recommendation 1.4); d) do not conduct post-fire salvage logging during nesting season, May 1 through July 31 (Recommendation 1.5)); and e) maintain dense, mature/old unburned forests in order to facilitate high quality Black-backed Woodpecker habitat when such areas experience wildland fire (Recommendation 3.1)); see also: a) Hanson and North (2008) (Black-backed Woodpeckers selected dense, old forests that experienced high-severity fire, and avoided salvage logged areas [see Tables 1 and 2]); b) Hutto (2008) (Figure 4a, showing about 50% loss of Black-backed Woodpecker post-fire occupancy due to moderate <u>pre</u>-fire logging [consistent with mechanical thinning] in areas that later experienced wildland fire); c) Odion and Hanson (2013) (High-severity fire, which creates primary habitat for Black-backed Woodpeckers, has declined >fivefold since the early 20th century in the Sierra Nevada and eastern Oregon Cascades due to fire suppression. Further, the current rate of high-severity fire in mature/old forest (which creates primary, or high suitability, habitat for this species) in the Sierra Nevada and eastern Oregon Cascades is so low, and recent high-severity fire in mature/old forest comprises such a tiny percentage of the overall forested landscape currently (0.66%, or about 1/150th of the landscape), that even if high-severity fire in mature/old forest was increased by several times, it would only amount to a very small proportional reduction in mature/old forest, while getting Black- backed Woodpecker habitat closer to its historical, natural levels. Conversely, the combined effect of a moderate version of current forest management—prefire thinning of 20% of the mature/old forest (in order to enhance fire suppression) over the next 27 years, combined with post-fire logging of one-third of the primary Black-backed Woodpecker habitat – would reduce primary Black-backed Woodpecker habitat to an alarmingly low 0.20% (1/500th) of the forested landscape, seriously threatening the viability of Black-backed Woodpecker populations); d) Rota (2013) (finding that Black-backed Woodpeckers in the Black Hills of South Dakota only maintain stable or increasing populations (i.e., viable populations) in recent wildland fire areas occurring within dense mature/older forest (which have very high densities of large wood-boring beetle larvae due to the very high densities of medium/large fire-killed trees). And, while Black-backeds are occasionally found in unburned forest or prescribed burn areas, unburned 'beetle-kill' forests (unburned forest areas with high levels of tree mortality from small pine beetles) and lower-intensity prescribed burns have declining populations of Black-backed Woodpeckers (with the exception of a tiny percentage of beetle-kill areas). The study shows that unburned beetle-kill forests do not support viable populations, but very high snag-density beetle-kill areas tend to slow the population decline of Black-backed Woodpeckers in between occurrences of wildland fire. Population decline rates are alarmingly fast in low-intensity prescribed burn areas, indicating that such areas do not provide suitable habitat. Black-backed Woodpeckers are highly specialized and adapted to prey upon wood-boring beetle larvae found predominantly in recent higher-severity wildland fire areas. Moreover, while Black-backed Woodpeckers are naturally camouflaged against the charred bark of fire-killed trees, they are more conspicuous in unburned forests, or low-severity burned forests, and are much more vulnerable to predation by raptors in such areas. For this reason, even when a Black-backed Woodpecker pair does successfully reproduce in unburned forest or low-severity fire areas, both juveniles and adults have much lower survival rates than in higher-severity wildland fire areas.); e) Seavy et al (2012) (Black-backed Woodpeckers selected sites with an average of 13.3 snags per 11.3-meter radius plot [i.e., 0.1-acre plot], or about 133 snags per acre.); f) Siegel et al (2013) (Black-backed woodpeckers strongly select large patches of higher-severity fire with high densities of medium and large snags, generally at least 100 to 200 hectares (roughly 250 to 500 acres) per pair, and post-fire salvage logging eliminates Black-backed woodpecker foraging habitat [see Fig. 13, showing almost complete avoidance of salvage logged areas]. Suitable foraging habitat was found to have more than 17-20 square meters per hectare of recent snag basal area [pp. 45, 68-70], and suitable nesting habitat was found to average 43 square meters per hectare of recent snag basal area and range from 18 to 85 square meters to hectare [p. 59, Table 13]. Moreover, Appendix 2, Fig. 2 indicates that the Sierra Nevada population of Black-backed Woodpeckers is genetically distinct from the Oregon Cascades population, though additional work needs to be conducted to determine just how distinct the two populations are. Siegel et al. 2013 also found that the small number of Black-backed Woodpeckers with mostly unburned forest home ranges had home ranges far larger than those in burned forest, and that the birds in unburned forest were traveling more than twice as far as those in burned forest in order to obtain lesser food than those in burned forests, indicating that such areas do not represent suitable, viable habitat for this species.)

  - It is important to keep in mind also that black-backed woodpeckers rely upon large patches (generally at least 200 acres per pair) of recently killed trees (typically less than 8 years post-mortality) with very high densities of medium and large snags (usually at least 80-100 per acre), and any significant level of post-fire salvage logging largely eliminates nesting and foraging potential;

- It is necessary to incorporate into planning the impacts of pesticides and rodenticides. For example, Thompson et al. (2013) recently found that in regard to fishers, likelihood of exposure to rodenticides was related to the presence of marijuana cultivation sites, and female fisher survival was influenced by the number of cultivation sites within its home range. Moreover, pesticides have been found to be prevalent in Sierra frogs even though they are many miles from where the pesticides are used for agriculture (Smalling et al. 2013).

Section 2

Best Available Science

The Assessment states the following regarding its approach to "best available science":

> The Forest Service focused on the references to the Sierra chapter papers, the Science Synthesis, the Bio-Regional Assessment, and other information sources to identify information to be included in this assessment.
>
> The information from these sources was evaluated to determine if it was relevant to the scope and scale of the question at hand, if it was accurate, and if it was reliable. High quality and valid scientific information was considered particularly valuable. This type of information is characterized by clearly-defined and well-developed methodology, logical conclusions, reasonable inferences, adequate peer-review, suitable quantitative methodology, proper spatial and temporal context, and the use of relevant and credible citations.
>
> Accuracy and reliability of relevant information was determined by comparing the scientific certainty and quality of the information, and using the most scientifically certain information available. Information from the chapter papers

> without appropriate supporting citations or references was considered to be less certain under the draft directives.
>
> If the information appeared to be of comparable scientific certainty, then both points of view were carried forward and a data gap was identified as to the final conclusions. In this way conflicting information will be made available during public feedback opportunities, collaboration and the internal review process to verify and validate the information meets the criteria to be considered BASI. An assumption of the planning process is that public feedback will help ensure that relevant, accurate, and reliable information is considered.

During the Science Synthesis comment period, the draft Bio-regional Assessment comment period, the NRV comment period, as well as during the WIKI comment periods, we submitted "[h]igh quality and valid scientific information." Yet, thus far, the vast majority of it has been ignored. We therefore submit it again below, and note that there is no basis at all for Forest Service scientists to act as gatekeepers for which science to include. The information we submitted is certainly at least "of comparable scientific certainty" as compared to the science the Forest Service presented. It therefore should have been "carried forward". The Forest Service's approach deprives the agency itself, and more importantly, the public, of the ability to see and understand the breadth of the literature, and results in the censorship of science that contradicts the agency's management approach/assumptions. We therefore again request that the current approach to scientific literature end, and that the breadth of the literature be both acknowledged and incorporated.

We turn now to specific statements by providing quotes from the draft Assessment and then addressing them:

- "terrestrial ecosystems are experiencing increasing tree densities and canopy cover, especially shade-tolerant species at low to mid elevations. This pattern of increasing tree density and cover in mixed conifer and yellow pine forests are supported by extensive stand reconstruction studies at the Teakettle Experimental Forest (e.g., North et al. 2007, 2009) and neighboring Yosemite National Park (Scholl and Taylor 2010), and comparisons of early 20th century versus current stand inventory data (Meyer et al. 2013) on the Sierra NF."

  "The pair of photos below shows a comparison of historic (1929) and current (2013) stand conditions in a mixed conifer stand of the Sierra NF. This is taken from the original Dunning "Methods of Cutting" plot, used to illustrate forestry practices in the late 1920s. The photos were taken at an identical location and direction. In the top black and white picture taken in 1929, the forest is composed of a mixture of stand conditions (heterogeneity), including an open gap (foreground), dense clumps (background right), and moderately dense large trees (middle of photo). These include pine and fir trees. In front of the trees, the ground is open. Below the trees there are several large logs. In the background, a large snag is visible along with a variety of size from pole to overstory trees. In contrast, in the bottom color photo, taken in 2013, the forest is more uniformly dense and dominated by mid- and small-sized trees. The forest floor has a continuous litter layer covering it. Large logs are absent."

  "Tree densities are also increasing in high elevation subalpine forests, based on information from immediately north of the Sierra NF (Dolanc et al. 2012). Species composition is shifting toward

> shade-tolerant species in low to mid-elevation forests and woodlands, favoring species such as white fir and incense cedar at the expense of shade-intolerant species such as ponderosa pine, yellow pine, and giant sequoia. Subalpine forests are within NRV with respect to species composition (Dolanc et al. 2012)."

These assertions are misleading and incomplete. For example, North et al. (2007) was simply a modeling study that attempted to guess what historical tree density would have been in one small area (but, in particular, density of understory and lower-canopy trees in the 1860s could not be reliably determined because many of these trees have since died due to competition or fire, and have long since decayed into soil). Scholl and Taylor (2010) was from a small subset of a 1910-1912 Forest Service data set on the Stanislaus National Forest (Scholl and Taylor 2010). As noted above, this area experienced substantial mixed- and high-severity fire in the years and decades prior to the 1911 surveys. Moreover, there were two other study areas in this survey, and both had far higher forest density levels, in terms of recorded board feet per acre (often 3-10 times higher), than the study sites chosen in Scholl and Taylor (2010) and Collins et al. (2011). Further, Lyderson et al. (2013 [Table 1]) found that the historical forests contained numerous non-forested inclusions, representing early-successional habitat after natural disturbance, and that the forested areas ("clumps") had 1,001 to 1,172 trees/hectare >10 cm dbh, which is not significantly different from current densities in the forested areas. What has changed is that, due to fire suppression, there are now fewer early-successional "gaps" in that particular study area, making the overall stand-scale tree density higher. By neglecting to report that, when comparing historical forested areas to current forested areas, the tree density was very high in both time periods, and was not significantly different, and by also neglecting to adequately disclose that 53% of the trees over 10 cm dbh in the historic forests were between 10 and 25 cm dbh (Lydersen et al. 2013 [Table 1]), the draft Assessment misrepresents the data by inaccurately implying that historical stands were open and parklike, with relatively few smaller trees.

Moreover, with regard to understory density, the USFS 1911 Stanislaus data set (USFS 1910-1912) recorded average sapling density on 72 ponderosa pine forest sections (and some mixed-conifer) (each section one square mile in size), with an average density of 102 saplings per acre (252 per hectare) in sections noted as having no previous logging. This is not consistent with the assumption of very low densities of saplings historically. Moreover, the 1911 Stanislaus data set also recorded percent shrub cover on 57 sections (each one square mile) in ponderosa pine forests (and some mixed-conifer), with an average of 28% shrub cover in unlogged sections within forested areas with merchantable timber. In a total of 35 sections, surveyors recorded the proportion of the one-square-mile section comprised by montane chaparral areas (which often included natural conifer regeneration in the seedling, sapling, and/or pole-sized successional stage) with no merchantable timber. These montane chaparral areas represented 12,200 acres out of a total of 22,400 acres, or about 54%. As discussed above, in many of these montane chaparral areas, the visible signs of past high-severity fire were still evident, and surveyors specifically recorded large high-severity fire patches.

- "Terrestrial ecosystems of the Sierra NF are expected to experience dramatic changes in climate in the coming decades (Meyer and Safford 2013, Safford et al. 2012). Consequently, the future range of variation in climate exposure for these ecosystems will almost certainly exceed the NRV. Schwartz et al. (2013) evaluated future climate exposure to vegetation using downscaled climate projections for the southern Sierra Nevada, including the Sierra and Sequoia National

> Forests. Their results indicate a high proportion of all terrestrial ecosystems will be moderately, highly, or extremely vulnerable to future climate by the end of the century."

It is not clear what the Forest Service means here with regard to the assertion that conditions "will almost certainly exceed the NRV". To the extent that this is a reference to fire intensity, as we point out above and below, there is no current trend of increasing fire severity (Hanson and Odion 2013), and precipitation is increasing consistently in the Sierra Nevada (North 2012, GTR 237).

- "Early seral vegetation includes areas where the vegetation is relatively young. In forests, this often means that instead of trees, sites are dominated by shrubs, herbs and grasses. Complex early seral forests are created by disturbances and contain residual legacies from previous older forests, such as large snags and logs. Although information pertaining to the proportion of early seral forest is lacking for the Sierra NF, these habitats may be less abundant compared to pre-European settlement conditions due to fire suppression and past forestry practices. Lack of these forests is a reflection of the decrease in forest heterogeneity described above. Large snags, large live trees and shrubs are the most common nesting habitat used by birds in the bio-region. A comprehensive map of complex early seral forests is not available. There is no comprehensive vegetation map that includes large snags and logs."

This is not strictly true. The Forest Service keeps annual maps of high-severity fire areas, and also retains an annually updated database of logging activities (the FACTS database); thus, the information already exists to determine where high-severity fire areas, within conifer forest, exist and have not been salvage logged.

- "While lightening caused fires are part of the natural ecosystem, suppression of them has led to conditions that can result in large areas of high severity effects that may be detrimental to old forest species such as the fisher or California spotted owl. There is some uncertainty about the effects of fire severity on these species (Keane 2013 and Zielinski 2013). Modeling has suggested that large, high severity fires can have significant, negative impacts on fisher habitat quality and population size (Scheller et al. 2011, Thomson et al. 2011). But there have been no studies of actual fishers in burned landscapes in the Sierra. In addition, California spotted owls may occupy burned forest landscapes for breeding but primarily following low to moderate severity fires (Roberts et al. 2011)."

This is inaccurate. First, as discussed in detail above, increased time since fire does not lead to increased fire severity. Second, Hanson (2013) directly studied fisher use of post-fire habitat, and found substantial fisher use of this habitat in large, intense fire areas (e.g., McNally fire), as discussed in detail above. Third, Bond et al. (2009) found that spotted owls preferentially select high-severity fire areas for foraging, and Lee et al. (2012) found that mixed-severity fire (dominated by moderate/high-severity fire) does not reduce spotted owl occupancy—and, in fact, occupancy was slightly higher in burned areas than in unburned forest, unless burned areas were salvage logged.

- "Recurrent fire has shaped ecosystems of the Sierra Nevada (Skinner and Chang 1996). Many of the plants have fire adapted or enhanced traits, such as sprouting, thick bark, fire-stimulated flowering, or seed release or germination (Chang 1996, van Wagtendonk and Fites-Kaufman 2006). Many of these have been reduced in density or health. A notable example is black oak. It sprouts following fire and seedlings are resistant to low intensity fire. Currently, there are concerns about negative impacts of dense conifer cover around them, reducing their vigor, extent, and reproduction (USFS 2001). They readily form cavities and can be important for many species. Highly variable fires maintained patchy or "heterogeneous" vegetation structure and composition (North et al. 2009). This patchiness, along with enhanced plant growth from sprouting or fire-induced nutrient flushes, is thought to have provided diverse and productive habitat for many different plant and animal species. Animals currently associated with high density canopy, such as fisher or California spotted owl, may have previously been associated with more diverse vegetation that supported more prey (small mammals and birds) as well as cover. With fire suppression, this diversity has decreased. It is unknown how species would change with increased vegetation diversity (Keane 2013, Zielinski 2013). Further, one of the most important ecological effects of fire is to keep dead and alive vegetation, or fuels, variable and at lower levels. This means that when fires do burn, even under more severe weather conditions, they would burn less intensely and with more patchiness. This is not the case for much of the Sierra NF landscape at this time, which has experienced decades of fire exclusion."

Again, the scientific data consistently find that the most fire-suppressed forests are not burning more severely, as discussed in detail above. Nor is it accurate that fire keeps vegetation levels low—in fact, high-severity fire areas support high levels of biomass and carbon storage (Powers et al. 2013), and mixed-severity fire areas are highly complex (Swanson et al. 2011, Donato et al. 2012).

- "Overall, continuous vegetation cover is present but within-patch diversity is greatly reduced from estimated historic conditions. This is largely due to fire suppression and past forest management, which has also resulted in high forest and vegetation densities, and very high surface fuel loads. These conditions, in combination with current and future warming and drying climate trends, is leading to high vulnerability to uncharacteristically, large, uniformly high intensity fires. This could result in fragmentation of old forest habitat currently used by species of concern including the California spotted owl, fisher, and marten. It will have unknown effects on the extent and quality of early seral vegetation."

Once again, the assumption of increased fire severity due to increased fuel accumulation with greater time since fire is not accurate, as discussed in detail above.

- "Prior to European settlement, fire was widespread throughout the Sierra NF and bio-region (van Wagtendonk and Fites-Kaufman 2006). Frequency, spatial pattern, and severity varied by ecosystem. The variation by ecosystem and the ecological role of fire was described in Chapter 1 of this assessment. There have been two primary changes to fire patterns in the past 50 years. First, the overall frequency of fire across the landscape is greatly diminished from historic patterns. Second, the extent of high severity fires has increased beyond what is desirable by most."

This last sentence in the above is highly misleading, and vague. Substantial proportions of high-severity fire are ecologically natural, and desirable, and there is a deficit of it on the landscape.

Historic high-severity fire in yellow-pine/mixed-conifer (YPMC) forests of the eastern Cascades represented 37% of fire effects (Hessburg et al. 2007), and another study found that historic dry YPMC forests in the eastern Oregon Cascades (abutting the northern boundary of the Sierra Nevada management region) had an average high-severity fire proportion of about 20% (Baker 2012 [Table 5]). Beaty and Taylor (2001) found approximately 38% high-severity fire in historic mixed-conifer forests of the western slope of the southern Cascades in the Sierra Nevada management region. In addition, Bekker and Taylor (2001) and Bekker and Taylor (2010) found that 50-60% of fire effects were high-severity in unlogged pre-suppression mixed-conifer forests.

Show and Kotok (1925) state that, out of 12,000,000 acres of California YPMC forest, 2,000,000 acres, or about 17%, was in an early-successional stage of montane chaparral due to high-severity fire—and that does not even include the areas that had high-severity fire but still retained some dominant, surviving trees.

Leiberg (1902) specifically mapped high-severity fire patches over 80 acres in size in unlogged forests, prior to fire suppression, where he defined this category as 75-100% timber volume mortality (this would equate to even higher levels of basal area mortality). In these unlogged forests, within mixed-conifer forest, the 75-100% timber volume mortality represented about 20% of fire effects—and that does not include the patches under 80 acres (Hanson 2007).

Bekker and Taylor (2010) documented a 1,684-hectare mixed-conifer forest area that burned mainly at high-severity in 1889 in a remote, unmanaged area. Leiberg (1902 [see map following page 18]) mapped numerous large high-severity fire patches—many exceeding 5,000 hectares—in unlogged YPMC areas prior to fire suppression (see also Hanson 2007, Figure 3.1). Show and Kotok (1924) documented numerous large high-severity fire patches in YPMC, finding that, historically, within ponderosa pine and mixed-conifer/pine forests of the Sierra Nevada, high-severity crown fires, though infrequent on any particular area, “may extend over a few hundred acres” in patches [p. 31; see also Plate V, Fig. 2, Plate VII, Fig. 2, Plate VIII, Plate IX, Figs. 1 and 2, and Plate X, Fig. 1], with some early-successional areas, resulting from high-severity fire patches, covering 5,000 acres (over 2,000 hectares) in size or more [pp. 42-43]. The authors distinguished high-severity fire patches of this size from more “extensive” patches occurring in the northern Rocky Mountains [p. 31], where high-severity fire patches occasionally reach tens of thousands, or hundreds of thousands, of acres in size, and noted that patches of such enormous size were “almost” unknown in Sierra Nevada ponderosa pine and mixed-conifer forests. Within unlogged areas, the authors noted many large early-successional habitat patches, dominated by montane chaparral and young, regenerating conifer forest, and explained that such areas were the result of past severe fire because: a) patches of mature/old forest and individual surviving trees were found interspersed within these areas, and were found adjacent to these areas, indicating past forest; b) snags and stumps of fallen snags, as well as downed logs from fallen snags, were abundant in these areas; c) the species of chaparral found growing in these areas are known to sprout abundantly following severe fire; and d) natural conifer regeneration was found on most of the area [p. 42], often growing through complete chaparral cover [p. 43].

Similarly, surveys conducted in unlogged forests prior to effective fire suppression (USFS 1910-1912) documented common occurrence of large high-severity fire patches in YPMC. Surveys were conducted within primary forest to evaluate timber production potential in 16.2-ha (40-acre) plots within each 259.1-ha (640-acre) section in ponderosa pine and mixed-conifer forest on the westside of the Stanislaus National Forest, using one or more 1.62-ha transect per plot. Surveyors noted that surveys for individual tree size, density and species were not conducted in areas that had experienced high-severity fire sufficiently recently such that the regenerating areas did not yet contain significant merchantable sawtimber. Surveyors noted that the dominant vegetation cover across the majority of many 259.1-ha sections was montane chaparral and young conifer regeneration following high-severity fire. For example (from a typical township in the data set): a) T1S, R18E, Section 9 ("Severe fire went through [this section] years ago and killed most of the trees and land was reverted to brush", noting "several large dense sapling stands" and noting that merchantable timber existed on only four of sixteen 16.2-ha plots in the section); b) T1S, R18E, Section 14 ("Fires have killed most of timber and most of section has reverted to brush"); c) T1S, R18E, Section 15 (same); d) T1S, R18E, Section 23 ("Most of timber on section has been killed by fires which occurred many years ago"); T1S, R18E, Section 21 ("Old fires killed most of timber on this section and most of area is now brushland".

- "Van de Water and Safford (2011) compared current fire frequencies with historic fire frequencies. The map below shows the mean frequency departure for the Sierra NF, expressed as percent of departure in classes. The classes include: . . ."

  "Total area burned annually is far below historic levels (Stephens et al. 2007, North et al. 2012). The result of these changes is denser, more uniform forests and shrubfields (Collins and Skinner 2013). This in turn has led to more uniform, high severity fires (van Wagtendonk and Fites-Kaufman 2006, Miller et al. 2009, Collins and Stephens 2010, Miller and Safford 2012)."

We agree that there is a current fire deficit, but the draft Assessment neglects to discuss the fact that we also have a deficit of high-intensity fire in particular (e.g., Hanson and Odion 2013, Odion and Hanson 2013, Miller et al. 2012).

With regard to the assumption that the fire-suppressed forests are burning at uncharacteristically high levels of high-intensity fire, relative to areas with more recent fire, this is scientifically inaccurate, as discussed in detail above and below.

- "The map below shows the results of the fire resilience assessment. It is of four "tiled" maps, each depicting different weather scenarios. There are six categories of resilience mapped: gray is sparsely vegetated or unknown areas thought to have little or no fire potential; light green denotes high fire resilience; yellow is moderate fire resilience; orange is low resilience; and red is very low resilience. The black dots on the map represent developed areas, an indicator of wildland urban interface. In all weather conditions, highest elevations in the subalpine zone covering about one-fourth of the forest has high resilience. Below that in elevation is the upper montane, or dominantly red fir forests. Depending on the weather scenario, resilience in this zone varies from low to moderate. The top left map depicts results in moderate fire weather. These would be typical early summer fire conditions. Here most of the upper montane zone is orange and yellow, which is low and moderate resilience. In contrast, the low and mid-elevation mixed conifer, pine, and foothill areas are mostly low to very low resilience under all weather conditions. Under hotter, drier and windier conditions (high and very high weather in the lower maps), all but the highest elevations have low to very low resilience to fire. This means that most of the landscape could burn at high intensities with high severity effects. For forests, a high level of tree mortality would likely. For shrublands, a high level of above ground consumption of foliage and branches would likely occur. Areas that are depicted as moderate to high resilience would likely burn with more of a mosaic of intensities and effects."

This is not scientifically accurate, and this section misrepresents the concept of ecological resilience. As discussed throughout these comments, high-intensity fire areas, including large patches, provide peak levels of native biodiversity and overall wildlife abundance, and provide vital refugia for many rare and imperiled wildlife species that depend upon such post-fire habitat (Raphael et al. 1987, Hutto 1995, Hanson and North 2008, Burnett et al. 2010, 2012, Swanson et al. 2011, Siegel et al. 2010, 2011, 2012, 2013, Buchalski et al. 2013, DellaSala et al. 2013, Hanson 2013, Odion and Hanson 2013). Ecological resilience is enhanced by mixed-intensity fire, and more high-intensity fire in particular.

- "The combination of accumulated vegetation and fuels in the wildlands with increased population is contributes to increasing threats to communities, as well as increased fire management costs throughout the western United States (California Forest and Range Assessment 2010, Toman et al. 2012, Cohesive Strategy 2013, Ecological Restoration Institute 2013). The extensive WUI in the bio-region has resulted in changes to fire management, including choice of strategies and expenditures during uncontrolled wildires (Calkin et al. 2005, Canton-Thomson et al. 2008). Extensive research has shown that fuels in the "home ignition zone" and ignitability of building materials are most critical to whether or not structures burn in the WUI (Cohen 2001, 2003, 2004, Reinhardt et al. 2008). Investigations of recent catastrophic fires in the WUI, where many structures burned, show that most of the damage occurs during the most severe fire weather conditions (Menakis et al. 2003). Fires under these conditions have rapid growth rates and/or high intensities (Reinhardt et al. 2008). A recent example in the bio-region is the Angora Fire in South Lake Tahoe in 2007 (USFS 2007, Safford et al. 2009). Despite fuel hazard reduction treatments in the WUI, 254 homes were destroyed (Safford et al. 2009). Similar outcomes would be expected with fires on the Sierra NF. In a national risk assessment, the Sierra Nevada mountain range was identified as one of the highest risk areas in the country (Cohesive Strategy2013, p. 17). A more refined risk assessment is under development for the Sierra NF, and will be used during forest plan revision."

This is misleading. Most homes burned in forest fires are burned by lower-intensity fire (this was also true in the Angora fire), and the only effective way to protect homes from fire is to reduce brush in the Defensible Space zone within 100 to 200 feet of homes, and to reduce the combustibility of the homes themselves—the WUI is generally an unscientific concept that does not effectively protect homes because it diverts resources away from the Defensible Space zones to areas much, much farther away from structures (Cohen 2000, Cohen and Stratton 2008, Gibbons et al. 2012).

- "Predictions indicate climate will continue to change and magnify the fire risk to communities, as well as increase the likelihood of more intense and faster growing fires in the wildlands (McKenzie et al. 2004, Westerling et al. 2006, Westerling and Bryant 2008, Westerling et al. 2011). Longer fire seasons and drier and hotter fire conditions have already been noted over the last decade (Safford and Meyer 2012)."

This is inaccurate. While many areas have gotten warmer, some have gotten colder since 1930, and almost every area of the Sierra Nevada has gotten wetter since 1930 (Crimmins et al. 2011, Safford et al. 2012). Moreover, the draft Assessment misrepresents McKenzie et al. (2004), which predicts less fire in California's forests due to climate change, not more fire. Also, the draft Assessment cherry-picks information, neglecting to mention that there is a debate about future fire patterns, and numerous studies predict less fire (McKenzie et al. 2004, Krawchuk et al. 2009, Gonzalez et al. 2010).

- "The effects of fire suppression on increasing fuels in the Sierra Nevada (van Wagtendonk 1985, Stephens and Moghaddas 2005, Stephens 2005, van Wagtendonk and Fites-Kaufman 2006, North et al. 2009, Valliant et al. 2013) and elsewhere in the western United States has been well documented (Reinhardt et al. 2008) and has been considered in past forest plans and forest plan revisions (USDA 2001 and 2004). More recently, changes in climate have been overlaid on increased fuel conditions, contributing to undesirable fire effects to ecosystems and communities. An estimate of the area under different "condition classes" was developed by the Forest Service in 2008. Condition Classes 2 and 3 represent areas where vegetation density and fuels are substantially greater than historic conditions. Only 10 percent of the Sierra NF was estimated to be in Condition Class 1. A little over 20 percent was in Condition Class 3, the worst condition possible. The remainder was in Condition Class 2. The areas in the best condition are in the subalpine zone and the areas in the worst condition are in the mixed conifer and pine forests."

Again, the Condition Class system, based upon fire return interval departure, has been debunked, as discussed in detail above and below.

- "Currently, most of the landscape is not resilient to large, high intensity fire, and is susceptible to drought and insect/pathogen outbreaks. Restoration is proceeding at a pace and scale that is inadequate to address the problem in a timely way. The limited pace and scale of restoration and lack of active management is a stressor."

As discussed above, the draft Assessment does not accurately represent the concept of ecological resilience (Thompson et al. 2009).

- "Overall, ecosystems on the Sierra NF are outside of the natural range of variability in terms of fire, insect/pathogens, air quality, invasive species, and vegetation succession."

Sierran forests are outside of the natural range of variability due to a lack of fire, and a deficit of large snags, as discussed above. Christensen et al. (2008 [Table 27]) specifically found, for mixed-conifer and ponderosa pine forests, an average of only 1.4 snags per acre 20-39 inches in diameter and only 0.25 per acre over 39 inches in diameter (mixed-conifer and ponderosa pine combined), currently, and expressed concern about the lack of large snags with regard to minimum habitat requirements for cavity-nesting species.

- "In the table below, the conditions of these drivers and stressors are summarized using similar elements as described in the National Report on Sustainable Forests (2004). The deviations from the natural range of variability are great for foothill and montane areas (mixed conifer, oak and pine), moderate for upper montane (red fir and Jeffrey pine), and low for subalpine and alpine areas for all characteristics (fire, vegetation succession, insects/pathogens, air quality). The trend is for these characteristics to continue to deviate from the natural range of variability, and to deviate more because of the low rate of restoration vegetation management. This includes fire managed for resource objectives."

As discussed throughout these comments, there is a substantial deficit of high-intensity fire, and large snags, in Sierra Nevada forests. The "vegetation management" referenced in the quoted passage above appears to refer to logging, which is designed to further suppress fire, and which undermines potential for snag recruitment by reducing stand density, thus exacerbating the current snag deficit too.

- "Given that the current condition of vegetation is denser than the natural range of variability, it is likely that the foothill and montane landscapes on the Sierra NF will not be resilient to drought, high severity fire, and insect and pathogen outbreaks. Air pollution is currently at levels where there is impaired function. This weakens vegetation, making it more susceptible to drought and insects and pathogen related die-back. Increased tree mortality has already been reported (Van Mantgem et al. 2009). Fires are more likely to be more uniformly severe across large areas. Severe fire has always occurred. In the past, however, vegetation was more heterogeneous and as a result the fires were patchier."

This is inaccurate. As discussed above, there is a deficit of snags currently (North et al. 2009 acknowledge this as well), as well as a deficit of high-intensity fire. Also, van Mantgem et al. (2009) did not report increased mortality of large trees (their largest category was >16 inches in diameter), and the authors have acknowledged that there has been no decrease in larger trees.

- "Ecological integrity of terrestrial ecosystems varies with location and elevation on the Sierra NF. At the highest elevations, in wilderness and subalpine and alpine, ecosystems are generally intact. There are some impacts from climate change, but they are limited. Trees are moving up in elevation and there are pending effects of climate change on increasing fire. Upper montane forests, meadows, and chaparral are in mixed condition of ecological integrity and these areas are among the most vulnerable to climate change. Red fir forest and meadows are tied to snowpack. Snowpack is declining and expected to continue declining. Fire suppression and limited forest management has led to some increases in forest density, and uniformity of structure and fuels. These effects will continue and with an increased risk of drought-related tree mortality, insect and pathogen outbreak, and uniformly intense, high severity, large wildfires. Mixed conifer and pine forests in the montane ecosystems have been most impacted by fire suppression and past management. These forests are home to key species of conservation concern including the fisher and California spotted owl. Forests are denser, large tree densities are reduced and forest structure is more uniform with reductions in snags, shrubs. This has decreased the overall biodiversity of song-birds, woodpeckers, small mammals, and understory plants adapted to light and fire. The foothill zone has been the most altered, as a result extensive human development and non-native invasive grasses."

  "Aquatic and riparian ecosystems have varied ecological integrity. Water quality and quantity are within the natural range of variability. These are at risk from climate change, including decreased precipitation and changes in seasonal timing. Extensive water development has reduced the habitat extent of some species, such as salmon, and changed the habitat of others. Riparian habitat is in various states of ecological integrity. Water development has decreased it in some areas through changes in water flow and timing. Fire suppression has impacted riparian habitat by increasing conifer density and decreasing riparian hardwood and herbaceous vegetation. This results in decreased habitat diversity for birds, bats, insects, and amphibians. Meadows have lowered water

> tables from overgrazing in the late 1800s, water development, road placement, and recreation. Current meadow management is more controlled but impacts remain."

Again, the data indicate that there is a deficit of high-intensity fire, that high-intensity fire creates one of the most biodiverse and ecologically important habitat types (rarer than old-growth forest in fact), and that ecological resilience is enhanced by increasing, not decreasing, high-intensity fire.

Below are references, which have been provided in past comments as well:

References

Baker, W.L. and D.S. Ehle. 2001. Uncertainty in surface-fire history: the case of ponderosa pine forests in the western United States. Canadian Journal of Forest Research 31: 1205-1226.

Baker, W.L. 2006. Fire history in ponderosa pine landscapes of Grand Canyon National Park: is it reliable enough for management and restoration? International Journal of Wildland Fire 15: 433-437.

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Baker, W.L., T.T. Veblen, and Sherriff, R.L. 2007. Fire, fuels and restoration of ponderosa pine-Douglas-fir forests in the Rocky Mountains, USA. Journal of Biogeography, 34: 251-269.

Beaty, R.M., and A.H. Taylor. 2001. Spatial and temporal variation of fire regimes in a mixed conifer forest landscape, Southern Cascades, USA. Journal of Biogeography 28: 955–966. ***(On the western slope of the southern Cascades in California, historic fire severity in mixed-conifer forests was predominantly moderate- and high-severity, except in mesic canyon bottoms, where moderate- and high-severity fire comprised 40.4% of fire effects [Table 7]. Contrary to the occasionally stated assumption that the forests studied in the southern Cascades of California allowed more high-severity fire than the western slope of the central and southern Sierra Nevada due to gentle and unbroken topography that allowed large "runs" of fire, and due to different conifer forest types and precipitation levels, the study area was mostly on moderate to steep slopes, with forest frequently broken by peaks, rock outcroppings, and water bodies [Fig. 1], the annual precipitation is similar to the southern/central Sierra Nevada's western slope (134 cm/yr, mostly as snow), and the composition of conifers in mixed-conifer forest is the same as in the southern/central Sierra Nevada, comprised of ponderosa and Jeffrey pine, white fir, incense-cedar, sugar pine, and Douglas-fir.)***

Bekker, M. F. and Taylor, A. H. 2001. Gradient analysis of fire regimes in montane forests of the southern Cascade Range, Thousand Lakes Wilderness, California, USA. Plant Ecology 155: 15-28. ***(On the western slope of the southern Cascades in California, in mixed-conifer forests, fire severity was predominantly high-severity historically [Fig. 2F]. Contrary to the occasionally stated assumption that the forests studied in the southern Cascades of***

California allowed more high-severity fire than the western slope of the central and southern Sierra Nevada due to gentle and unbroken topography that allowed large "runs" of fire, and due to different conifer forest types and precipitation levels, the study area was mostly on moderate to steep slopes, with forest frequently broken by peaks, rock outcroppings, and water bodies [Fig. 1], the annual precipitation is similar to the southern/central Sierra Nevada's western slope (105 cm/yr, mostly as snow), and the composition of conifers in mixed-conifer forest is the same as in the southern/central Sierra Nevada, comprised of ponderosa and Jeffrey pine, white fir, incense-cedar, and sugar pine [Table 1].)

Bekker, M. F. and Taylor, A. H. 2010. Fire disturbance, forest structure, and stand dynamics in montane forest of the southern Cascades, Thousand Lakes Wilderness, California, USA. Ecoscience 17: 59-72. ***(In mixed-conifer forests of the southern Cascades, reconstructed fire severity was dominated by high-severity fire effects, including high-severity fire patches over 2,000 acres in size [Tables I and II]. Contrary to the occasionally stated assumption that the forests studied in the southern Cascades of California allowed more high-severity fire than the western slope of the central and southern Sierra Nevada due to gentle and unbroken topography that allowed large "runs" of fire, and due to different conifer forest types and precipitation levels, the study area was mostly on moderate to steep slopes, with forest frequently broken by peaks, rock outcroppings, and water bodies [Fig. 1], the annual precipitation is similar to the southern/central Sierra Nevada's western slope (105 cm/yr, mostly as snow), and the composition of conifers in mixed-conifer forest is the same as in the southern/central Sierra Nevada, comprised of ponderosa and Jeffrey pine, white fir, incense-cedar, and sugar pine [Fig. 2].)***

Bond, M. L., D. E. Lee, R. B. Siegel, & J. P. Ward, Jr. 2009a. Habitat use and selection by California Spotted Owls in a postfire landscape. Journal of Wildlife Management 73: 1116-1124. ***(In a radiotelemetry study, California spotted owls preferentially selected high-severity fire areas, which had not been salvage logged, for foraging.)***

Brown, P.M., M.R. Kaufmann, and W.D. Shepperd. 1999. Long-term, landscape patterns of past fire events in a montane ponderosa pine forest of central Colorado. Landscape Ecology 14: 513-532.

Buchalski, M.R., J.B. Fontaine, P.A. Heady III, J.P. Hayes, and W.F. Frick. 2013. Bat response to differing fire severity in mixed-conifer forest, California, USA. PLOS ONE 8: e57884. ***(In mixed-conifer forests of the southern Sierra Nevada, rare myotis bats were found at greater levels in unmanaged high-severity fire areas of the McNally fire than in lower fire severity areas or unburned forest.)***

Burnett, R.D., P. Taillie, and N. Seavy. 2010. Plumas Lassen Study 2009 Annual Report. U.S. Forest Service, Pacific Southwest Region, Vallejo, CA. ***(Bird species richness was approximately the same between high-severity fire areas and unburned mature/old forest at 8 years post-fire in the Storrie fire, and total bird abundance was greatest in the high-severity fire areas of the Storrie fire [Figure 4]. Nest density of cavity-nesting species increased with higher proportions of high-severity fire, and was highest at 100% [Figure***

8]. The authors noted that "[o]nce the amount of the plot that was high severity was over 60% the density of cavity nests increased substantially", and concluded 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, R.D., P. Taillie, and N. Seavy. 2011. Plumas Lassen Study 2010 Annual Report. U.S. Forest Service, Pacific Southwest Region, Vallejo, CA. ***(Black-backed Woodpecker nesting was eliminated by post-fire salvage. See Figure 11 [showing nest density on national forest lands not yet subjected to salvage logging versus private lands that had been salvage logged.)***

Burnett, R.D., M. Preston, and N. Seavy. 2012. Plumas Lassen Study 2011 Annual Report. U.S. Forest Service, Pacific Southwest Region, Vallejo, CA. ***(Black-backed Woodpecker potential occupancy rapidly approaches zero when less than 40-80 snags per acre occur, or are retained (Burnett et al. 2012, Fig. 8 [occupancy dropping towards zero when there are fewer than 4-8 snags per 11.3-meter radius plot—i.e., less than 4-8 snags per 1/10th-acre, or less than 40-80 snags per acre.)***

Christensen, G.A., S.J. Campbell, and J.S. Fried, tech eds. 2008. California's forest resources, 2001-2005: five-year Forest Inventory and Analysis report. Gen. Tech. Rep. PNW-GTR-763. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 183 p.

Cohen, J.D. 2000. Preventing disaster: home ignitability in the Wildland-Urban Interface. Journal of Forestry 98: 15-21.

Cohen, J.D., and R.D. Stratton. 2008. Home destruction examination: Grass Valley Fire. U.S. Forest Service Technical Paper R5-TP-026b. U.S. Forest Service, Region 5, Vallejo, CA. *(The vast majority of homes burned in wildland fires are burned by slow-moving, low-intensity fire, and defensible space within 100-200 feet of individual homes [reducing brush and small trees, and limbing up larger trees, while also reducing the combustibility of the home itself] effectively protects homes from fires, even when they are more intense.)*

Collins, B.M., and S.L. Stephens. 2010. Stand-replacing patches within a mixed severity fire regime: quantitative characterization using recent fires in a long-established natural fire area. Landscape Ecology 25: 927939. ***(In a modern "reference" forest condition within mixed-conifer/fir forests in Yosemite National Park, 15% of the area experienced high-severity fire over a 33-year period—a high-severity fire rotation interval of approximately 223 years.)***

Collins, B.M., G. Roller, and S.L. Stephens. 2011. Fire and fuels at the landscape scale. Plumas Lassen Study: 2010 Annual Report. U.S. Forest Service, Pacific Southwest Research Station, Davis, CA. ***(See pages 15-23, including Tables 5 and 6.)***

Colombaroli, D. and D. G. Gavin 2010. Highly episodic fire and erosion regime over the past 2,000 y in the Siskiyou Mountains, Oregon. Proceedings of the National Academy of Sciences 107: 18909-18915.

Crimmins, S.L., et al. 2011. Changes in climatic water balance drive downhill shifts in plant species' optimum elevations. Science 331:324-327.

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Donato, D.C., J.B. Fontaine, W.D. Robinson, J.B. Kauffman, and B.E. Law. 2009. Vegetation response to a short interval between high-severity wildfires in a mixed-evergreen forest. Journal of Ecology 97: 142-154. ***(The high-severity re-burn [high-severity fire occurring 15 years after a previous high-severity fire] had the highest plant species richness and total plant cover, relative to high-severity fire alone [no re-burn] and unburned mature/old forest; and the high-severity fire re-burn area had over 1,000 seedlings/saplings per hectare of natural conifer regeneration.)***

Duren, O.C., P.S. Muir, and P.E. Hosten. 2012. Vegetation change from the Euro-American settlement era to the present in relation to environment and disturbance in southwest Oregon. Northwest Science 86: 310-328.

Fontaine, J.B., D.C. Donato, W.D. Robinson, B.E. Law, and J.B. Kauffman. 2009. Bird communities following high-severity fire: response to single and repeat fires in a mixed evergreen forest, Oregon, USA. Forest Ecology and Management 257: 1496-1504. ***(Bird species richness was not significantly different between high-severity re-burn, high-severity burn alone, and unburned old-growth forest, but was numerically highest in areas burned once by high-severity fire 17-18 years earlier, and in high-severity re-burn areas. Total bird abundance was higher in the high-severity fire area, at 17-18 years post-fire, than in the unburned old-growth forest [Figs. 3a and 3b].)***

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Haire, S.L. and K. McGarigal. 2008. Inhabitants of landscape scars: succession of woody plants after large, severe forest fires in Arizona and New Mexico. The Southwestern Naturalist 53:

146-161. ***(A high diversity of tree and shrub species naturally regenerates after severe fire [Table 1].)***

Haire, S.L. and K. McGarigal. 2010. Effects of landscape patterns of fire severity on regenerating ponderosa pine forests (*Pinus ponderosa*) in New Mexico and Arizona, USA. Landscape Ecology 25: 1055-1069. ***(Natural post-fire conifer regeneration, within the same fire areas analyzed in Haire and McGarigal 2008, occurs in 100% mortality patches even 200 or more meters from the nearest live tree, and regeneration nearer to the live-tree edge occurs vigorously within a few years post-fire, increasing rapidly after 10-15 years post-fire [Fig. 5]. The proportion of the total high-severity fire area that is more than 200 meters from the nearest live-tree edge was relatively small [Fig.2].)***

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Hanson, C. T. and M. P. North. 2008. Postfire woodpecker foraging in salvage-logged and unlogged forests of the Sierra Nevada. Condor 110: 777–782. ***(Black-backed woodpeckers depend upon dense, mature/old forest that has recently experienced higher-severity fire, and has not been salvage logged; sBlack-backed Woodpeckers selected dense, old forests that experienced high-severity fire, and avoided salvage logged areas [see Tables 1 and 2].)***

Hanson, C.T. , D.C. Odion, D.A. DellaSala, and W.L. Baker. 2009. Overestimation of fire risk in the Northern Spotted Owl Recovery Plan. Conservation Biology 23:1314–1319. ***(Fire severity is not increasing in forests of the Klamath and southern Cascades or eastern Cascades.)***

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Hessburg, P. F., R. B. Salter, and K. M. James. 2007. Re-examining fire severity relations in pre-management era mixed conifer forests: inferences from landscape patterns of forest structure. Landscape Ecology 22:5-24.

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Hutto, R. L. 2008. The ecological importance of severe wildfires: Some like it hot. Ecological Applications 18:1827–1834. ***(Figure 4a, showing about 50% loss of Black-backed Woodpecker post-fire occupancy due to moderate pre-fire logging [consistent with mechanical thinning] in areas that later experienced wildland fire.)***

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Klenner, W., R. Walton, A. Arsenault, L. Kremsater. 2008. Dry forests in the Southern Interior of British Columbia: Historical disturbances and implications for restoration and management. Forest Ecology and Management 256: 1711-1722.

Kotliar, N.B., S.J. Hejl, R.L. Hutto, V.A. Saab, C.P. Melcher, and M.E. McFadzen. 2002. Effects of fire and post-fire salvage logging on avian communities in conifer-dominated forests of the western United States. Studies in Avian Biology 25: 49-64.

Krawchuk, M.A., M.A. Moritz, M. Parisien, J. Van Dorn, and K. Hayhoe. 2009. Global pyrogeography: the current and future distribution of wildfire. PloS ONE 4: e5102. ***(Fire is projected to decrease in the Sierra Nevada management region over the next several decades due to climate change [Fig. 3].)***

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Leiberg, J.B. 1899a. Bitterroot Forest Reserve. USDI Geological Survey, Nineteenth Annual Report, Part V. Forest Reserves, pp. 253–282. US Government Printing Office, Washington, D.C.

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Leiberg, J. B. 1902. Forest conditions in the northern Sierra Nevada, California. USDI Geological Survey, Professional Paper No. 8. U.S. Government Printing Office, Washington, D.C. ***(High-severity fire patches over 5,000 acres in size mapped in mixed-conifer forest that had not been logged previously during the 19th century, prior to fire suppression. In the 19th century, prior to fire suppression, composition of mixed-conifer forests in the central and northern Sierra Nevada was quantified in unlogged areas for several watersheds, and in dozens of specific locations within watersheds. The study reported that, while some of these areas were open and parklike stands dominated by ponderosa pine, Jeffrey pine, and sugar pine, the majority were dominated by white fir, incense-cedar, and Douglas-fir, especially on north-facing slopes and on lower slopes of subwatersheds; such areas were predominantly described as dense, often with "heavy underbrush" from past mixed-severity fire. Natural heterogeneity, resulting from fire, often involved dense stands of old forest adjacent to snag forest patches of standing fire-killed trees and montane chaparral with regenerating young conifers: "All the slopes of Duncan Canyon from its head down show the same marks of fire—dead timber, dense undergrowth, stretches of chaparral, thin lines of trees or small groups rising out of the brush, and heavy blocks of forest surrounded by chaparral." [p. 171])***

Leiberg, J. B. 1903. Southern part of Cascade Range Forest Reserve. Pages 229–289 in H. D. Langille, F. G. Plummer, A. Dodwell, T. F. Rixon, and J. B. Leiberg, editors. Forest conditions in the Cascade Range Forest Reserve, Oregon. Professional Paper No. 9. U.S. Geological Survey, U.S. Government Printing Office, Washington, D.C., USA.

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Malison, R.L., and C.V. Baxter. 2010. The fire pulse: wildfire stimulates flux of aquatic prey to terrestrial habitats driving increases in riparian consumers. Canadian Journal of Fisheries and Aquatic Sciences 67: 570-579. ***(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.)***

McKenzie, et al. 2004. Z. Gedalof, D.L. Peterson, and P. Mote. 2004. Climatic change, wildfire, and conservation. Conservation Biology 18: 890-902. *(**Fire was projected to decrease in California's forests in the coming decades from climate change, despite warming, due to increasing summer precipitation**.)*

Miller, J.D., B.M. Collins, J.A. Lutz, S.L. Stephens, J.W. van Wagtendonk, and D.A. Yasuda. 2012b. Differences in wildfires among ecoregions and land management agencies in the Sierra Nevada region, California, USA. Ecosphere 3: Article 80. ***(Current high-severity fire rotation interval in the Sierra Nevada management region overall is over 800 years. The authors recommended increasing high-severity fire amounts [i.e., decreasing rotation intervals] in the Cascades-Modoc region and on the western slope of the Sierra Nevada, where the current high-severity fire rotation is 859 to 4650 years [Table 3]. The authors noted that "high-severity rotations may be too long in most Cascade-Modoc and westside NF locations, especially in comparison to Yosemite…").***

Miller, J.D., C.N. Skinner, H.D. Safford, E.E. Knapp, and C.M. Ramirez. 2012a. Trends and causes of severity, size, and number of fires in northwestern California, USA. Ecological Applications 22:184-203. ***(No increase in fire severity was found in the Klamath region of California, which partially overlaps the Sierra Nevada management region.)***

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Odion, D.C., and Hanson, C.T. 2013. Projecting impacts of fire management on a biodiversity indicator in the Sierra Nevada and Cascades, USA: the Black-backed Woodpecker. The Open Forest Science Journal 6: 14-23 (in press). ***(High-severity fire, which creates primary habitat for Black-backed Woodpeckers, has declined fivefold since the early 20th century in the Sierra Nevada and eastern Oregon Cascades due to fire suppression. Further, the current rate of high-severity fire in mature/old forest (which creates primary, or high suitability, habitat for this species) in the Sierra Nevada and eastern Oregon Cascades is so low, and recent high-severity fire in mature/old forest comprises such a tiny percentage of the overall forested landscape currently (0.66%, or about 1/150th of the landscape), that even if high-severity fire in mature/old forest was increased by several times, it would only amount to a very small proportional reduction in mature/old forest, while getting Black-backed Woodpecker habitat closer to its historical, natural levels. Conversely, the combined effect of a moderate version of current forest management—prefire thinning of 20% of the mature/old forest (in order to enhance fire suppression) over the next two decades, combined with post-fire logging of one-third of the primary Black-backed Woodpecker habitat, would reduce primary Black-backed Woodpecker habitat to an alarmingly low 0.20% (1/500th) of the forested landscape, seriously threatening the viability of Black-backed Woodpecker populations.)***

Powers, E.M., J.D. Marshall, J. Zhang, and L. Wei. 2013. Post-fire management regimes affect carbon sequestration and storage in a Sierra Nevada mixed conifer forest. Forest Ecology and Management 291: 268-277. ***(In Sierra Nevada mixed conifer forests, the highest total aboveground carbon storage was found to occur in mature/old forest that experienced 100% tree mortality in wildland fire, and was not salvage logged or artificially replanted, relative to lightly burned old forest and salvage logged areas [Fig. 1b]).***

Raphael, M.G., M.L. Morrison, and M.P. Yoder-Williams. 1987. Breeding bird populations during twenty-five years of postfire succession in the Sierra Nevada. The Condor 89: 614-626. ***(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 by 25 years post-fire, while flycatchers and species associated with shrubs continued to increase to 25 years post-fire.)

Rota, C.T. 2013. Not all forests are disturbed equally: population dynamics and resource selection of Black-backed Woodpeckers in the Black Hills, South Dakota. Ph.D. Dissertation, University of Missouri-Columbia, MO. (***Rota (2013) finds that Black-backed Woodpeckers only maintain stable or increasing populations (i.e., viable populations) in recent wildland fire areas occurring within dense mature/older forest (which have very high densities of large wood-boring beetle larvae due to the very high densities of medium/large fire-killed trees). And, while Black-backeds are occasionally found in unburned forest or prescribed burn areas, unburned "beetle-kill" forests (unburned forest areas with high levels of tree mortality from small pine beetles) and lower-intensity prescribed burns have declining populations of Black-backed Woodpeckers (with the exception of a tiny percentage of beetle-kill areas). The study shows that unburned beetle-kill forests do not support viable populations, but very high snag-density beetle-kill areas tend to slow the population decline of Black-backed Woodpeckers in between occurrences of wildland fire. Population decline rates are alarmingly fast in low-intensity prescribed burn areas, indicating that such areas do not provide suitable habitat. Black-backed Woodpeckers are highly specialized and adapted to prey upon wood-boring beetle larvae found predominantly in recent higher-severity wildland fire areas. Moreover, while Black-backed Woodpeckers are naturally camouflaged against the charred bark of fire-killed trees, they are more conspicuous in unburned forests, or low-severity burned forests, and are much more vulnerable to predation by raptors in such areas. For this reason, even when a Black-backed Woodpecker pair does successfully reproduce in unburned forest or low-severity fire areas, both juveniles and adults have much lower survival rates than in higher-severity wildland fire areas.***)

Russell, W. H., J. McBride, and R. Rowntree. Revegetation after four stand-replacing fires in the Tahoe Basin. Madrono 45: 40-46.

Saab, V.A., R.E. Russell, and J.G. Dudley. 2009. Nest-site selection by cavity-nesting birds in relation to postfire salvage logging. Forest Ecology and Management 257:151–159. ***(Black-backed Woodpeckers select areas with about 325 medium and large snags per hectare [about 132 per acre], and nest-site occupancy potential dropped to near zero when snag density was below about 270 per hectare, or about 109 per acre [see Fig. 2A, showing 270 snags per hectare as the lower boundary of the 95% confidence interval].)***

Safford, H.D., M. North, and M.D. Meyer. 2012. Climate change and the relevance of historical forest conditions. Chapter 3 In: North, M., Editor. Managing Sierra Nevada forests. U.S. Forest Service, Pacific Southwest Research Station, General Technical Report PSW-GTR-237. ***(Finding that precipitation has increased across the entire Sierra Nevada since the 1930s—see Figure 3-1)***.

Seavy, N.E., R.D. Burnett, and P.J. Taille. 2012. Black-backed woodpecker nest-tree preference in burned forests of the Sierra Nevada, California. Wildlife Society Bulletin 36: 722-728.

(Black-backed Woodpeckers selected sites with an average of 13.3 snags per 11.3-meter radius plot [i.e., 0.1-acre plot], or about 133 snags per acre.)

Schieck, J., and S.J. Song. 2006. Changes in bird communities throughout succession following fire and harvest in boreal forests of western North America: literature review and meta-analyses. Canadian Journal of Forest Research 36: 1299-1318. ***(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]).***

Schwind, B. compiler. 2008. Monitoring trends in burn severity: report on the Pacific Northwest and Pacific Southwest fires (1984 to 2005). U.S. Geological Survey Center for Earth Resources Observation and Science, Sioux Falls, South Dakota. Available from http://www.mtbs.gov/reports/projectreports.htm (accessed October 2008). ***(No increase in fire severity was found in California, with all vegetation combined.)***

Sestrich, C.M., T.E. McMahon, and M.K. Young. 2011. Influence of fire on native and nonnative salmonid populations and habitat in a western Montana basin. Transactions of the American Fisheries Society 140: 136-146. ***(Native Bull and Cutthroat trout tended to increase with higher fire severity, particularly where debris flows occurred.)***

Shatford, J.P.A., D.E. Hibbs, and K.J. Puettmann. 2007. Conifer regeneration after forest fire in the Klamath-Siskiyous: how much, how soon? Journal of Forestry April/May 2007, pp. 139-146.

Sherriff, R. L., and T. T. Veblen. 2007. A spatially explicit reconstruction of historical fire occurrence in the Ponderosa pine zone of the Colorado Front Range. Ecosystems 9:1342-1347.

Shinneman D.J. and W.L. Baker, 1997. Nonequilibrium dynamics between catastrophic disturbances and old-growth forests in ponderosa pine landscapes of the Black Hills. Conservation Biology11: 1276-1288.

Show, S.B. and Kotok, E.I. 1924. The role of fire in California pine forests. United States Department of Agriculture Bulletin 1294, Washington, D.C. ***(Historically, within ponderosa pine and mixed-conifer/pine forests of the Sierra Nevada, high-severity crown fires, though infrequent on any particular area, "may extend over a few hundred acres" in patches [p. 31; see also Plate V, Fig. 2, Plate VII, Fig. 2, Plate VIII, Plate IX, Figs. 1 and 2, and Plate X, Fig. 1], with some early-successional areas, resulting from high-severity fire patches, covering 5,000 acres in size or more [pp. 42-43]. The authors distinguished high-severity fire patches of this size from more "extensive" patches occurring in the northern Rocky Mountains [p. 31], where high-severity fire patches occasionally reach tens of thousands, or hundreds of thousands, of acres in size, and noted that patches of such enormous size were "almost" unknown in Sierra Nevada ponderosa pine and mixed-conifer forests. Within unlogged areas, the authors noted many large early-successional habitat patches, dominated by montane chaparral and young, regenerating conifer forest, and explained that such areas were the result of past severe fire because: a) patches of***

mature/old forest and individual surviving trees were found interspersed within these areas, and were found adjacent to these areas, indicating past forest; b) snags and stumps of fallen snags, as well as downed logs from fallen snags, were abundant in these areas; c) the species of chaparral found growing in these areas are known to sprout abundantly following severe fire; and d) natural conifer regeneration was found on most of the area [p. 42], often growing through complete chaparral cover [p. 43].)

Show, S.B. and Kotok, E.I. 1925. Fire and the forest (California pine region). United States Department of Agriculture Department Circular 358, Washington, D.C. ***(Historically, within the ponderosa pine and mixed-conifer/pine belt of the Sierra Nevada, 1 acre out of every 7 on average was dominated by montane chaparral and young regenerating conifer forest following high-severity fire [Footnote 2, and Figs. 4 and 5]; on one national forest 215,000 acres out of 660,000 was early-successional habitat from severe fire [p. 17].)***

Siegel, R. B., R. L. Wilkerson, and D. L. Mauer. 2008. Black-backed Woodpecker (*Picoides arcticus*) surveys on Sierra Nevada national forests: 2008 pilot study. The Institute for Bird Populations, Point Reyes, CA.

Siegel, R.B., J.F. Saracco, and R.L. Wilkerson. 2010. Management Indicator Species (MIS) surveys on Sierra Nevada national forests: Black-backed Woodpecker. 2009 Annual Report. The Institute for Bird Populations, Point Reyes, CA.

Siegel, R.B., M.W. Tingley, and R.L. Wilkerson. 2011. Black-backed Woodpecker MIS surveys on Sierra Nevada national forests: 2010 Annual Report. A report in fulfillment of U.S. Forest Service Agreement No. 08-CS-11052005-201, Modification #2; U.S. Forest Service Pacific Southwest Region, Vallejo, CA. ***(Black-backed woodpecker occupancy declines dramatically by 5-7 years post-fire relative to 1-2 years post-fire, and approaches zero by 10 years post-fire [Fig. 15a].)***

Siegel, R.B., M.W. Tingley, R.L. Wilkerson, and M.L. Bond. 2012b. Assessing home range size and habitat needs of Black-backed Woodpeckers in California: 2011 Interim Report. Institute for Bird Populations. A report in fulfillment of U.S. Forest Service Agreement No. 08-CS-11052005-201, Modification 3; U.S. Forest Service, Pacific Southwest Region, Vallejo, CA. ***(See Figure 10, showing almost complete avoidance of salvage logged areas by Black-backed Woodpeckers in a radiotelemetry study in the southern Cascades in California.)***

Siegel, R.B., M.W. Tingley, R.L. Wilkerson, M.L. Bond, and C.A. Howell. 2013. Assessing home range size and habitat needs of Black-backed Woodpeckers in California: Report for the 2011 and 2012 field seasons. Institute for Bird Populations. ***(Black-backed woodpeckers strongly select large patches of higher-severity fire with high densities of medium and large snags, generally at least 100 to 200 hectares (roughly 250 to 500 acres) per pair, and post-fire salvage logging eliminates Black-backed woodpecker foraging habitat [see Fig. 13, showing almost complete avoidance of salvage logged areas]. Suitable foraging habitat was found to have more than 17-20 square meters per hectare of recent snag basal area [pp. 45, 68-70], and suitable nesting habitat was found to average 43 square meters per***

hectare of recent snag basal area and range from 18 to 85 square meters to hectare [p. 59, Table 13]. Moreover, Appendix 2, Fig. 2 indicates that the Sierra Nevada population of Black-backed Woodpeckers is genetically distinct from the Oregon Cascades population, though additional work needs to be conducted to determine just how distinct the two populations are.)

Stephens, S.L., R.E. Martin, and N.E. Clinton. 2007. Prehistoric fire area and emissions from California's forests, woodlands, shrublands, and grasslands. Forest Ecology and Management 251:205–216. *(**Estimated high-severity fire proportion and frequency indicate historic high-severity fire rotation intervals of approximately 250 to 400 years in historic ponderosa pine and mixed-conifer forests in California**.)*

Stephenson, N. L.; Parsons, D,J.; Swetnam, T,W. 1991. Proceedings of the Tall Timbers Fire Ecology Conference 17:321-337.

Tarbill, G.L. 2010. Nest site selection and influence of woodpeckers on recovery in a burned forest of the Sierra Nevada. Master's Thesis, California State University, Sacramento. ***(In post-fire eastside pine and mixed-conifer forests of the northern Sierra Nevada, Black-backed woodpeckers strongly selected stands with very high densities of medium and large snags, with well over 200 such snags per hectare on average at nest sites [Table 2], and nesting potential was optimized at 250 or more per hectare, dropping to very low levels below 100 to 200 per hectare [Fig. 5b].)***

Taylor A.H. 2002. Evidence for pre-suppression high-severity fire on mixed conifer forests on the west shore of the Lake Tahoe Basin. Final report. South Lake Tahoe (CA): USDA Forest Service, Lake Tahoe Basin Management Unit.

Thompson, I., B. Mackey, S. McNulty, and A. Mosseler. 2009. Forest resilience, biodiversity, and climate change. United Nations Environment Programme (UNEP), Secretariat of the Convention on Biological Diversity, Montreal, Canada. Technical Series No. 43. 67 pp.

USFS (United States Forest Service). 1910-1912. Timber Survey Field Notes, 1910-1912, U.S. Forest Service, Stanislaus National Forest. Record Number 095-93-045, National Archives and Records Administration—Pacific Region, San Bruno, California, USA. ***(Surveys were conducted within primary forest to evaluate timber production potential in 16.2-ha (40-acre) plots within each 259.1-ha (640-acre) section in ponderosa pine and mixed-conifer forest on the westside of the Stanislaus National Forest, using one or more 1.62-ha transect per plot. Surveyors noted that surveys for individual tree size, density and species were not conducted in areas that had experienced high-severity fire sufficiently recently such that the regenerating areas did not yet contain significant merchantable sawtimber. Surveyors noted that the dominant vegetation cover across the majority of many 259.1-ha sections was montane chaparral and young conifer regeneration following high-severity fire. For example (from a typical township in the data set): a) T1S, R18E, Section 9 ("Severe fire went through [this section] years ago and killed most of the trees and land was reverted to brush", noting "several large dense sapling stands" and noting that merchantable timber existed on only four of sixteen 16.2-ha plots in the section); b) T1S,***

R18E, Section 14 (“Fires have killed most of timber and most of section has reverted to brush”); c) T1S, R18E, Section 15 (same); d) T1S, R18E, Section 23 (“Most of timber on section has been killed by fires which occurred many years ago”); T1S, R18E, Section 21 (“Old fires killed most of timber on this section and most of area is now brushland”.)

van Wagtendonk, J.W., K.A. van Wagtendonk, and A.E. Thode. 2012. Factors associated with the severity of intersecting fires in Yosemite National Park, California, USA. Fire Ecology 8: 11-32. ***(“The proportion burned in each fire severity class was not significantly associated with fire return interval departure class…[L]ow severity made up the greatest proportion within all three departure classes, while high severity was the least in each departure class (Figure 4).”)***

Whitlock, C., J. Marlon, C. Briles, A. Brunelle, C. Long and P. Bartlein, 2008. Long-term relations among fire, fuel, and climate in the north-western US based on lake-sediment studies. International Journal of Wildland Fire17: 72-83.

Whitlock, C., P.E. Higuera, D.B. McWethy, and C.E. Briles. 2010. Paleoecological perspectives on fire ecology: revisiting the fire-regime concept. The Open Ecology Journal 3: 6-23.

Williams, M.A. & Baker, W.L. 2010. Bias and error in using survey records for ponderosa pine landscape restoration. *Journal of Biogeography*37, 707–721.

Williams, M.A. & Baker, W.L. 2011. Testing the accuracy of new methods for reconstructing historical structure of forest landscapes using GLO survey data. *EcologicalMonographs*, 81: 63–88.

Williams, M.A., W.L. Baker. 2012a. Spatially extensive reconstructions show variable-severity fire and heterogeneous structure in historical western United States dry forests. Global Ecology and Biogeography. DOI: 10.1111/j.1466-8238.2011.00750.

Williams, M.A., W.L. Baker. 2012b. Comparison of the higher-severity fire regime in historical (A.D. 1800s) and modern (A.D. 1984-2009) montane forests across 624,156 ha of the Colorado Front Range. Ecosystems DOI 10.1007/s10021-012-9549-8.

Wills, R. D. & Stuart, J. D. 1994. Fire history and stand development of a Douglas-fir/hardwood forest in northern California. Northwest Science 68, 205-212.

Sincerely,

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