April 24, 2023

Wendi Weber, Acting Director
U.S. Fish and Wildlife Service

Re: Comments on USFWS's proposal to list the California spotted owl under the ESA

Submitted to: *https://www.regulations.gov* (docket #: FWS-R8-ES-2022-0166)

Dear Acting Director Weber,

On behalf of the undersigned organizations and scientists, we are submitting the following comments on your proposal to list the California spotted owl (CSO) as endangered (southern CA mountains) and threatened (Sierra Nevada) under the Endangered Species Act (ESA). As we explain below, we strongly support your proposal to list the CSO under the ESA, though we urge you to list the Sierra Nevada DPS as endangered also, which we believe is more than warranted by the Bond and Hanson (2014) petition, ongoing habitat loss and degradation from commercial thinning, salvage logging, and clearcutting, and ongoing continued population declines as discussed in the USFWS CSO listing proposal.

We equally strongly oppose your proposal to exempt most commercial logging activities in the Sierra Nevada through a 4(d) rule. As we explain below, USFWS relied upon a series of scientifically inaccurate statements and assertions, and omissions of key data, in the course of promoting this 4(d) logging exemption. We request that you list the CSO under the ESA, as proposed, but drop the proposed 4(d) logging exemption, which is arbitrary and capricious for the reasons discussed below.

I. The Proposed 4(d) Logging Exemption Fails to Include Commercial Thinning and Post-fire Logging as Threats or Even Potential Threats to the CSO, Despite Repeated Admissions Elsewhere that Such Logging Can Harm CSOs.

On p. 120 of the USFWS CSO listing proposal, USFWS states the following (quotes from USWS CSO listing proposal in italics):

As discussed previously in ***Summary of Biological Status and Threats****, we have concluded that the Sierra Nevada DPS of the California spotted owl is likely to become in danger of extinction within the foreseeable future primarily due to wildfire, tree mortality, drought, climate change, rodenticides, and barred owls.*

Notably absent from this list of threats to the CSO is logging, despite numerous admissions in the main body of the USFWS proposal that commercial thinning and post-fire logging can pose a threat to the CSO, as discussed below.

Then, on p. 122 of the USFWS CSO listing proposal, USFWS states:

The proposed 4(d) rule would also provide for the conservation of the species by allowing exceptions that incentivize conservation actions or that, while they may have some minimal level of take of the Sierra Nevada DPS of the California spotted owl, are not expected to rise to the level that would have a negative impact (that is, would have only de minimis impacts) on the conservation of the DPS. The proposed exceptions to these prohibitions include the following provisions (described below) that are expected to have negligible impacts to the Sierra Nevada DPS of the California spotted owl and its habitat:

(1) Forest or fuels management to reduce the risk or severity of wildfire (such as prescribed fire) where fuels management activities are essential to reduce the risk of catastrophic wildfire, and when such activities will be carried out in accordance with an established and recognized fuels or forest management plan that includes measures to minimize impacts to the California spotted owl and its habitat and results in conservation benefits to California spotted owls.

(2) Habitat management and restoration efforts that are specifically designed to provide for the conservation of the California spotted owl's habitat needs and include measures that minimize impacts to the California spotted owl and its habitat. These activities must be carried out in accordance with finalized State or Federal agency conservation plans or strategies for the California spotted owl.

In both paragraph "(1)" and "(2)" in the quoted passage above, the breadth of the language used by USFWS would allow logging of any type or intensity. Notably, in paragraph "(1)" above, USFWS exempts "forest or fuels management to reduce the risk or severity of wildfire" and, in a parenthetical, mentions "such as prescribed fire", instead of simply stating that the exemptions in (1) and (2) are to allow for more prescribed fire. The words "such as" opens the door for any activity, that the Forest Service or other land agencies euphemistically describe as "fuel reduction" or "forest management" to curb wildfires, to be exempted from ESA's protections, including mechanical thinning that removes many mature and old-growth trees and substantially degrades forest canopy cover and post-fire clearcutting of important CSO foraging habitat—

logging activities that not only degrade or destroy CSO habitat but which also tend to increase, not decrease, overall wildfire severity, as discussed in detail below.

Notably, on p. 64 of the CSO listing proposal, USFWS states the following:

"Fuels reductions and forest management practices within the California spotted owl's range *include clearcutting, mechanical thinning, salvage logging*, and prescribed fire." (emphasis added). Therefore, by proposing a 4(d) exemption for any and all "forest or fuels management to reduce the risk or severity of wildfire", USFWS proposes to broadly exempt clearcutting, mechanical thinning, and salvage logging, and directly contradicts its own conclusions that these activities are threats to the CSO.

In the "Threats" section of the USFWS CSO listing proposal, on p. 41, USFWS specifically lists "fuels reduction and forest management" among the threats to CSOs. And, in the "Fuels Reduction and Forest Management" subsection of the Threats section, on pp. 58-65, USFWS repeatedly admits that thinning and post-fire logging are threats to the CSO.

On p. 59, USFWS acknowledges that clearcutting is a threat to CSOs, stating that, "By removing entire stands of trees, clearcutting reduces the amount of large trees, high canopy cover, and coarse woody debris available for California spotted owls", and USFWS admits (p. 59) that clearcutting "still occurs in some areas of the Sierra Nevada" yet, inexplicably, clearcutting was excluded from the list of threats on p. 120 in the proposed 4(d) rule.

On p. 60, USFWS asserts that mechanical thinning "can have positive or negative impacts on the California spotted owl's habitat and demographics depending on the specific methods used", but does nothing in the proposed 4(d) rule to prevent the admitted negative impacts.

On p. 61, USFWS admits that the "positive effects" that the agency *assumes* mechanical thinning would have for CSOs "would not be observed until mid-century", and cautions that "treatments should still strive to maintain large trees and high canopy cover forest", but USFWS includes nothing in its proposed 4(d) rule to prevent removal of large trees or degradation and loss of high canopy cover forests from mechanical thinning. Mechanical thinning projects that remove vast numbers of large trees and severely reduce forest canopy cover are extremely common on Sierra Nevada national forests in CSO habitat, including for example the enormous SERAL logging project on the Stanislaus National Forest, which allows removal of large trees up to 40 inches in diameter at breast height (over 10 feet in circumference) (https://www.fs.usda.gov/project/stanislaus/?project=56500).

On p. 62, USFWS admits that "mechanical thinning can decrease California spotted owl occupancy and is negatively correlated with reproduction (Tempel et al. 2014a, p. 2089; Stephens et al. 2014, p. 903; Tempel et al. 2022, p. 19)", and further concludes on p. 62 that "there is evidence of reduced foraging in fuel treatment areas" and "Thinning may have negative short-term effects on prey species by increasing the risk of predation by removing above-ground cover and reducing canopy connectivity, and thinning may remove suitable nesting substrates…" Yet, once again, USFWS's proposed 4(d) logging exemption contains no mention of mechanical thinning as a threat, and arbitrarily excludes any measures to prevent projects that would cause degradation and loss of CSO habitat from being included in the 4(d) exemption.

On p. 63, USFWS admits that "California spotted owls inhabit areas of low-medium severity fire, patchy high-severity fire, and areas with dead trees; therefore, salvage logging likely reduces the amount of habitat available for California spotted owls (Gutiérrez et al. 2017, p. 276)." However, as with mechanical thinning, USFWS's proposed 4(d) logging exemption contains no mention of salvage logging as a threat, and arbitrarily allows it under the proposed 4(d) exemption, given that salvage logging conducted under the guise of "fuel reduction".

USFWS further admits, on p. 63, that there is evidence that "California spotted owl occupancy decreases with salvage logging (Lee et al. 2013, p. 1327; Lee and Bond 2015, p. 228; Hanson and Chi 2021, p. 5)", and that "Salvage logging can be a threat to California spotted owls when their habitat components of large trees, coarse woody debris, and habitat heterogeneity are removed from the landscape, resulting in a decrease in occupancy at the population level." USFWS also admits, at the top of p. 64, that the Sierra Nevada Forest Plan Amendment even allows salvage logging in CSO PACs that are occupied by CSOs after fires, so long as the Forest Service merely claims that the territory is no longer suitable for CSOs postfire, which the agency can do under the forest plan amendment even if CSOs are nesting and reproducing (Lee and Bond 2015, Hanson et al. 2018). But USFWS's proposed 4(d) rule arbitrarily omits salvage logging from the list of threats (p. 120) and is written so expansively (p. 122) that it would exempt salvage logging in occupied CSO habitat from the ESA's protections.

II. The Proposed 4(d) Logging Exemption Fails to Include Commercial Thinning and Post-fire Logging as Threats or Even Potential Threats to the CSO, Despite Abundant Scientific Evidence of Such Threats Provided in Both CSO ESA Listing Petitions—Evidence that USFWS Omits and Ignores in the Course of Proposing the 4(d) Logging Exemption.

Both of the ESA petitions that spurred USFWS's CSO listing proposal contained dozens of pages of analysis, and citations, clearly establishing the major threat to CSOs posed by mechanical/commercial thinning and post-fire logging (as well as other logging, such as clearcutting of mature/old forest). Yet the analysis used by USFWS to promote its 4(d) logging exemption arbitrarily omits any mention of the great majority of this analysis.

III. Dr. Monica Bond's Analysis of the Scientific Flaws in the Proposed 4(d) Rule

I am grateful for the opportunity to provide input on the U.S. Fish and Wildlife Service's proposed rule to list the Sierra Nevada distinct population segment of the California Spotted Owl (CSO) as threatened with Section 4(d) rule, and the Southern California DPS as endangered, under the Endangered Species Act of 1973. I am a wildlife biologist with expertise in wildlife biology, ecology, and behavior. I hold a B.A. degree in Biology from Duke University (1992); an M.Sc. degree in Wildlife Science from Oregon State University (1998); and a Ph.D. in Ecology from University of Zurich (2020). I have more than 20 years of research experience focused on the interactions between Spotted Owls and wildfire, including habitat use and dynamic site occupancy of California Spotted Owls in the Sierra Nevada and Southern California in response to severe fire. I have dedicated much of my life and career to this topic, publishing 13 original empirical studies about Spotted Owls and fire, which is more than any other scientist. These publications include the following:

- Bond et al. 2022. Forest management, Barred Owls, and Wildfire in Northern Spotted Owl Territories.
- Hanson et al. 2021. Disentangling post-fire logging and high-severity fire effects for spotted owls.
- Hanson et al. 2018. Effects of post-fire logging on California spotted owl occupancy.
- Bond et al. 2016. Foraging habitat selection by California spotted owls after fire.
- Lee and Bond 2015. Previous year's reproductive state affects Spotted Owl site occupancy and reproduction responses to natural and anthropogenic disturbances.
- Lee and Bond 2015. Occupancy of California Spotted Owl sites following a large fire in the Sierra Nevada, California.
- Odion et al. 2014. Effects of fire and commercial thinning on future habitat of the Northern Spotted Owl.
- Lee et al. 2013. Influence of fire and salvage logging on site occupancy of spotted owls in the mountains of Southern California.
- Bond et al. 2013. Diet and home-range size of California Spotted Owls in a burned forest.
- Lee et al. 2012. Dynamics of California Spotted Owl breeding-season site occupancy in burned forests.
- Bond et al. 2010. Winter movements by California Spotted Owls in a burned landscape.
- Bond et al. 2009. Habitat selection and use by California Spotted Owls in a post-fire landscape.
- Bond et al. 2002. Short-term effects of wildfires on spotted owl survival, site fidelity, mate fidelity, and reproduction.

I also co-authored the following in response to an ad hominem attack on my character that was not based on truth:

- Lee et al. 2019. We refute the "conundrum of agenda-driven science," a comment on Peery et al. 2019. and Supporting Information.

I am in full support of listing these two California Spotted Owl DPSs, although I am concerned about the 4(d) special rule. In general, the proposal fails to adequately present the robust scientific evidence in support of logging being a greater threat to Spotted Owls than high-severity wildfire, as well as the abundance of scientific evidence that logging will not prevent high-severity wildfire in Spotted Owl habitats. This failure leads to an erroneous conclusion that logging will be a solution to restoring California Spotted Owl habitat and populations. In fact, logging as would be allowed by the 4(d) special rule will only serve to further endanger the California Spotted Owl. Therefore I strongly recommend changes to the listing proposed rule that puts the focus squarely on the real threats to this raptor, anthropogenic logging and other anthropogenic drivers of habitat loss. We cannot alter behavior of large, severe wildfire through logging, because this type of fire occurs as a result of local climatic conditions such as hot temperatures, low moisture, and high winds and primarily burns forests that have previously been cut (thus, logging only makes fire more severe). However, we can alter our own behaviors that result in loss of mature and older forest conditions that are most resilient to severe wildfires, and that CSOs require for their populations to thrive.

Already in the executive summary, the proposed rule lists high-severity fire as the biggest threat, along with 'tree mortality' (which in itself is an excessively vague term, as many factors cause tree mortality and Spotted Owls often nest in large snags and thus benefit from tree mortality), drought, and barred owls. The claim that high-severity fire is the biggest threat is patently untrue, and it fails to reflect the preponderance of scientific evidence about wildfire and Spotted Owls (*sensu* Lee 2018, 2020). Even U.S. Forest Service-funded research has not shown that fire is the greatest threat. The proposed rule fails to list logging as a threat factor even here in the executive summary, which is a harbinger of the inadequate discussion to come. The proposed rule clearly shows a demonstrated bias against the preponderance of scientific evidence that indicates wildfire is not a major threat to CSO populations.

I generally agree with the assessment that Spotted Owls are considered to be specialists of old-growth and mature forests of the western USA. Habitat characteristics such as high canopy cover and multiple layers of trees allow the Spotted Owl to hide in the shade and remain cool during the heat of the day, and old forests' structural complexity provides habitat for the owl's prey species while offering plenty of larger trees for the owl's nesting sites. The Spotted Owl is a perch-and-pounce predator, so it also needs a diversity of tree branches to perch on and listen for prey rustling in the undergrowth below.

However, the discussion about the effects of severe wildfire on Spotted Owls and their habitat is lacking. My comments below focus primarily on the assessment of fire effects on Spotted Owls beginning on page 42 up to page 45. Subsequent to this assessment, the proposed rule 'quantifies' the purported 'threat' of wildfire by simply listing the amount of forest that burned at high severity: this does not quantify the actual effects of those fires on California Spotted Owl populations, because CSOs very often continue to inhabit territories with a large proportion of forest burned at high severity.

The proposed rule states on page 43 that 'large-scale, high-severity fires have a detrimental effect on both the California spotted owl and its habitat.' However, this statement is too vague to be useful. Some old-growth Spotted Owl nesting habitat is inevitably burned by some wildfires (since wildfires are natural in western forests). Further, it is possible that some individual Spotted Owls might be harmed by such wildfire (in a similar way that individuals may be harmed by Great Horned Owl predation or inclement weather events). However, at a <u>population level</u> the vast majority of science actually shows <u>no **significant** negative effects</u> of high-severity fire (see meta-analysis by Lee 2018 and additional analysis by Lee 2020; comprehensive meta-analyses that include all available data are specifically designed to avoid cherry-picking certain results and thus avoid bias). This rigorous meta-analysis cannot be ignored in this proposed rule.

The proposed rule states on page 44 that 'California spotted owl dispersal, fecundity, and occupancy are subsequently reduced...' by megafires. However, there are <u>no</u> data showing that dispersal after severe fire is reduced, there are data showing fecundity is <u>increased</u> (Lee 2018, 2020, Rockweit et al. 2017), and the occupancy data is more nuanced, likely because many occupancy studies are confounded by logging. Further, occupancy of burned sites by Spotted Owls depends to a large extent on previous occupancy status, as explained below.

My peer-reviewed research has shown that in Southern California, the presence of big severely burned patches in a territory that had not been consistently occupied (unproductive) by Spotted Owls before the fire can result in the loss of occupancy in that territory after the fire, but this was not evident in territories that had been consistently occupied and supported reproduction before the fire (Lee et al. 2013, Lee and Bond 2015a). Further, older forest where (Northern) Spotted Owls live is less likely to burn severely (Lesmeister et al. 2019). If regions have been intensively logged both before and after fire, such as in the Eldorado California Spotted Owl Study Area in the Sierra Nevada, then the negative impacts of such logging might be exacerbated when a wildfire does occur, as was apparent in the King Fire (Jones et al. 2016). In areas that were not intensively logged, fires as they have naturally burned for millennia provide important benefits to Spotted Owls (Bond et al. 2009, Lee and Bond 2015b, Lee 2018; 2020), and these benefits are largely ignored or downplayed in this proposed rule. For example, Spotted Owls often hunt in heavily burned forests within their territories, but only where those forests had not been logged after fire (Bond et al. 2009, Bond et al. 2016, Jones et al. 2020).

A recent paper was published regarding California Spotted Owl population declines in Southern California (Tempel et al. 2022). This paper indicates that, like in previous studies of CSOs, big, old trees and the cooling shade they produce appear to be important to owls, and fortunately these older forests are also the most naturally fire resistant. This means that the focus of our forest management to benefit and recover Spotted Owls should be on protecting older trees and forests from human activities like logging and water diversion.

It was not surprising that this research by Tempel et al. suggested fire accounted for only 9.6% of the 30 years of declines in occupancy by Spotted Owls. Two recent meta-analyses showed fire has significant overall net benefits to Spotted Owl foraging and reproduction, and insignificant effects on occupancy, so there is no reason to consider fire as a primary threat (Lee 2018, 2020). Yet, the Tempel et al. group spends most of their text in this paper promoting logging against fire, with the impossible goal of re-creating a climate-fire regime that existed in Southern California during a wetter and cooler period of time in the last century. This is not our future.

Logging projects are often proposed as a way to stop wildfires from destroying Spotted Owl habitat, but the preponderance of scientific evidence has found that wildfires that burn in a mixture of low to high severity—a perfectly natural and ecologically important phenomenon in forests of the western USA—pose little threat to Spotted Owl populations (Roberts et al. 2011, Lee et al. 2012, Lee and Bond 2015b, Schofield et al. 2020), while logging—a novel threat that the Spotted Owl has never before experienced in its evolutionary history—does threaten these birds (e.g. Dugger et al. 2016, Lee 2018, Wood et al. 2018, Lesmeister et al. 2019, Lee 2020). Logging as a novel threat includes timber harvest in green forests before wildfire occurs (supposedly to reduce fire risk) as well as logging burned forests after wildfire (supposedly to help the forest "recover"), but both types of logging remove trees that Spotted Owls need to perch on for foraging (in burned and green forests) and roosting (in green forests). If logging includes cutting down large trees (live or dead), then this also reduces the number of potential Spotted Owl nests. Studies that purportedly showed negative effects of high-severity wildfire on

Spotted Owls actually had substantial amounts of logging in the burned forests after the fire, which means they could not separate the effects of logging from fire. For example, Rockweit et al. (2017) and Jones et al. (2016) both reported negative effects of wildfire, but Spotted Owl territories in their study areas had post-fire logging that was not reported by the authors (see e.g. Hanson et al. 2018 regarding Jones et al. 2016, and Appendix S1 in Lee 2018 regarding both papers). Tempel et al. (2022) also has this same problem – a failure to separate the effects of fire from logging. Lee et al. (2013) did separate these effects on California Spotted Owls in southern California and found that when >50% of a site burned severely, occupancy was reduced, and was further reduced by post-fire logging, but a subsequent analysis (Lee and Bond 2015a) showed that significant adverse effects of severe fire were not evident in high-quality, consistently occupied and productive sites. I recently published a paper demonstrating that logging occurred in 87% of Northern Spotted Owl sites, with many sites logged both before and after fire (Bond et al. 2022). This logging confounds the analysis of effects of fire alone – only 14 of 105 Northern Spotted Owl burned sites (all of the sites for which we were provided data from the U.S. Forests Service upon our request) that we analyzed had experienced fire with no logging during our study period of 2000-2017.

Furthermore, logging projects that would reduce canopy cover and remove trees in older forests will not even reduce the risk of severe wildfire—this logging only exacerbates wildfire risk (see e.g. Bradley et al. 2016, Lesmeister et al. 2019). A Forest Service report on the Hermits Peak Fire in New Mexico was released in late June 2022 (https://wildfiretoday.com/2022/06/22/report-released-for-the-prescribed-fire-that-led-to-the-hermits-peak-fire/) and concluded: "A thinning project in the burn area opened the canopy in some areas, allowing more sunlight which led to lower fuel moistures. Heavy ground fuels resulting from the construction of firelines for the burn project added to the fuel loading. This contributed to higher fire intensities, torching, spotting, and higher resistance-to-control." Therefore, the ostensible "cure" to habitat loss from fire (cure=logging) is actually *causing* habitat loss and is far worse for Spotted Owls than the [non-existent] "problem" (problem=wildfire).

Protecting forests from logging is good for California Spotted Owls. In a meta-analysis of California Spotted Owl territory occupancy in the Sierra Nevada, Tempel et al. (2016) found each incremental reduction in the number of acres of forest with high canopy cover (>70%) within a California Spotted Owl territory increases the probability of territory extinction and reduces territory occupancy. Table 3 (page 757) of that study reports significant effect sizes for canopy cover such that reducing the proportion of a territory (number of acres) with either high or medium canopy cover increases extinction and decreases colonization, resulting in lower occupancy. Figure 3 (page 758) of that study demonstrates this clearly in visual format: for every incremental reduction in the amount (proportion of total acres in a territory) of high canopy cover (>70%) or medium canopy cover (40–69%), there is a reduction in occupancy probability by Spotted Owls. Thus, even if 'thinning'-style logging does not reduce canopy cover below 50% cover, there is still a likely significant negative impact on the Spotted Owl due to the reduction in the amount of high canopy cover forest in the territories that will occur from logging. Wood et al. (2018) monitored 64 California Spotted Owl territories in the Eldorado Study Area over 22 years and found territories with greater amounts of owl habitat were more likely to be recolonized and less likely to go extinct. Owl habitat was defined as >70% canopy cover and quadratic mean diameter of trees >61 cm (24 inches). However, smaller-sized trees <61 cm are also required to provide heterogeneity and ensure an ongoing future supply of larger-sized trees. Medium-sized trees, if they survive, eventually grow into large-sized trees, and in the meantime create heterogeneity of the canopy surface that was described as important for Northern Spotted Owls (Sovern et al. 2019). Sovern et al. (2019) specifically noted that while cover of tall trees was very important, "a combination of old and young trees may be more important than just tall, old trees." Indeed, trees > 8 inches diameter provide important cover in California Spotted Owl nesting stands: in a study of 316 California Spotted Owl territories in four study areas throughout the Sierra Nevada (North et al. 2017), total canopy cover of tall (>48 m) trees was the canopy structure most highly selected for in nest sites and protected activity centers, while cover in lower strata (up to 16 m tall, trees shorter than about 8 inches in diameter) was avoided. We therefore must consider that all tree sizes starting at about 50 feet high (=16 m), which translates to about 8 inches diameter (Won and O'Hara 2001), are important contributors to Spotted Owl suitable habitat. Protecting all large and medium-sized trees from logging would provide the optimal amount of Spotted Owl habitat now and in the future as the medium-sized trees grow into large trees, which will facilitate the recovery of the subspecies. Further, retaining high canopy cover and ensuring a long-term supply of large trees will allow currently vacant territories to be recolonized. Simply put, the more high-canopy cover and big trees now and in the future, the better for California Spotted Owls.

Studies have not only found that Spotted Owls select high canopy, large trees, and heterogeneity of tree sizes, and are less likely to abandon territories with more of those characteristics, but these characteristics are also associated with higher survival and reproduction, which are vital rates that ensure the recovery and persistence of populations. Franklin et al. (2000), Olson et al. (2004), and Dugger et al. (2005) found Northern Spotted Owl survival was correlated with more old forest around nests. Tempel et al. (2014) documented that mechanical thinning, when conducted in high canopy cover forests, is significantly harming California Spotted Owls in the Sierra Nevada. The authors found that "medium-intensity" logging targets dense, mature forests with high canopy cover, degrading the quality of such habitat by reducing it to moderate canopy cover, which leads to lost occupancy, lost reproductive capacity, and/or decreased survival. The amount of forest with high (>70%) canopy cover dominated by medium-or large-sized trees was the most important predictor of variation in demographic rates; this variable occurred in the top-ranked models for survival, territory extinction, and territory colonization rates, and explained far more variation in population growth rate and equilibrium occupancy than other covariates.

Moreover, the authors of the study stated (on page 2103) that the adverse effects of mechanical thinning on Spotted Owls is probably even larger than their results indicated: "Understory removal is generally an important component of fuel-reduction strategies, but we caution that medium-intensity harvesting with understory treatments occurred on only 5.2% of the total area within owl territories, which could have limited our power to detect effects . . ." In other words, the adverse effects of mechanical thinning were apparent even with a relatively small portion of the study area affected by such logging. The authors further noted that when medium-intensity harvests were implemented within high-canopy forests, they reduced the canopy sufficiently for mapped polygons to be reclassified into a lower-canopy vegetation class in 90.1% of these treated areas, and such changes were associated with reductions in survival and territory colonization rates, as well as increases in territory extinction rates. The authors stated (on page

2103): “As a result, we believe the most appropriate inference about the influence of medium-intensity harvesting practices is that they appear to reduce reproductive potential, and when implemented in high-canopy forests, likely reduce survival and territory occupancy as well.” Again, it is important to note that understory removal by mechanical thinning often involves removing trees <61 cm (24 inches) in diameter, which are the medium-sized trees that provide heterogeneity and structure within these older forests and ensure a future supply of large trees—all of which are crucial Spotted Owl habitat elements. Therefore, removing trees >8 inches in owl home ranges will likely have significant adverse effects on California Spotted Owls and might further precipitate the need to list the species under the U.S. Endangered Species Act.

I firmly believe, based on the preponderance of scientific evidence, that logging in Spotted Owl habitats is misguided, and that mature and older forests—and the heterogeneity and structure within the older forests that are provided by all different tree sizes—should be protected from logging [rather than being exempted in a 4(d) special rule] because **(1)** they tend to burn less severely, **(2)** they provide critical habitat for Spotted Owls, and **(3)** the more intact, unlogged older forest is preserved, the more resilient this forest is when a fire does burn (which is inevitable and natural).

Research on fire effects in Northern Spotted Owl habitat (Lesmeister et al. 2019) found that the odds that suitable nesting/roosting habitat would burn at lower severity was 2–3 times higher than the odds it would burn at moderate-to-high severity, and the odds that unsuitable forest burned at moderate-to-high severity was about twice that of suitable nesting/roosting habitat. The authors stated (on page 15) that “thinned forests have more open conditions, which are associated with higher temperatures, lower relative humidity, higher wind speeds, and increasing fire intensity”. Lesmeister et al. (2019) further noted that fire modeling projections are not correct “when the inputs rate older forests with higher relative fire behavior”, because such models “will likely overestimate fire severity and inflate estimated loss of old forests...” (page 15). They also caution that “fire model results can show nesting/roosting habitat has higher burn probabilities and higher crown fire potential than adjacent areas,” but the results of the Lesmeister study as well as other recent studies “show that these older forests in mixed-conifer forest environments are *less susceptible* to high-severity fire than other successional stages, even under high fire weather conditions and with short return intervals < 15 years.” (emphasis added by me.) Therefore, logging intended to reduce fire risk by reducing canopy cover will actually worsen the fire risk.

Furthermore, even if wildfire does burn in Spotted Owl habitat, some Spotted Owls actually prefer to forage in areas impacted by high-severity fire (see Bond et al. 2009, Jones et al. 2020 in the Sierra Nevada) or they use this type of habitat relative to its availability (Bond et al. 2016 in Southern California) and thus can benefit from the fire (Lee 2018, 2020). This is because California Spotted Owls evolved with wildfire in their forests for millennia, even substantially large patches of high-severity fire. Current fire patterns are not adversely impacting Spotted Owl occupancy dynamics in unmanaged forests (Roberts et al. 2011, Schofield et al. 2020). Again, I must stress that post-fire logging, even small amounts, might alter habitat suitability and force owls to abandon sites, and thus it is actually logging rather than fire that might be driving observed loss of occupancy after fire in some sites (e.g. Bond et al. 2022 for NSOs). Lee (2018, 2020) and Hanson et al. (2018) provide further information about the effects of post-fire logging and the amount of post-fire logging in Rockweit et al. (2017) and Jones et al. (2016). Studies of California Spotted Owls showed that when wildfire does burn large portions of a Spotted Owl territory, it tends to cause abandonment only if the territory was marginal before the fire, such as those that were often unoccupied or occupied only by single owls and not pairs (Lee and Bond 2015a). Territories that were continuously occupied and often reproductive showed no tendency to be abandoned even after lots of high-severity fire (Lee and Bond 2015a and b). Thus, researchers who that state that wildfire is the greatest threat to the persistence of Spotted Owls and that forests must be logged to protect them (a sentiment that I am concerned to see repeated in the proposed rule) are not basing this opinion on the best available scientific evidence. I have long advocated against post-fire logging on any public forests, which would allow research into fire effects on Spotted Owls (and other wildlife) without the confounding effects of logging.

Additionally, I note that the impacts of logging on California Spotted Owls do not mimic fire impacts (Seamans and Gutiérrez 2007). Pre-and post-fire logging are different disturbances from high-severity fire and do not provide the same benefits to wildlife (Schieck and Song 2006, Fontaine and Kennedy 2012).

A large body of research has documented over and over again that forests burned by low, moderate, and even high-severity fire that are not post-fire salvage logged can provide suitable foraging habitat for Spotted Owls (Bond et al. 2009, Bond et al. 2016, Comfort et al. 2016, Jones et al. 2020), possibly by increasing abundance and/or access to some of their prey which include dusky-footed woodrats, pocket gophers, and mice. However, to be useful for owls, the burned forests must have enough trees for them to perch upon and locate prey rustling in the ground or shrubs or trees, thus salvage logging of trees after a fire can have negative effects on the ability of owls to use burned forests to find food (see Hanson et al. 2018 for impacts of salvage logging to Spotted Owls). Lee (2018, 2020) provided a comprehensive literature review and meta-analysis of all the effects from every published Spotted Owl and wildfire study and found no significant adverse effects of fire, only positive effects on some aspects of demography and habitat use. One additional study was published after Lee (2018, 2020), Jones et al. (2020), which found California Spotted Owls in the King Fire in the Sierra Nevada selected foraging in small-and medium-sized patches of high-severity burn, but avoided foraging in very large patches of high-severity burn. All of the literature I present here constitutes the best available science and should be thoroughly discussed and objectively analyzed in the proposed rule and any management activities designed to recover the California Spotted Owl.

In sum, a reasonable working hypothesis based on available science and knowledge of Spotted Owl ecology is that **(1)** some amount of high-severity fire within a Spotted Owl core area does not significantly affect occupancy probability (Roberts et al. 2011, Lee et al. 2012, Lee et al. 2013, Lee and Bond 2015a and b) and may even be beneficial to reproduction (Bond et al. 2002, Jenness et al. 2004, Roberts et al. 2011) and foraging (Bond et al. 2009 and 2016, Comfort et al. 2016, Jones et al. 2020), but **(2)** beyond a threshold amount of core area burned by high-severity fire—especially when subjected to post-fire salvage logging—occupancy (Lee et al. 2013) and vital rates (Clark et al. 2011, Jones et al. 2016, Rockweit 2017) may be adversely affected, but this effect is worsened by salvage logging (Hanson et al. 2018, 2021). Certainly, pre- and post-fire logging confounds our understanding of effects of fire alone (Bond et al. 2022). In other words, some degree of early successional habitat created by fire in a territory may enhance short-term Spotted Owl fitness, as long as sufficient old forest habitat is also present for nesting and roosting—and especially when the owl's territory is not salvage logged after fire.

Further, logging can seriously damage the genetic resilience of trees (Spotted Owl habitat) to future drought and insect attacks. Logging to reduce fire severity or insect attacks or mortality from drought is counter-productive because this could be eliminating the very trees that are most genetically resistant to disturbances associated with a warmer, drier climate. As an example, a study conducted in Montana found that survivorship of individual trees during mountain pine beetle outbreaks is genetically based and therefore heritable (Six et al. 2018). The authors stated "the insect outbreak acts as a natural selection event, removing trees most susceptible to the bark beetle and least adapted to warmer, drier conditions." Logging trees is tampering with the evolutionary trajectory of forests and their capacity to adapt to changing conditions. When timber harvesting is conducted in California's forests, there are genetic consequences that are not considered in environmental analyses, which could be devastating for forest resilience—and California Spotted Owl habitat—in a warming world.

We cannot stop droughts or fires or insects because these natural disturbances are climate-driven and can only be addressed by reducing greenhouse gas emissions and global temperatures. We can, however, stop human-driven forest loss in California Spotted Owl habitat from logging and water diversions right now. We can also prioritize funding for ignition-proofing homes and communities instead of wasting money on ineffective and short-lived forest fuels treatments.

Below are some minor comments on the Individual Needs Section.

On page 36, the proposed rule failed to discuss the Bond et al. 2009 and 2016 foraging studies in the section on the importance of habitat heterogeneity. This is a blatant disregard for the available science. The rule cited only Atuo, Hobart, Kramer, Zulla and an in prep study (which is totally inappropriate here, as the public does not have access to this report), but the rule did not include two published studies demonstrating that owls selected burned forests (= habitat heterogeneity) for foraging. I also point out here my concern that the proposed rule incorrectly described the results of Zulla et al. This paper was not able to quantify when a prey item was successfully captured and consumed immediately by the male owls. It only quantified when a prey item was successfully captured and brought to a nest (provisioning), and it was only able to quantify larger prey items. Thus, to state that "high canopy cover from tall trees is associated with higher probability of successful prey capture by California Spotted Owls" is not actually telling the full story—it is associated with higher success of capturing prey that are then taken to the nest, and likely included only the larger-sized prey items. Please change the assessment to reflect the appropriate inference of this study.

Regarding Duchac et al. 2021, this study was not about Spotted Owls and did not present any new research on this species, on page 12 or anywhere in the manuscript. This citation should be removed. Finally, on page 19 of the proposed rule, when discussing diet shifts of Spotted Owls after wildfires, Bond et al. 2013 was not cited. Bond et al. 2013 specifically studied diets in a burned landscape and compared to other nearby unburned study sites and should be included here.

Below are the references I cited in this section of our comment letter:

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IV. The Information and Assumptions USFWS Relies Upon for the Proposed 4(d) Logging Exemption Is Based on Scientific Omissions and Mischaracterizations about the Effect of High-Severity Fire on CSOs.

Below are key scientifically inaccurate and unsound statements upon which USFWS relied to promote the 4(d) rule exemption for commercial logging in CSO habitat in Sierra Nevada forests, based on the claim that high-severity fire is a/the main threat to CSOs. Page references are to pdf pages in the USFWS CSO listing proposal, and quotes from the USFWS CSO listing proposal are in italics, followed by our comments explaining why the assertions are scientifically inaccurate and/or unsound:

P. 44:
It has been observed that large patches of high-severity fire significantly reduce colonization (dispersal), occupancy, and habitat use across the California spotted owl's range (Eyes 2014, p. 42; Tempel et al. 2014b, p. 2089; Jones et al. 2016a, pp. 300, 303–305; Eyes et al. 2017, pp. 381, 384; Jones et al. 2019, p. 26; Jones et al. 2020, entire; Schofield et al. 2020, pp. 5–6; Jones et al. 2021a, p. 5; Tempel et al. 2022, p. 13)

Most of the studies referenced in this quote above, for the proposition that high-severity fire patches harm CSOs, were confounded by post-fire logging, as discussed in detail in Hanson et al. (2018). The negative effects reported were from post-fire logging, not high-severity fire, as established in (Hanson et al. 2018). USFWS mischaracterizes and misleadingly references Eyes et al. (2017) and Schofield et al. (2020), neither of which can be cited for the proposition posed above by USFWS. On this point, below are quotes from the findings of Hanson et al. (2021) regarding Eyes et al. (2017):

> Eyes et al. (2017) found that the odds of spotted owls using "high contrast edges" created by high-severity fire for foraging "were 2.8 times greater than odds for the low contrast edge type and 3.5 times greater than for the no edge type". The authors reported a reduction (4%) in the probability of use from the lowest to the highest fire severity index, but there was nearly equivalent evidence (weight) for models that had no fire effect relative to models that included a fire effect. However, Eyes et al. did not analyze the interaction of distance with fire severity.
>
> Figure 1 of Eyes et al. shows that, in most of the owl sites analyzed by the authors, high-severity fire patches were several hundred meters to >1 km from site centers. In the three spotted owl sites in Eyes et al. for which the owls had access to high-severity fire areas in reasonable proximity to site centers, the owls actively foraged in the high-severity fire patches (Eyes et al. 2017).
>
> Moreover, Eyes et al. under-reported foraging in snag forest habitat created by high-severity fire in two of these three territories. Numerous foraging locations were in high-severity fire patches created by an earlier fire (the 1990 A-Rock fire) that subsequently reburned at low/moderate-severity (compare Figure 1 of Eyes et al. 2017 with Figure 2 of van Wagtendonk and Lutz 2007 [45]) within 19 years or less after the 1990 fire, and decades before natural succession would transition the snag forest habitat into mid-successional forest [46].

And, below are quotes from the findings of Hanson et al. (2018) regarding Schofield et al. (2020):

> Schofield et al. (2020) [11]—this study investigated California spotted owl occupancy before and after the Rim fire of 2013 in Yosemite National Park within areas protected from logging (no pre-fire or post-fire logging). They found 11 occupied spotted owl territories during a ten-year survey period before the Rim fire (2004-2013) and 12 occupied territories during a three-year survey period in the same area after the Rim fire (Schofield et al. 2020, Figure 1). Based on this, the authors concluded that, in these areas that were not subjected to post-fire logging, this large mixed-intensity fire did not adversely affect spotted owl occupancy.

P. 45:
As discussed above, high-severity fire has negative effects on individual California spotted owls and their habitat, ranging from reduced occupancy to direct mortality of individuals. However, several publications conclude that spotted owls will continue to use areas burned at high-severity and, therefore, there are no negative effects of high-severity fire for California spotted owls (Lee and Bond 2015, entire; Hanson et al. 2018, entire; Hanson et al. 2021, entire; Lee 2018, entire). We have reviewed these publications and acknowledge this disagreement in the literature. However, our review of all the best available science, including those sources that conclude no negative effects, has led us to agree with the vast majority of science, which concludes that overall spotted owls avoid large patches of high-severity fire and that high-severity fire is increasing throughout California and the western United States. For more analysis on the conflicting results of these studies and our analysis, please see the SSA report (Service 2022, pp. 27– 28).

USFWS's "review" of the science glaringly omits the Lee (2020) meta-analysis (see citation and discussion of this study in Section III above). Lee (2020) was a response to a reply to Lee (2018) and contained additional comprehensive analyses of the effects of high-severity fire on spotted owls, including CSO, in the absence of the confounding influence of post-fire logging, and included 20 fires and hundreds of spotted owl sites. Lee (2020) found no negative effect of large mixed-severity fires on spotted owls and, in fact, reported numerically positive (though not statistically significant) effects. The Lee (2018) meta-analysis reported a significant positive effect of high-severity fire on spotted owl reproduction. Lee (2020) addressed all suggested critiques from Jones et al. (2020) and the Lee (2018) results were robust to re-analysis.

Lee (2018), Lee (2020), and Hanson et al. (2021) analyzed far more data than the combination of all of the studies referenced by USFWS for the proposition that high-severity fire is a threat to CSOs. That is objective fact. Therefore, USFWS's claim that the "vast majority of science" supports their assumption, that high-severity fire is a threat to CSO, is patently false.

P. 46:

Between the years of 2000 and 2014, 7 percent of suitable California spotted owl nesting habitat (a total of 85,046 ha (210,153 ac) out of 1,166,560 ha (2,882,633 ac)) was burned either partially at moderate severity (typically 25–50 percent tree basal area mortality) or entirely at high severity (typically >75 percent tree basal area mortality), causing ≥ 50 percent tree basal area mortality and reducing canopy cover to <25 percent (Stephens et al. 2016, pp. 1, 9).

As discussed immediately above, the comprehensive Lee (2018) and Lee (2020) meta-analyses found no negative effect of large mixed-severity fires, or high-severity fire, on spotted owls. These meta-analyses include far more data than the studies cited by USFWS for the proposition that high-severity fire is a threat to CSOs—studies that have been discredited scientifically for confounding post-fire logging and high-severity fire (Hanson et al. 2021).

P. 47:

Based on fire activity and anticipated trends over the next 75 years, the cumulative amount of nesting habitat burned at ≥ 50 percent tree basal area mortality will exceed the total existing habitat in the Sierra Nevada (Stephens et al. 2016, pp. 1, 12). In other words, the loss of suitable California spotted owl habitat would exceed the rate of new forest growing post-fire (Stephens et al. 2016, pp. 11–13).

Stephens et al. (2016) grossly misrepresented future wildfire and high-severity fire trends predicted by climate scientists. On the pages of this study cited above by USFWS, specifically p. 11 of that study, Stephens et al. (2016) rely on Westerling et al. (2011) for their claim about dramatically increased future fire. However, Figure 5 of Westerling et al. (2011) predicts that, by the year 2085, there will be two to three times more wildfire in the Sierra Nevada forests than in 1975. The y-axis of Figure 4 of Stephens et al. (2016) shows the square root of the area of CSO habitat burned in wildfires in different years. That square root is 40 hectares for 1975, equating to a total annual area of CSO habitat affected by wildfire of 1600 hectares during that time period. Even tripling that amount by 2085 would equate to only about 5000 hectares of CSO habitat burned by wildfire per year on average. Stephens et al. (2016) also report, in Figure 4, that less than one-half of the total area burned has ≥50% basal area mortality from fire. So, from Westerling et al. (2011), that would equate to approximately 2500 hectares of CSO nesting/roosting habitat burned at higher severity per year by 2085, on average (as with all averages, this includes big fire years and years with very little CSO habitat burned at higher severity). Yet Stephens et al. (2016), in Figure 5, shows nearly 1,100,000 hectares of CSO nesting/roosting habitat being burned by higher-severity fire per year by 2085—a level that is over 400 times higher than that predicted by climate scientists in Westerling et al. (2011), the very study that Stephens et al. (2016) ostensibly relied upon. One might ask whether Stephens et al. (2016) offer some other explanation for the graph in Figure 5 of that study. The answer is no. Nowhere in the Methods section of Stephens et al. (2016) is there any mention of predictions of future fire levels, nor are any data or scientific evidence whatsoever offered to support the future fire extents shown in Figure 5 of Stephens et al. (2016). Notably, in the Acknowledgements section of Stephens et al. (2016), the authors state that they are funded by the U.S. Forest Service, an agency that is financially involved in, and financially benefits from, commercial logging on national forests. Predictably, Stephens et al. (2016) promotes more logging on public lands as a supposed measure to curb wildfires. Stephens et al. (2016) does not represent best available science.

PP. 47-48:
Between 1984–2019, 1,084,171 ha (2,679,044 ac; 55.7 percent) burned throughout the California spotted owl range in the Sierra Nevada with 317,605 ha (784,820 ac; 46.6 percent) burned at high severity (Keane in litt. 2022, p. 3). In contrast, between 2020 and 2021, 862,625 ha (2,131,593 ac; 44.3 percent) burned throughout the California spotted owl's range with almost 363,812 ha (899,000 ac; 53.4 percent) of that at high severity (Keane in litt. 2022, p. 3). This comparison illustrates how megafires in 2020 and 2021 burned more habitat at high severity in 2 years than fires over the past three and a half decades. In addition, between 1984 and 2021, 50 percent of California spotted owl PAC acres have been impacted by wildfire, with 56 percent of that total burned in 2020 and 2021. Further, of the 56 percent that burned between 2020 and 2021, 65 percent burned at high severity (Keane in litt. 2022, p. 5). Because California spotted owls are displaced from areas where the entire PAC or majority of the PAC has burned at high severity, it is unlikely the species will continue to persist in these areas until the habitat can recover, which can take decades.

We conducted a fire severity analysis within the entire California spotted owl's range; details of the methodology used in this analysis are available in the SSA report (Service 2022, pp. 29–30). Of the California spotted owl's range, approximately 47 percent burned between 1984 and 2021, with 15 percent at high severity. Most of the area burned at high severity occurred in 2020 and 2021, with 2 percent and 4 percent, respectively (Service 2022, table 3). Additionally, based on an existing dataset from the California Department of Forestry and Fire Protection of the potential threat of future wildfire in California, the majority of the California spotted owl's range occurs within the very high wildfire threat category (Service 2022, figure 8).

Keane in litt. (2022) has not been peer-reviewed or published. It does not represent best available science, and the claims by USFWS based on this unpublished document cannot be verified, nor can the accuracy of the methods and conclusions of Keane in litt. (2022) be verified. Moreover, we know that CSO reproduction benefits from high-severity fire (Lee 2018), and that CSO occupancy in very large, intense wildfires that are not post-fire logged can be as high or higher than in unburned mature/old forest in the absence of or prior to wildfire occurrence (Lee and Bond 2015, Schofield et al. 2020). There are no data yet on CSO occupancy following the 2020 and 2021 wildfire seasons, within biological home ranges that have not been salvage logged. According to USFWS's own analysis, described above, less than half of CSO habitat has burned at all since 1984, and only 15% of the 47% that has burned since 1984 experienced high-severity fire—i.e., only 7% of all CSO habitat in California has experienced high-severity fire over the past 4 decades, and 93% has not. How can high-severity fire be the main threat to CSOs when 93% of CSO habitat has not been affected by high-severity fire over the past 4 decades, and when 100% of the scientific studies that have analyzed the influence of high-severity fire, in the absence of the confounding impact of post-fire logging, have found neutral or positive effects of high-severity fire (See extensive analyses of dozens of scientific studies in Lee 2020 and Hanson et al. 2021)?

PP. 50-51:
Between 2010 and 2016, an estimated 102 million trees died across about 3,106,367 ha (7,676,000 ac) throughout California (Tree Mortality Task Force 2017, p. 2). By February 2019, total tree mortality in California increased to an estimated 147 million dead trees (Cal Fire and USFS 2019, p. 1). The latest estimate shows that between 2010 and 2021, the drought combined with subsequent beetle attacks resulted in approximately 173 million dead trees in California with approximately 3.3 percent of the surveyed forest area in 2021 showing signs of elevated mortality (USFS 2021, p. 5). The tree mortality events are particularly severe in the southern Sierra Nevada area. Most of the tree mortality observed is due to effects from the 2012–2016 drought, with less mortality occurring from 2018–2021; however, another drought period started in 2020 (USFS 2021, p. 5).

This claim is factually false. The Forest Service itself has admitted that their aerial tree mortality surveys exaggerate tree mortality dramatically, often by tenfold or more relative to true figures from field data, as shown in Figure 12.3 of Slaton et al. (2021).

PP. 103-104:
High-severity wildfire is one of the most significant threats currently affecting the California spotted owl and its habitat, including the Sierra Nevada DPS. The Sierra Nevada DPS occurs within a very high wildfire threat category. Approximately 47 percent of the California spotted owl's range burned between 1984 and 2021, with 15 percent burned at high severity. Most of the area burned at high severity occurred in 2020 and 2021. In the Sierra Nevada DPS specifically, over 1,000,000 ha (2,500,000 ac) burned between 1984–2019, with 317,605 ha (784,820 ac) burned at high severity (Keane in litt. 2022, p. 3). Areas burned at high fire severity can take decades to recover. Based on fire activity data from 2000 through 2014, the cumulative amount of fire burned at high severity within the next 75 years could exceed total existing habitat in the Sierra Nevada, such that the loss of suitable habitat may exceed the rate of new habitat growing post-fire (Stephens et al. 2016, pp. 1, 11–13).

See the discussion above addressing the USFWS figure regarding 47% of CSO habitat burned since 1984, with 15% high-severity fire, and regarding the Keane in litt. (2022) unpublished report, as well as the wildly inaccurate and baseless figures reported in Stephens et al. (2016).

V. The Information and Assumptions USFWS Relies Upon for the Proposed 4(d) Logging Exemption Is Based on Scientific Omissions and Mischaracterizations about the Effectiveness of "Fuels Reduction" Forest Management, Including Clearcutting, Mechanical Thinning, and Salvage Logging, in Reducing Fire Severity and Curbing High-Severity Effects.

Below are key scientifically inaccurate and unsound statements upon which USFWS relied to promote the 4(d) rule exemption for commercial logging in CSO habitat in Sierra Nevada forests, based on the claim that logging, including clearcutting, mechanical thinning, and salvage logging, effectively reduces overall wildfire severity. Page references are to pdf pages in the USFWS CSO listing proposal, and quotes from the USFWS CSO listing proposal are in italics, followed by our comments explaining why the assertions are scientifically inaccurate and/or unsound:

P. 48:
Wildfire fuel reduction treatments, such as prescribed fire and mechanical thinning, can reduce the amount or degree of spotted owl habitat loss from a high-severity fire, and a balanced approach to fuel reduction treatments may ensure suitable California spotted owl habitat is maintained (Jones et al. 2016a, p. 305; Service 2017, pp. 24–25; Chiono et al. 2017, p. 1; Jones et al. 2021a, entire).

P. 61:
When conducted outside California spotted owl activity centers, mechanical thinning will likely reduce the amount of damage the habitat may experience due to high-severity fire while also minimizing short-term habitat impacts (Stephens et al. 2014, p. 904; Tempel et al. 2015, p. 1; Chiono et al. 2017, p. 1).

Neither Jones et al. (2016a), Jones et al. (2021a), Stephens et al. (2014), nor Tempel et al. (2015) included any empirical data regarding the extent to which mechanical thinning reduces fire severity. Chiono et al. (2017) claimed that mechanical thinning provides a net benefit for CSOs, ostensibly by thinning saving more trees than it kills, but this was a theoretical modeling study with zero empirical data to support the self-serving assumptions in favor of logging.

Every single data-based (not hypothetical) scientific study that has investigated this issue has found that mechanical thinning kills far more trees than it prevents from being killed, and thinning dramatically increases forest carbon loss and emissions relative to wildfire alone (Campbell et al. 2012, Harmon et al. 2022, Bartowitz et al. 2022, Hanson 2022, Baker and Hanson 2022).

Further, this passage is a serious misrepresentation of the results of Stephens et al. (2014). Stephens et al. (2014) (pp. 902-903) reported that mechanical thinning was associated with a shocking 43% decline in CSO occupancy over just several years, and the authors (p. 904) noted the following:

> Our ability to optimize heterogeneity at large scales may be more effectively achieved with prescribed and managed fires that are allowed to burn under moderate weather

> conditions. This type of burn often produces variable forest conditions that mimic historic patterns (Collins et al. 2011) to which this fauna, including the CSO, has adapted.

Why does USFWS fail to acknowledge the huge loss of CSO occupancy associated with mechanical thinning, as well as the caution by the authors of Stephens et al. (2014) that, rather than mechanical thinning, conservation of CSOs would be better achieved through prescribed fire and managed wildfires?

P. 63:
Salvage logging in certain instances may also be necessary to reduce future fire severity as high levels of dead biomass are associated with high-severity fire (Lydersen et al. 2019, p. 7; Stephens et al. 2022, p. 8)

Stephens et al. (2022) is not best available science. Stephens et al. (2022) used theoretical modeling, not actual data, to present the argument that the largest day of growth of the Creek fire was September 6, 2020, and was associated with high snag densities from drought and earlier fires, claiming that fire weather was secondary, ostensibly because the most severe weather was on September 5, 2020, which Stephens et al. (2022) claimed had relatively little fire growth. Stephens et al. (2022) claimed that the Creek fire's biggest day, September 6, 2020, trapped over 100 people as the fire reached and passed Mammoth Pool Reservoir. To draw this conclusion, Stephens et al. (2022) ignored readily available (in GIS layers) and aerially-verified daily fire maps produced by the U.S. Forest Service—data which clearly show that September 5, 2020, not September 6th, was by a substantial margin the biggest day of growth of the fire and was the day on which the Creek fire reached and passed Mammoth Pool Reservoir. The authors also ignored an abundance of local and national news coverage discussing the fact that the Creek fire had reached, and passed, Mammoth Pool on the afternoon of September 5, 2020, trapping a large number of people; this includes an interview with Scott Stephens, the lead author of Stephens et al. (2022). Below are links to this news and social media coverage, definitively documenting that the fire reached Mammoth Pool on the 5th of September, not the 6th:

https://www.listennotes.com/bg/podcasts/kqeds-the/200-people-airlifted-to-qRCY5t2UiO-/

https://kmph.com/news/instagram/creek-fire-traps-150-people-at-mammoth-pool-in-madera-county

https://www.yourcentralvalley.com/news/creek-fire-hundreds-trapped-near-mammoth-pool-exit-road-blocked-due-to-fire/

https://wildfiretoday.com/2020/09/06/creek-fire-reaches-mammoth-pool-reservoir-military-helicopters-rescue-over-150-people/

https://www.visaliatimesdelta.com/story/news/2020/09/06/creek-fire-california-survivor-rescued-mammoth-pool-reservoir/5735661002/

https://www.sfgate.com/california-wildfires/article/mammoth-pool-reservoir-sierra-wildfire-rescues-15550093.php

https://twitter.com/sfchronicle/status/1302408923429974016

https://www.latimes.com/california/story/2020-09-06/dramatic-night-airlift-rescues-scores-of-victims-trapped-by-creek-fire-at-mammoth-pool

https://static1.squarespace.com/static/58d2aed0d482e95d297d64e9/t/60f9aada1cd49e602c89b5eb/1626974949769/3+Days+of+the+Creek+Fire+by+Jen+Casner.pdf

https://www.thedailybeast.com/military-helicopters-rescue-dozens-trapped-by-creek-fire-at-mammoth-pool

The results of Lydersen et al. (2019) are merely a tautology that has little or nothing to do with fire effects to conifer forests as a function of snag/log density. Lydersen et al. (2019) report that high-severity fire patches from the Storrie fire of 2000 had higher snag and downed log densities than lower-severity areas prior to re-burning in the 2012 Chips fire. In other words, they reported that a higher proportion of trees are killed in high-severity fire areas, which is the literal definition of higher-severity fire. They then reported that such areas re-burned with somewhat higher severity than low/moderate-severity areas in the 2012 Chips fire, but they acknowledged that these areas were montane chaparral, not conifer forest, after high-severity fire in the 2000 Storrie fire (it takes longer than 12 years for natural post-fire conifer regeneration to replace montane chaparral as the dominant vegetation in the vast majority of areas). Chaparral naturally burns mostly at high severities, so Lydersen et al. (2019) stands for a triple-tautology proposition that higher-severity fire kills more trees, creates a natural succession stage of montane chaparral that naturally burns at higher severities, and if such areas re-burn shortly after the last fire, montane chaparral will burn as it typically does: hot. The snag/log density issue is a classic case of a third variable that has no causal effect.

Perhaps more importantly, there is an enormous body of scientific evidence finding that logging, including mechanical thinning and post-fire logging, tend to increase, not decrease, overall wildfire severity, and that no tree removal is needed prior to conducting prescribed burning (such burning is simply done in mild fire weather, regardless of the density of the forest). Below is a list of some of these sources (sources co-authored by the U.S. Forest Service are noted):

Morris, W.G. (**U.S. Forest Service**). 1940. Fire weather on clearcut, partly cut, and virgin timber areas at Westfir, Oregon. Timberman 42: 20-28.

> "This study is concerned with one of these factors - the fire-weather conditions near ground level - on a single operation during the first summer following logging. These conditions were found to be more severe in the clear-cut area than in either the heavy or light partial cutting areas and more severe in the latter areas than in virgin timber."

Countryman, C.M. (**U.S. Forest Service**). 1956. Old-growth conversion also converts fire climate. Fire Control Notes 17: 15-19.

> "Although the general relations between weather factors, fuel moisture, and fire behavior are fairly well known, the importance of these changes following conversion and their combined effect on fire behavior and control is not generally recognized. The term 'fireclimate,' as used here, designates the environmental conditions of weather and fuel moisture that affect fire behavior. It does not consider fuel created by slash because regardless of what forest managers do with slash, they still have to deal with the new fireclimate. In fact, the changes in wind, temperature, humidity, air structure, and fuel moisture may result in greater changes in fire behavior and size of control job than does the addition of more fuel in the form of slash."
>
> "Conversion which opens up the canopy by removal of trees permits freer air movement and more sunlight to reach the ground. The increased solar radiation in turn results in higher temperatures, lower humidity, and lower fuel moisture. The magnitude of these changes can be illustrated by comparing the fireclimate in the open with that in a dense stand."
>
> "A mature, closed stand has a fireclimate strikingly different from that in the open. Here nearly all of the solar radiation is intercepted by the crowns. Some is reflected back to space and the rest is converted to heat and distributed in depth through the crowns. Air within the stand is warmed by contact with the crowns, and the ground fuels are in turn warmed only by contact with the air. The temperature of fuels on the ground thus usually approximates air temperature within the stand."
>
> "Temperature profiles in a dense, mixed conifer stand illustrate this process (fig. 2). By 8 o'clock in the morning, air within the crowns had warmed to 68° F. Air temperature near the ground was only 50°. By 10 o'clock temperatures within the crowns had reached 82° and, although the heat had penetrated to lower levels, air near the surface at 77° was still cooler than at any other level. At 2:00 p.m., air temperature within the stand had become virtually uniform at 87°. In the open less than one-half mile away, however, the temperature at the surface of pine litter reached 153° at 2:00 p.m."
>
> "Because of the lower temperature and higher humidity, fuels within the closed stand are more moist than those in the open under ordinary weather conditions. Typically, when moisture content is 3 percent in the open, 8 percent can be expected in the stand."

"Moisture and temperature differences between open and closed stands have a great effect on both the inception and the behavior of fire. For example, fine fuel at 8-percent moisture content will require nearly one-third more heat for ignition than will the same fuel at 3-percent moisture content. Thus, firebrands that do not contain enough heat to start a fire in a closed stand may readily start one in the open."

"When a standard fire weather station in the open indicates a temperature of 85° F., fuel moisture of 4 percent, and a wind velocity of 15 m.p.h.--not unusual burning conditions in the West--a fire starting on a moderate slope will spread 4.5 times as fast in the open as in a closed stand. The size of the suppression job, however, increases even more drastically."

"Greater rate of spread and intensity of burning require control lines farther from the actual fire, increasing the length of fireline. Line width also must be increased to contain the hotter fire. Less production per man and delays in getting additional crews complicate the control problem on a fast-moving fire. It has been estimated that the size of the suppression job increases nearly as the square of the rate of forward spread. Thus, fire in the open will require 20 times more suppression effort. In other words, for each man required to control a surface fire in a mature stand burning under these conditions, 20 men will be required if the area is clear cut."

"Methods other than clear cutting, of course, may bring a less drastic change in fireclimate. Nevertheless, the change resulting from partial cutting can have important effects on fire. The moderating effect that a dense stand has on the fireclimate usually results in slow-burning fires. Ordinarily, in dense timber only a few days a year have the extreme burning conditions under which surface fires produce heat rapidly enough to carry the fire into the crowns. Partial cutting can increase the severity of the fireclimate enough to materially increase the number of days when disastrous crown fires can occur."

SNEP (**co-authored by U.S. Forest Service**). 1996. Sierra Nevada Ecosystem Project, Final Report to Congress: Status of the Sierra Nevada. Vol. I: Assessment summaries and management strategies. Davis, CA: University of California, Davis, Center for Water and Wildland Resources.

"Timber harvest, through its effects on forest structure, local microclimate, and fuel accumulation, has increased fire severity more than any other recent human activity."

Beschta, R.L.; Frissell, C.A.; Gresswell, R.; Hauer, R.; Karr, J.R.; Minshall, G.W.; Perry, D.A.; Rhodes, J.J. 1995. Wildfire and salvage logging. Eugene, OR: Pacific Rivers Council.

"We also need to accept that in many drier forest types throughout the region, forest management may have set the stage for fires larger and more intense than have occurred in at least the last few hundred years."

"With respect to the need for management treatments after fires, there is generally no need for urgency, nor is there a universal, ecologically-based need to act at all. By acting quickly, we run the risk of creating new problems before we solve the old ones."

"[S]ome argue that salvage logging is needed because of the perceived increased likelihood that an area may reburn. It is the fine fuels that carry fire, not the large dead woody material. We are aware of no evidence supporting the contention that leaving large dead woody material significantly increases the probability of reburn."

Chen, J., et al. (**co-authored by U.S. Forest Service**). 1999. Microclimate in forest ecosystem and landscape ecology: Variations in local climate can be used to monitor and compare the effects of different management regimes. BioScience 49: 288–297.

When moving from open forest areas, resulting from logging, and into dense forests with high canopy cover, "there is generally a decrease in daytime summer temperatures but an increase in humidity…"

The authors reported a 5° C difference in ambient air temperature between a closed-canopy mature forest and a forest with partial cutting, like a commercial thinning unit (Fig. 4b), and noted that such differences are even greater than the increases in temperature predicted due to anthropogenic climate change.

Dombeck, M. (**U.S. Forest Service Chief**). 2001. How Can We Reduce the Fire Danger in the Interior West. Fire Management Today 61: 5-13.

"Some argue that more commercial timber harvest is needed to remove small-diameter trees and brush that are fueling our worst wildlands fires in the interior West. However, small-diameter trees and brush typically have little or no commercial value. To offset losses from their removal, a commercial operator would have to remove large, merchantable trees in the overstory. Overstory removal lets more light reach the forest floor, promoting vigorous forest regeneration. Where the overstory has been entirely removed, regeneration produces thickets of 2,000 to 10,000 small trees per acre, precisely the small-diameter materials that are causing our worst fire problems. In fact, many large fires in 2000 burned in previously logged areas laced with roads. It seems unlikely that commercial timber harvest can solve our forest health problems."

Morrison, P.H. and K.J. Harma. 2002. Analysis of Land Ownership and Prior Land Management Activities Within the Rodeo & Chediski Fires, Arizona. Pacific Biodiversity Institute, Winthrop, WA. 13 pp.

Previous logging was associated with higher fire severity.

Donato DC, Fontaine JB, Campbell JL, Robinson WD, Kauffman JB, Law BE. 2006. *Science* 311: 352.

> "In terms of short-term fire risk, a reburn in [postfire] logged stands would likely exhibit elevated rates of fire spread, fireline intensity, and soil heating impacts…Postfire logging alone was notably incongruent with fuel reduction goals."

Hanson, C.T., Odion, D.C. 2006. Fire Severity in mechanically thinned versus unthinned forests of the Sierra Nevada, California. In: Proceedings of the 3rd International Fire Ecology and Management Congress, November 13-17, 2006, San Diego, CA.

> "In all seven sites, combined mortality [thinning and fire] was higher in thinned than in unthinned units. In six of seven sites, fire-induced mortality was higher in thinned than in unthinned units…Mechanical thinning increased fire severity on the sites currently available for study on national forests of the Sierra Nevada."

Platt, R.V., et al. 2006. Are wildfire mitigation and restoration of historic forest structure compatible? A spatial modeling assessment. Annals of the Assoc. Amer. Geographers 96: 455-470.

> "Compared with the original conditions, a closed canopy would result in a 10 percent reduction in the area of high or extreme fireline intensity. In contrast, an open canopy [from thinning] has the opposite effect, increasing the area exposed to high or extreme fireline intensity by 36 percent. Though it may appear counterintuitive, when all else is equal open canopies lead to reduced fuel moisture and increased midflame windspeed, which increase potential fireline intensity."

Thompson, J.R., Spies, T.A., Ganio, L.M. (**co-authored by U.S. Forest Service**). 2007. Reburn severity in managed and unmanaged vegetation in a large wildfire. Proceedings of the National Academy of Sciences of the United States of America 104: 10743–10748.

> "Areas that were salvage-logged and planted after the initial fire burned more severely than comparable unmanaged areas."

Cruz, M.G, and M.E. Alexander. 2010. Assessing crown fire potential in coniferous forests of western North America: A critique of current approaches and recent simulation studies. Int. J. Wildl. Fire. 19: 377–398.

> The fire models used by the U.S. Forest Service falsely predict effective reduction in crown fire potential from thinning:
>
> "Simulation studies that use certain fire modelling systems (i.e. NEXUS, FlamMap, FARSITE, FFE-FVS (Fire and Fuels Extension to the Forest Vegetation Simulator), Fuel

Management Analyst (FMAPlus), BehavePlus) based on separate implementations or direct integration of Rothermel's surface and crown rate of fire spread models with Van Wagner's crown fire transition and propagation models are shown to have a significant underprediction bias when used in assessing potential crown fire behaviour in conifer forests of western North America. The principal sources of this underprediction bias are shown to include: (i) incompatible model linkages; (ii) use of surface and crown fire rate of spread models that have an inherent underprediction bias; and (iii) reduction in crown fire rate of spread based on the use of unsubstantiated crown fraction burned functions. The use of uncalibrated custom fuel models to represent surface fuelbeds is a fourth potential source of bias."

Thompson, J., and T.A. Spies (**co-authored by U.S. Forest Service**). 2010. Exploring Patterns of Burn Severity in the Biscuit Fire in Southwestern Oregon. Fire Science Brief 88: 1-6.

"Areas that burned with high severity…in a previous wildfire (in 1987, 15 years prior) were more likely to burn with high severity again in the 2002 Biscuit Fire. Areas that were salvage-logged and planted following the 1987 fire burned with somewhat higher fire severity than equivalent areas that had not been logged and planted."

Graham, R., et al. (**U.S. Forest Service**). 2012. Fourmile Canyon Fire Findings. Gen. Tech. Rep. RMRS-GTR-289. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 110 p.

Thinned forests "were burned more severely than neighboring areas where the fuels were not treated", and 162 homes were destroyed by the Fourmile Canyon Fire (see Figs. 45 and 46).

DellaSala et al. (2013) (letter from over 200 scientists):

"Numerous studies also document the cumulative impacts of post-fire logging on natural ecosystems, including…accumulation of logging slash that can add to future fire risks…"

DellaSala et al. (2015) (letter from over 200 scientists):

"Post-fire logging has been shown to eliminate habitat for many bird species that depend on snags, compact soils, remove biological legacies (snags and downed logs) that are essential in supporting new forest growth, and spread invasive species that outcompete native vegetation and, in some cases, increase the flammability of the new forest. While it is often claimed that such logging is needed to restore conifer growth and lower fuel hazards after a fire, many studies have shown that logging tractors often kill most conifer seedlings and other important re-establishing vegetation and actually increases flammable logging slash left on site. Increased chronic sedimentation to streams due to the extensive road network and runoff from logging on steep slopes degrades aquatic organisms and water quality."

North, M.P., S.L. Stephens, B.M. Collins, J.K. Agee, G. Aplet, J.F. Franklin, and P.Z. Fule (**co-authored by U.S. Forest Service**). 2015. Reform forest fire management. Science 349: 1280-1281.

"…fire is usually more efficient, cost-effective, and ecologically beneficial than mechanical treatments."

Bradley, C.M. C.T. Hanson, and D.A. DellaSala. 2016. Does increased forest protection correspond to higher fire severity in frequent-fire forests of the western USA? Ecosphere 7: article e01492.

In the largest study on this subject ever conducted in western North American, the authors found that the more trees that are removed from forests through logging, the higher the fire severity overall:

"We investigated the relationship between protected status and fire severity using the Random Forests algorithm applied to 1500 fires affecting 9.5 million hectares between 1984 and 2014 in pine (*Pinus ponderosa*, *Pinus jeffreyi*) and mixed-conifer forests of western United States, accounting for key topographic and climate variables. We found forests with higher levels of protection [from logging] had lower severity values even though they are generally identified as having the highest overall levels of biomass and fuel loading."

Lesmeister, D.B., et al. (**co-authored by U.S. Forest Service**). 2019. Mixed-severity wildfire and habitat of an old-forest obligate. Ecosphere10: Article e02696.

Denser, older forests with high canopy cover had lower fire severity.

Dunn, C.J., et al. 2020. How does tree regeneration respond to mixed-severity fire in the western Oregon Cascades, USA? Ecosphere 11: Article e03003.

Forests that burned at high-severity had lower, not higher, overall pre-fire tree densities.

Meigs, G.W., et al. (**co-authored by U.S. Forest Service**). 2020. Influence of topography and fuels on fire refugia probability under varying fire weather in forests of the US Pacific Northwest. Canadian Journal of Forest Research 50: 636-647.

Forests with higher pre-fire biomass are more likely to experience low-severity fire.

Moomaw et al. (2020) (letter from over 200 scientists: https://johnmuirproject.org/2020/05/breaking-news-over-200-top-u-s-climate-and-forest-scientists-urge-congress-protect-forests-to-mitigate-climate-crisis/):

> "Troublingly, to make thinning operations economically attractive to logging companies, commercial logging of larger, more fire-resistant trees often occurs across large areas. Importantly, mechanical thinning results in a substantial net loss of forest carbon storage, and a net increase in carbon emissions that can substantially exceed those of wildfire emissions (Hudiburg et al. 2013, Campbell et al. 2012). Reduced forest protections and increased logging tend to make wildland fires burn *more* intensely (Bradley et al. 2016). This can also occur with commercial thinning, where mature trees are removed (Cruz et al. 2008, Cruz et al. 2014). As an example, logging in U.S. forests emits 10 times more carbon than fire and native insects combined (Harris et al. 2016). And, unlike logging, fire cycles nutrients and helps increase new forest growth."

Moomaw et al. (2021) (letter from over 200 scientists: https://bit.ly/3BFtIAg):

> "[C]ommercial logging conducted under the guise of "thinning" and "fuel reduction" typically removes mature, fire-resistant trees that are needed for forest resilience. We have watched as one large wildfire after another has swept through tens of thousands of acres where commercial thinning had previously occurred due to extreme fire weather driven by climate change. Removing trees can alter a forest's microclimate, and can often increase fire intensity. In contrast, forests protected from logging, and those with high carbon biomass and carbon storage, more often burn at equal or lower intensities when fires do occur."

Lesmeister, D.B., et al. (**co-authored by U.S. Forest Service**). 2021. Northern spotted owl nesting forests as fire refugia: a 30-year synthesis of large wildfires. Fire Ecology 17: Article 32.

> More open forests with lower biomass had higher fire severity, because the type of open, lower-biomass forests resulting from thinning and other logging activities have "hotter, drier, and windier microclimates, and those conditions decrease dramatically over relatively short distances into the interior of older forests with multi-layer canopies and high tree density…"

Stephens, S.L., et al. (**co-authored by U.S. Forest Service**). 2021. Forest Restoration and Fuels Reduction: Convergent or Divergent? BioScience 71: 85-101.

While the authors continued to promote commercial thinning, they acknowledged that commercial thinning causes wildfires to move faster and become larger more quickly:

"Interestingly, surface fire rate of spread increased after restoration and fuel treatments [commercial thinning] relative to the untreated stand. This increased fire rate of spread following both treatment types is due to a combination of higher mid-flame wind speeds and a greater proportion of grass fuels, which result from reductions to canopy cover."

Hanson, C.T. 2021. Is "Fuel Reduction" Justified as Fire Management in Spotted Owl Habitat? Birds 2: 395-403.

"Within the forest types inhabited by California Spotted Owls, high-severity fire occurrence was not higher overall in unmanaged forests and was not associated with the density of pre-fire snags from recent drought in the Creek Fire, contrary to expectations under the fuel reduction hypothesis. Moreover, fuel-reduction logging in California Spotted Owl habitats was associated with higher fire severity in most cases. The highest levels of high-severity fire were in the categories with commercial logging (post-fire logging, private commercial timberlands, and commercial thinning), while the three categories with lower levels of high-severity fire were in forests with no recent forest management or wildfire, less intensive noncommercial management, and unmanaged forests with re-burning of mixed-severity wildfire, respectively."

Hanson, C.T. 2022. Cumulative severity of thinned and unthinned forests in a large California wildfire. Land 11: Article 373.

"Using published data regarding the percent basal area mortality for each commercial thinning unit that burned in the Antelope fire, combined with percent basal area mortality due to the fire itself from post-fire satellite imagery, it was found that commercial thinning was associated with significantly higher overall tree mortality levels (cumulative severity)."

Baker, B.C., and C.T. Hanson. 2022. Cumulative tree mortality from commercial thinning and a large wildfire in the Sierra Nevada, California. Land 11: Article 995.

"Similar to the findings of Hanson (2022) in the Antelope Fire of 2021 in northern California, in our investigation of the Caldor Fire of 2021 we found significantly higher cumulative severity in forests with commercial thinning than in unthinned forests, indicating that commercial thinning killed significantly more trees than it prevented from being killed in the Caldor Fire…Despite controversy regarding thinning, there is a body of scientific literature that suggests commercial thinning should be scaled up across western US forest landscapes as a wildfire management strategy. This raises an important question: what accounts for the discrepancy on this issue in the scientific literature? We believe several factors are likely to largely explain this discrepancy. First and foremost, because most previous research has not accounted for tree mortality from thinning itself, prior to the wildfire-related mortality, such research has underreported tree mortality in commercial thinning areas relative to unthinned forests. Second, some prior studies have not controlled for vegetation type, which can lead to a mismatch when comparing severity in thinned areas to the rest of the fire area given that thinning necessarily occurs in conifer forests but unthinned areas can include large expanses of non-conifer vegetation types that burn almost exclusively at high severity, such as grasslands and chaparral. Third, some research reporting effectiveness of commercial thinning in terms of reducing fire severity has been based on the subjective location of comparison sample points between thinned and adjacent unthinned forests. Fourth, reported results have often been based on theoretical models, which subsequent research has found to overestimate the effectiveness of thinning. Last, several case studies draw conclusions about the effectiveness of thinning as a wildfire management strategy when the results of those studies do not support such a conclusion, as reviewed in DellaSala et al. (2022)." (internal citations omitted)

Prichard, S.J., et al. (**co-authored by U.S. Forest Service**). 2021. Adapting western US forests to wild-fires and climate change: 10 key questions. Ecological Applications 31: Article e02433.

In a study primarily authored by U.S. Forest Service scientists, and scientists funded by the Forest Service, the authors state that "There is little doubt that fuel reduction treatments can be effective at reducing fire severity..." yet these authors repeatedly contradict their own proposition, acknowledging that thinning can cause "higher surface fuel loads," which "can contribute to high-intensity surface fires and elevated levels of associated tree mortality," and mastication of such surface fuels "can cause deep soil heating" and "elevated fire intensities." The authors also acknowledge that thinning "can lead to increased surface wind speed and fuel heating, which allows for increased rates of fire spread in thinned forests," and even the combination of thinning and prescribed fire "may increase the risk of fire by increasing sunlight exposure to the forest floor, drying vegetation, promoting understory growth, and increasing wind speeds."

Despite these admissions, contradicting their promotion of thinning, the authors cite to several U.S. Forest Service-funded studies for the proposition that thinning can effectively reduce fire severity, but a subsequent analysis of those same studies found that the results of these articles do not support that conclusion, and often contradict it, as detailed in Section 5.2 of DellaSala et al. (2022) (see below).

DellaSala, D.A., B.C. Baker, C.T. Hanson, L. Ruediger, and W.L. Baker. 2022. Have western USA fire suppression and megafire active management approaches become a contemporary Sisyphus? Biological Conservation 268: Article 109499.

With regard to a previous U.S. Forest Service study claiming that commercial thinning effectively reduced fire severity in the large Wallow fire of 2011 in Arizona, DellaSala et al. (2022, Section 5.1) conducted a detailed accuracy check and found that the previous analysis had dramatically underreported high-severity fire in commercial thinning units, and forests with commercial thinning in fact had higher fire severity, overall.

DellaSala et al. (2022, Section 5.2) also reviewed several U.S. Forest Service studies relied upon by Prichard et al. (2021) for the claim that commercial thinning is an effective fire management approach and found that the actual results of these cited studies did not support that conclusion.

Bartowitz, K.J., et al. 2022. Forest Carbon Emission Sources Are Not Equal: Putting Fire, Harvest, and Fossil Fuel Emissions in Context. Front. For. Glob. Change 5: Article 867112.

The authors found that logging conducted as commercial thinning, which involves removal of some mature trees, substantially increases carbon emissions relative to wildfire alone, and commercial thinning "causes a higher rate of tree mortality than wildfire."

Evers, C., et al. 2022. Extreme Winds Alter Influence of Fuels and Topography on Megafire Burn Severity in Seasonal Temperate Rainforests under Record Fuel Aridity. Fire 5: Article 41.

The authors found that dense, mature/old forests with high biomass and canopy cover tended to have lower fire severity, while more open forests with lower canopy cover and less biomass burned more severely.

USFS (U.S. Forest Service) (2022). Gallinas-Las Dispensas Prescribed Fire Declared Wildfire Review. U.S. Forest Service, Office of the Chief, Washington, D.C.

"A thinning project in the burn area opened the canopy in some areas, allowing more sunlight which led to lower fuel moistures. Heavy ground fuels resulting from the construction of fireline for the burn project added to the fuel loading. This contributed to higher fire intensities, torching, spotting, and higher resistance-to-control."

The only effective way to protect homes from fire is home-hardening and defensible space pruning within 100 to 200 feet of homes or less:

Cohen, J.D. (**U.S. Forest Service**). 2000. Preventing disaster: home ignitability in the wildland-urban interface. Journal of Forestry 98: 15-21.

The only relevant zone to protect homes from wildland fire is within approximately 135 feet or less from each home—not out in wildland forests.

Gibbons P, van Bommel L, Gill MA, Cary GJ, Driscoll DA, Bradstock RA, Knight E, Moritz MA, Stephens SL, Lindenmayer DB (2012) Land management practices associated with house loss in wildfires. PLoS ONE **7**: Article e29212.

> Defensible space pruning within less than 130 feet from homes was effective at protecting homes from wildfires, while vegetation management in remote wildlands was not. A modest additional benefit for home safety was provided by prescribed burning less than 500 meters (less than 1641 feet) from homes.

Syphard, A.D., T.J. Brennan, and J.E. Keeley. 2014. The role of defensible space for residential structure protection during wildfires. Intl. J. Wildland Fire 23: 1165-1175.

> Vegetation management and removal beyond approximately 100 feet from homes provides no additional benefit in terms of protecting homes from wildfires.

Tree removal is not necessary prior to conducting prescribed fire as an additional community safety buffer:

Decades of scientific studies have proven that, even in the densest forests that have not experienced fire in many decades, prescribed fire can be applied without prior tree removal, as demonstrated in the following studies:

Hankin, L.E.; Anderson, C.T. 2022. Second-Entry Burns Reduce Mid-Canopy Fuels and Create Resilient Forest Structure in Yosemite National Park, California. Forests 13: Article 1512.

Knapp EE, Keeley JE, Ballenger EA, Brennan TJ. 2005. Fuel reduction and coarse woody debris dynamics with early season and late season prescribed fire in a Sierra Nevada mixed conifer forest. Forest Ecology and Management 208: 383–397.

Knapp, E.E., and Keeley, J.E. 2006. Heterogeneity in fire severity within early season and late season prescribed burns in a mixed-conifer forest. Int. J. Wildland Fire 15: 37–45.

Knapp, E.E., Schwilk, D.W., Kane, J.M., Keeley, J.E., 2007. Role of burning on initial understory vegetation response to prescribed fire in a mixed conifer forest. Canadian Journal of Forest Research 37: 11–22.

van Mantgem, P.J., A.C. Caprio, N.L. Stephenson, and A.J. Das. 2016. Does prescribed fire promote resistance to drought in low elevation forests of the Sierra Nevada, California, USA? Fire Ecology 12: 13-25.

van Mantgem, P.J., N.L. Stephenson, J.J. Battles, E.K. Knapp, and J.E. Keeley. 2011. Long-term effects of prescribed fire on mixed conifer forest structure in the Sierra Nevada, California. Forest Ecology and Management 261: 989−994.

Webster, K. M., and C. B. Halpern. 2010. Long-term vegetation responses to reintroduction and repeated use of fire in mixed-conifer forests of the Sierra Nevada. Ecosphere 1: article 9.

Zachmann, L.J., D.W.H. Shaw, and B.G. Dickson. 2018. Prescribed fire and natural recovery produce similar long-term patterns of change in forest structure in the Lake Tahoe basin, California. Forest Ecology and Management 409: 276-287.

VI. The Information and Assumptions USFWS Relies Upon for the Proposed 4(d) Logging Exemption Is Based on Scientific Omissions and Mischaracterizations about Historical Forest Density and Fire Regimes.

Below are key scientifically inaccurate and unsound statements upon which USFWS relied to promote the 4(d) rule exemption for commercial logging in CSO habitat in Sierra Nevada forests, based on the claim that current forests are overgrown (too dense) relative to current forests, and the claim that historical fire regimes had little high-severity fire or only very small high-severity fire patches. Page references are to pdf pages in the USFWS CSO listing proposal, and quotes from the USFWS CSO listing proposal are in italics, followed by our comments explaining why the assertions are scientifically inaccurate and/or unsound:

P. 58:
The goal of fuels management is to reduce the buildup of fuels in forests that contribute to these large-scale, high-severity fires, which can effectively mitigate subsequent fire behavior and their effects, even under extreme weather (Hessburg et al. 2021, p. 7; Prichard et al. 2021, p. 9).

P. 59:
The natural range of variation for forest gaps in the Sierra Nevada has been found to range from 0.03–1.17 ha (0.07–2.89 ac) (Safford and Stevens 2017, p. 140), and within the SSA report and this proposed rule, clearcutting refers to complete removal greater than the natural range of variation.

P. 61:
Resilience of California spotted owl habitat results from low stand densities, which reduces competition and allows trees to grow, so more intensive fuels treatments (mechanical thinning and prescribed fire) may be needed to achieve historically lower levels of tree densities (North et al. 2022, p. 6).

These sources have been scientifically discredited by a comprehensive new study, Baker et al. (2023):

Baker, W.L., C.T. Hanson, M.A. Williams, and D.A. DellaSala. 2023. Countering Omitted Evidence of Variable Historical Forests and Fire Regime in Western USA Dry Forests: The Low-Severity-Fire Model Rejected. Fire 6: Article 146.

A pattern of omissions of peer-reviewed, published reply articles, which refuted and discredited U.S. Forest Service response articles, created a "falsification" of the scientific record regarding historical forest density and fire regimes. The corrected record shows that historical forests were much denser on average than assumed by the Forest Service and were shaped by mixed-severity fire, not merely low-severity fire.

VII. Critical Habitat Must Include Snag Forest Habitat

Based on the foregoing, high-severity fire areas are important habitats for CSOs, given the abundant evidence that CSOs actively forage in such areas, if unlogged, and even select high-severity fire patches for foraging (Lee 2018, Lee 2020, Hanson et al. 2021), and given the evidence, admitted by USFWS, that loss and degradation of the "snag forest habitat" created by high-severity fire patches, due to salvage logging, harms CSOs (see discussion above). In light of this, snag forest habitat (forest patches comprised mostly of snags from high-severity fire or pockets of high-severity from native bark beetles and drought) from recent and future natural disturbances must be included in proposed and designated critical habitat for CSOs.

Sincerely,

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