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FIRE AND SPOTTED OWLS IN SIERRA NEVADA NATIONAL FORESTS: THE USE OF SCIENCE IN MANAGEMENT PLAN REVISION

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INTRODUCTION

The U.S. Forest Service is in the process of revising land management plans for national forests in the Sierra Nevada Mountains of California.[1] In 2016, the agency issued draft revised management plans for three Sierra Nevada national forests, the Inyo, Sequoia, and Sierra, and also released the draft Environmental Impact Statement ("EIS") for plan revision for these forests.[2] The final revised management plan for Inyo National

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[1] *See Land & Resource Management: Planning, Region 5*, FOREST SERV., U.S. DEP'T OF AGRIC., https://www.fs.usda.gov/main/r5/landmanagement/planning [https://perma.cc/AAL3-HYXY] (last visited Nov. 12, 2019) (explaining the purpose of a land management plan)*; Sequoia and Sierra Forest Plan Revisions, Region 5*, FOREST SERV., U.S. DEP'T OF AGRIC., https://www.fs.usda.gov/detail/r5/landmanagement/planning/?cid=stelprdb5444003 [https://perma.cc/2Y8Z-LR7Q] (last visited Nov. 12, 2019).

[2] *See* FOREST SERV., U.S. DEP'T OF AGRIC., DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR REVISION OF THE INYO, SEQUOIA, AND SIERRA NATIONAL FORESTS LAND MANAGEMENT PLANS (2016), https://www.fs.usda.gov/nfs/11558/www/nepa/3403_FSPLT3_3083744.pdf [https://perma.cc/J3CS-24VM] (last visited Nov. 12, 2019) [hereinafter DRAFT EIS]; *Forest Plan Revision Documents—Sequoia and Sierra National Forests, Region 5*, FOREST SERV., U.S. DEP'T OF AGRIC., https://www.fs.usda.gov/detail/r5/landmanagement/planning/?cid=STELPRD3802842 [https://perma.cc/HNY5-782Z] (last visited Nov. 12, 2019) (providing plan

Forest, and the final EIS for plan revision for the Inyo forest, were issued in August 2018.[3] The agency recently released a revised draft EIS for plan revision for the Sequoia and Sierra national forests, and revised draft management plans for these forests, in June 2019.[4]

The Forest Service is proposing an ambitious program of selective logging, mechanical thinning, and other treatments in order to restore historic conditions and reduce the threat of high-severity fire.[5] According to the agency, Sierra Nevada forests are increasingly susceptible to large high-severity fire due to decades of fire suppression, the buildup of flammable materials, and climate change.[6] Such fire is considered highly destructive of these forests, and a threat to California spotted owls (*Strix occidentalis occidentalis*) and other native species.[7] According to the draft EIS for plan revision: "[L]arge fires with high-severity effects are occurring more frequently in the Sierra Nevada, particularly in the dense forested stands in montane vegetation."[8] "Large, high-severity fires, which are occurring more frequently in the Sierra Nevada, are a major threat to the California spotted owl."[9]

Yet certain studies have called into question the scientific claims the Forest Service is relying on for its proposed restoration and fuel-reduction treatments.[10] There is evidence that, historically, high-severity fire played

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revision documents for these forests); *see also Planning: Inyo National Forest Land Management Plan, Inyo National Forest*, FOREST SERV., U.S. DEP'T OF AGRIC., https://www.fs.usda.gov/main/inyo/landmanagement/planning. [https://perma.cc/HNY5-782Z] (last visited Nov. 12, 2019).

[3] *See* FOREST SERV., U.S. DEP'T OF AGRIC., FINAL ENVIRONMENTAL IMPACT STATEMENT FOR REVISION OF THE INYO NATIONAL FOREST LAND MANAGEMENT PLAN 1 (Aug. 2018), https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd589660.pdf [https://perma.cc/B996-DJEA] [hereinafter INYO FINAL EIS].

[4] *See* FOREST SERV., U.S. DEP'T OF AGRIC., REVISED DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR REVISION OF THE SEQUOIA AND SIERRA NATIONAL FORESTS LAND MANAGEMENT PLANS 1 (June 2019), https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd640162.pdf [https://perma.cc/X2SQ-45LK] [hereinafter REVISED DRAFT EIS].

[5] *See* DRAFT EIS, *supra* note 2, at 24–40.

[6] *Id.* at 58–66.

[7] *See, e.g.*, *id.* at 58–66, 329, 336–37.

[8] *Id.* at 315.

[9] *Id.* at 336. The revised draft EIS for plan revision for the Sequoia and Sierra national forests indicates that high-severity fire is a "primary stressor" of California spotted owls, and states, "[h]igh-severity fire and widespread loss of habitat is perhaps the biggest threat to spotted owls." REVISED DRAFT EIS, *supra* note 4, at 463, 470.

[10] *See, e.g.*, Chad T. Hanson & Dennis C. Odion, *Historical Forest Conditions within the Range of the Pacific Fisher and Spotted Owl in the Central and Southern Sierra Nevada, California, USA*, 36 NAT. AREAS J. 8, 9 (2016).

an ecologically significant role in Sierra Nevada forests.[11] According to certain studies, these forests were generally not open and park-like, shaped primarily by low- and moderate-severity fire, as claimed by the agency.[12] In addition, some scientists argue that California spotted owls are able to adjust to large patches of high-severity fire within their territories.[13] According to one study, available data suggests that high-severity fire generally does not negatively affect these owls.[14] Some scientists warn, rather, of the impacts on owls from selective logging, mechanical thinning, and other agency actions that degrade habitat.[15] California spotted owls are strongly associated with dense, old-growth forests with large trees, abundant understory trees, and high canopy cover, forests that are especially threatened by proposed forest treatments.[16] Studies have shown that California spotted owls are declining on national forest lands in the Sierra Nevada, but not in the adjacent national parks, and wildlife experts have identified forest management as a major factor in this decline.[17]

Historian Paul Hirt discusses what he calls a "conspiracy of optimism" within the Forest Service.[18] According to Hirt, within the agency there is high confidence that professional foresters can successfully manage the national forests for the many uses required by federal law, including timber production, livestock grazing, outdoor recreation, water flows, and biodiversity conservation.[19] The underlying idea is that through intensive management, using the best available scientific information, these diverse uses can be balanced appropriately in relatively small geographical areas.[20] Indeed, there is much discussion of intensive management within the forest management literature.[21] According to Oliver et al. (1999), for example, "[i]ncreasingly refined techniques" allow provision of "many commodity

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[11] *Id.* at 8–9, 14–18.
[12] *Id.* at 17.
[13] *See* Derek E. Lee & Monica L. Bond, *Occupancy of California Spotted Owl Sites Following a Large Fire in the Sierra Nevada, California*, 117 CONDOR 228, 233–34 (2015).
[14] *Id.*
[15] *See, e.g.*, *id.*; Hanson & Odion, *supra* note 10, at 9, 17–18.
[16] Hanson & Odion, *supra* note 10, at 8–9.
[17] *See id.* at 9; *see also* FOREST SERV., U.S. DEP'T OF AGRIC., GENERAL TECHNICAL REPORT PSW-GTR-254, THE CALIFORNIA SPOTTED OWL: CURRENT STATE OF KNOWLEDGE 185–96 (Aug. 2017) [hereinafter CONSERVATION ASSESSMENT].
[18] PAUL W. HIRT, A CONSPIRACY OF OPTIMISM: MANAGEMENT OF THE NATIONAL FORESTS SINCE WORLD WAR TWO, xxxii (1994).
[19] *Id.* at xix–xxi.
[20] *Id.*
[21] *See, e.g.*, Chadwick Oliver et al., *Forest Organization, Management, and Policy*, *in* MAINTAINING BIODIVERSITY IN FOREST ECOSYSTEMS 556 (Malcolm L. Hunter ed., 1999).

and non-commodity products."[22] "[D]ifferent structures and patterns are maintained and/or created," they write, through "silvicultural and harvesting operations, which provide employment and commodities in the process of maintaining or enhancing biodiversity."[23] Hirt describes the "conspiracy of optimism" within the Forest Service as "involv[ing] a willful decision to look only at certain pieces of the puzzle . . . while neglecting others that . . . [do] not contribute to a preconceived notion of what the finished puzzle should look like."[24]

As will be discussed, within the draft EIS and other documents involved in plan revision for Sierra Nevada national forests, Forest Service scientists and other experts engage in a selective use of science. This includes use of certain studies rather than others, failure to disclose weaknesses and limitations of those studies the agency relies on, and failure to adequately consider critical studies that are perhaps cited but are discussed only superficially. Agency documents do not reveal the extent of the controversies within the scientific literature. To be sure, for the Inyo, Sequoia, and Sierra national forests the plan revision process is ongoing, yet similar assertions and patterns of argument are found in the draft EIS, final EIS for Inyo forest plan revision, revised draft EIS for Sequoia and Sierra forests plan revision, the California Spotted Owl Conservation Assessment (Conservation Assessment), and other agency documents.[25] In plan revision, scientific information is used in such a way as to support the agency's conception of the finished puzzle, the desired balance of forest treatments and spotted owl conservation. Management plan revision in the Sierra Nevada rests upon accepted beliefs concerning historic forest structure and fire, and the effects of high-severity fire on spotted owls, which are supported and protected by this selective use of science.

According to critics, one concern is that proposed forest treatments will lead to artificial, relatively homogenous forests in the Sierra Nevada that cannot support viable populations of California spotted owls and other native species.[26] Such reconstruction of these forests is already well underway.[27] The key, critics claim, is to recognize the essential role

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[22] *Id.* at 573.
[23] *Id.*
[24] HIRT, *supra* note 18, at xlviii.
[25] *See generally* DRAFT EIS, *supra* note 2; CONSERVATION ASSESSMENT, *supra* note 17; REVISED DRAFT EIS, *supra* note 4.
[26] *See, e.g.*, Hanson & Odion, *supra* note 10, at 17–18.
[27] *See, e.g.*, Chad T. Hanson et al., *Effects of Post-Fire Logging on California Spotted Owl Occupancy*, 24 NAT. CONSERVATION 93, 102 (Jan. 18, 2018); Dennis C. Odion et al., *Examining*

played historically by high-severity fire.[28] According to a number of scientists, we must adopt a new paradigm concerning fire.[29]

As will be discussed, National Environmental Policy Act ("NEPA") regulations mandate that, within an EIS, an agency provide a full and fair discussion of the environmental impacts of a proposed action.[30] In addition, according to NEPA regulations, all discussions and analyses within an EIS must have professional and scientific integrity.[31] Descriptions of the affected environment must be accurate and in sufficient detail.[32] In accordance with these regulations, within each EIS prepared for plan revision the Forest Service must use the best available scientific information in all descriptions and analyses of impacts, regardless of how well this information fits with traditional agency beliefs. As will be discussed, the standard of judicial review required for alleged NEPA violations necessitates that a reviewing court adopt a highly deferential attitude toward the agency's use of scientific information.[33] Yet, even so, the courts have the responsibility to ensure that the agency meets its information obligations under NEPA.[34]

I. FIRE IN THE SIERRA NEVADA

According to the draft EIS for management plan revision, "[L]arge fires with high-severity effects are occurring more frequently in the Sierra Nevada . . . ."[35] In addition: "Fire size has also changed, especially in recent years where some extremely large fires have burned, compared to the historical record. . . . Now fires burn with higher intensity, greater amounts of crown fire, and with larger areas of high severity."[36] According to the final EIS for Inyo forest plan revision, "decades of fire suppression, buildup of vegetation and forest debris, and more recently, drought

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Historical and Current Mixed-Severity Fire Regimes in Ponderosa Pine and Mixed-Conifer Forests of Western North America, 9 PLOS ONE 1, 2 (Feb. 2014), https://doi.org/10.1371/journal.pone.0087852 [https://perma.cc/JR5Q-9NVG].

[28] *See, e.g.*, Hanson & Odion, *supra* note 10, at 8, 14–18.

[29] *See* DOMINICK A. DELLASALA & CHAD T. HANSON, THE ECOLOGICAL IMPORTANCE OF MIXED-SEVERITY FIRES: NATURE'S PHOENIX xxxiii (2015) ("[w]e refute the dominant fire paradigm that [mixed- and high-severity] fires are ecologically destructive.").

[30] 40 C.F.R. § 1502.1 (1987).

[31] *Id.* § 1502.24.

[32] *Id.* § 1502.15.

[33] *See, e.g.*, Lands Council v. McNair, 537 F.3d 981, 993–94 (9th Cir. 2008).

[34] *Id.* at 1001–02.

[35] DRAFT EIS, *supra* note 2, at 315.

[36] *Id.* at 62; REVISED DRAFT EIS, *supra* note 4, at 72–73.

and climate change, have caused wildfires to grow larger and become more destructive."[37]

Both the final EIS for Inyo plan revision, and the revised draft EIS for Sequoia and Sierra plan revision, cite a Forest Service technical report (NRV Technical Report) that concerns the natural range of variation (historic or pre-settlement conditions) in Sierra Nevada forests.[38] This report states:

> Under presettlement conditions, [ponderosa] pine and mixed-conifer forests in the Sierra Nevada supported fire regimes characterized by frequent, low- to moderate-severity fires.[39]

> [C]urrent fires in [ponderosa pine and mixed-conifer] forests managed by the Forest Service in the assessment area are burning at much higher severity (30 to 35 percent high severity as an . . . average) than was generally the case under presettlement conditions (. . . ranging from 3 to 15 percent . . .).[40]

According to the draft EIS, revised draft EIS, final EIS, NRV Technical Report, and other documents involved in plan revision, historically high-severity fire was relatively uncommon in the Sierra Nevada.[41] As described in these documents, the forests were generally open and park-like, consisting primarily of medium and large trees with low densities and low canopy cover.[42] Regular rotations of low- and moderate-severity fire maintained scarce understory growth.[43] Gaps in forest cover, allowing growth of early successional vegetation, were numerous and relatively small, and were the result of low- and moderate-severity fire that

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[37] INYO FINAL EIS, *supra* note 3, at 110; *see also* REVISED DRAFT EIS, *supra* note 4, at 73.
[38] *See* INYO FINAL EIS, *supra* note 3, at 85; REVISED DRAFT EIS, *supra* note 4, at 172; *see also* HUGH D. SAFFORD & JENS T. STEVENS, U.S. DEP'T OF AGRIC., NATURAL RANGE OF VARIATION FOR YELLOW PINE AND MIXED-CONIFER FORESTS IN THE SIERRA NEVADA, SOUTHERN CASCADES, AND MODOC AND INYO NATIONAL FORESTS, CALIFORNIA, USA (2017) [hereinafter NRV TECHNICAL REPORT].
[39] *See* NRV TECHNICAL REPORT, *supra* note 38, at 31.
[40] *Id.* at 47.
[41] CONSERVATION ASSESSMENT, *supra* note 17, at 127–29; DRAFT EIS, *supra* note 2, at 61–62; INYO FINAL EIS, *supra* note 3, at 84–85; NRV TECHNICAL REPORT, *supra* note 38, at 38–48; REVISED DRAFT EIS, *supra* note 4, at 72–73.
[42] *See, e.g.*, NRV TECHNICAL REPORT, *supra* note 38, at 90, 93–97, 99, 138–39, 146–48.
[43] *Id.* at 31, 38–41, 146–48.

occasionally burned into the crowns of trees, as well as some low percentage (3 to 15 percent) of high-severity fire.[44] Sierra Nevada forests were historically heterogeneous, but, as explained in the NRV Technical Report, the heterogeneity was "fine-grained," meaning that, typically, only relatively subtle contrasts existed in forest structure and composition across a landscape.[45]

This view of historic Sierra Nevada forests is highly controversial. In an important study in the literature, Baker (2014), General Land Office ("GLO") survey data from the mid- to late 1800s are used to reconstruct historic forest structure and fire regimes in the Sierra Nevada.[46] The GLO survey involved dividing lands throughout the United States, west of (and including) Ohio, into grids of 6 x 6 mile townships, with thirty-six 1 x 1 mile sections within each township, and recording measurements of the vegetation at section corners and noting patterns of vegetation and disturbance along section lines.[47] In Baker (2014), various methods are used to pool the corner data, and to reconstruct historic forest structure and fire regimes from this data.[48] The reconstructions show, William Baker writes, that although "somewhat open, park-like forests . . . did occur," these were relatively sparse ("23 percent of the northern and 33 percent of the southern Sierra Nevada").[49] Baker writes that, historically, forests in the Sierra Nevada were "numerically dominated by smaller trees and also had abundant seedlings and saplings beneath these small trees."[50] Although traditionally it has been thought that high-severity fire occurred in patches limited to only a few hectares ("ha"), according to Baker contiguous areas burned at high severity "commonly exceeded 250 ha and reached as high as 9400 ha."[51]

As Baker (2014) claims, descriptions recorded by early observers (included in an appendix) support the assertion that Sierra Nevada forests

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[44] *Id.* at 38–41, 47, 139–41.
[45] *Id.* at 40–41, 87, 91–92.
[46] *See* William L. Baker, *Historical Forest Structure and Fire in Sierran Mixed-Conifer Forests Reconstructed from General Land Office Survey Data*, 5 ECOSPHERE 1, 2–4 (2014), https://esajournals.onlinelibrary.wiley.com/doi/full/10.1890/ES14-00046.1 [https://perma.cc/752R-W3AV].
[47] For a detailed account of survey methods, *see id.* at 4–6; *see also* Mark A. Williams & William L. Baker, *Bias and Error in Using Survey Records for Ponderosa Pine Landscape Restoration*, 37 J. BIOGEOGRAPHY 707, 707–08 (2010).
[48] Baker, *supra* note 46, at 6–7.
[49] *Id.* at 22.
[50] *Id.* at 24.
[51] *Id.* at 26.

were in many areas dense, numerically dominated by smaller and younger trees.[52] Baker writes, in conclusion:

> Historical [ponderosa pine and mixed-conifer] forests were not largely open or park-like, but instead were mostly dense or very dense, high-severity fire was common, and mixed-severity fires and topography fostered very heterogeneous forest structure.[53]

> Proposals to reduce fuels and fire severity would actually reduce, not restore, historical forest heterogeneity important to wildlife and resiliency. Sierran mixed-conifer forests are inherently dangerous places to live, which cannot be changed without creating artificial forests over large land areas.[54]

According to the final EIS for Inyo forest plan revision, and the revised draft EIS for Sequoia and Sierra forests plan revision, Baker (2014) and several other studies were not considered in the plan revision process due to "serious analytical and methodological issues," "unreasonable inferences and inappropriate conclusions drawn," and other reasons.[55] Studies from the literature are cited in support of these reasons, yet no explanation is provided as to why Baker (2014) and the other rejected studies suffer from "serious analytical and methodological issues" and the other alleged difficulties.[56] There is no discussion as to how the cited studies support the given reasons for rejection.[57]

More detailed criticisms of Baker (2014) are found, however, in the NRV Technical Report and the Conservation Assessment, both of which are referenced within the final EIS for Inyo forest and the revised draft EIS for the Sequoia and Sierra forests.[58] The Conservation Assessment, authored by agency scientists and other experts, provides a literature review of California spotted owls—their biology, habitat needs, and known

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[52] *Id.* at 24.
[53] *Id.* at 26.
[54] Baker, *supra* note 46, at 1.
[55] INYO FINAL EIS, *supra* note 3, at 168; REVISED DRAFT EIS, *supra* note 4, at 172.
[56] INYO FINAL EIS, *supra* note 3, at 168; REVISED DRAFT EIS, *supra* note 4, at 172.
[57] INYO FINAL EIS, *supra* note 3, at 168; REVISED DRAFT EIS, *supra* note 4, at 172.
[58] CONSERVATION ASSESSMENT, *supra* note 17, at 127–29; INYO FINAL EIS, *supra* note 3, at 704, 726; NRV TECHNICAL REPORT, *supra* note 38, at 48–50; REVISED DRAFT EIS, *supra* note 4, at 781, 807.

threats.[59] According to this document, in the GLO survey in the 1800s surveyors were biased in their selection of trees that could serve as corner markers ("bearing trees"), choosing smaller trees or species with low commercial value, and so trees less likely to be harvested and more likely to persist through the years.[60] Furthermore, according to these authors, Baker relies for his reconstructions on an unacceptably low sampling density, an inherent problem with use of GLO data for this purpose.[61]

Yet, according to Baker (2014), citing an earlier study, Williams and Baker (2010), in the Sierra Nevada bearing trees "were measured accurately and selected with little bias."[62] The earlier study involved an analysis of possible surveyor bias and error, through comparison of the GLO data with the results of resampling the original survey grids.[63] "[A]ll studies of direct comparison to date," William Baker and Mark Williams write, "show that selection bias is rare and most other error rates are low."[64] Authors of the Conservation Assessment do not discuss this response in Baker (2014) to the criticism they present of this study, and they do not discuss or cite the earlier study, Williams and Baker (2010), which is expressly concerned with this issue of possible surveyor bias and error.[65] Again, in Baker (2014), data from contiguous corners have been pooled for the reconstructions to compensate for the low sampling density.[66] Baker reports that the resulting reconstructions of historic forest structure and fire regimes are highly accurate, as validated by on-the-ground observations, historical narratives, tree-ring reconstructions, and other methods.[67] Authors of the Conservation Assessment do not discuss the pooling of data and the efforts to validate the procedure as reported in Baker (2014).[68]

The NRV Technical Report is also critical of Baker (2014) for the reason of low sampling density.[69] In this report there is also no discussion of Baker's use of pooled data for the reconstructions, and there is no

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[59] *See generally* CONSERVATION ASSESSMENT, *supra* note 17.
[60] *Id.* at 128.
[61] *Id.*
[62] *See* Baker, *supra* note 46, at 6; *see also* Williams & Baker, *supra* note 47.
[63] *See* Williams & Baker, *supra* note 47, at 710–13.
[64] *Id.* at 718.
[65] CONSERVATION ASSESSMENT, *supra* note 17, at 127–29.
[66] Baker, *supra* note 46, at 6–7.
[67] *Id.* at 11, 13, 15, 22, 26; *see also* William L. Baker, *Are High-Severity Fires Burning at Much Higher Rates Recently than Historically in Dry-Forest Landscapes of the Western USA?*, 10 PLOS ONE 1, 12–13 (Sept. 2015), https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0136147 [https://perma.cc/QL77-JZ5L].
[68] *See* CONSERVATION ASSESSMENT, *supra* note 17, at 127–29.
[69] NRV TECHNICAL REPORT, *supra* note 38, at 49.

mention of the numerous efforts to validate Baker's procedure, as reported in Baker (2014) and Baker (2015).[70]

The NRV Technical Report criticizes Baker (2014), as well, for providing estimates of forest density that are consistently too high in comparison to estimates provided in Collins et al. (2011, 2015), Hagmann et al. (2013, 2014), and Stephens et al. (2015).[71] Baker (2015) includes a response to these studies, however, replying that the early 1900s timber-inventory data analyzed in these studies lacks information concerning smaller trees and denser forests within the broader inventory areas, and the inventories were conducted in areas that had been subjected to human influences, such as logging, which would lower tree density.[72] In addition, according to Baker (2015), these studies did not take into account records of fire severity that were included with the inventory data.[73] Baker claims that the estimates of historic forest density and fire severity presented in Collins et al. (2011, 2015), Hagmann et al. (2013, 2014), and other studies are not representative "of even the overall inventory area, much less the larger surrounding landscape."[74] He writes, "[I]t is timber-inventory studies that omitted fire-severity records, and that were not validated or corroborated, that likely are in error."[75]

The NRV Technical Report does not discuss or cite Baker (2015), although this study provides a direct response to the criticism of Baker's procedure raised in this report.[76] Failure to discuss Baker (2015) is a serious omission, since this study provides plausible criticisms of Collins et al. (2011, 2015), Stephens et al. (2015), and other timber-inventory studies the agency relies on for its estimates of historic conditions in Sierra Nevada forests (natural range of variation estimates).[77] Indeed, the NRV Technical Report does not discuss the response in Baker (2014) to Hagmann et al. (2013).[78] According to Baker (2014), the timber-inventory data analyzed in Hagmann et al. (2013) omitted small trees in the broader inventory areas,

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[70] *See id.*; Baker, *supra* note 46, at 11, 13, 15, 22, 26; Baker, *supra* note 67, at 13, 20.
[71] NRV TECHNICAL REPORT, *supra* note 38, at 49; *see also id.* at 187, 193, 213 (referencing the Collins, Hagmann, and Stephens studies).
[72] Baker, *supra* note 67, at 12–13.
[73] *Id.* at 12.
[74] *Id.*
[75] *Id.* at 13.
[76] NRV TECHNICAL REPORT, *supra* note 38, at 49.
[77] NRV TECHNICAL REPORT, *supra* note 38, at 44–45, 49, 98–99; Baker, *supra* note 67, at 12–13.
[78] NRV TECHNICAL REPORT, *supra* note 38, at 49.

and is confounded by the occurrence of logging in the inventoried areas.[79] According to Baker, the methodology in Hagmann et al. (2013) is too limited and does not yield accurate density estimates.[80] The NRV Technical Report entirely misses this response.[81]

Both the Conservation Assessment and NRV Technical Report cite Fulé et al. (2014), which is critical of the use of GLO data for reconstructing historic fire regimes in Williams and Baker (2012) and (by extension) Baker (2014).[82] Both the final EIS for Inyo plan revision, and the revised draft EIS for Sequoia and Sierra plan revision, cite Fulé et al. (2014) in support of the reasons given for dismissing Baker (2014) ("serious analytical and methodological issues," etc.).[83] A major difficulty, Peter Fulé and others claim, is that the procedure used by Baker does not account for other possible causes of tree cohort regeneration, including bark beetles, windstorms, and climate-induced mortality and establishment, for example, periods of drought or relatively wet climate.[84] Fulé and others claim that cohorts often regenerate in the absence of fire.[85] "[Williams and Baker] make a huge leap," they write, "unsupported by modern observation and understanding of post-fire responses of dry forest ecosystems, to infer past fire occurrence and severity from structural data."[86]

Yet, in their response, Williams and Baker (2014) point out that, in their 2012 study, they clearly discuss alternative possible causes of cohort regeneration in western U.S. landscapes, concluding that the alternatives do not account for the structural patterns within reconstructed historic landscapes.[87] Although the Conservation Assessment and NRV

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[79] Baker, *supra* note 46, at 7.
[80] *See id.*
[81] NRV TECHNICAL REPORT, *supra* note 38, at 49.
[82] *See* CONSERVATION ASSESSMENT, *supra* note 17, at 129; NRV TECHNICAL REPORT, *supra* note 38, at 49. *See generally* Mark A. Williams & William L. Baker, *Spatially Extensive Reconstructions Show Variable-Severity Fire and Heterogenous Structure in Historical Western United States Dry Forests*, 21 GLOB. ECOLOGY & BIOGEOGRAPHY 1042, 1043 (2012); Baker, *supra* note 46, at 1; Peter Z. Fulé et al., *Unsupported Inferences of High-Severity Fire in Historical Dry Forests of the Western United States: Response to Williams and Baker*, 23 GLOB. ECOLOGY & BIOGEOGRAPHY 825, 825–26 (2014).
[83] INYO FINAL EIS, *supra* note 3, at 168; REVISED DRAFT EIS, *supra* note 4, at 172.
[84] Fulé et al., *supra* note 82, at 826.
[85] *Id.*
[86] *Id.* at 827.
[87] *See* Mark A. Williams & William L. Baker, *High-Severity Fire Corroborated in Historical Dry Forests of the Western United States: Response to Fulé et al.*, 23 GLOB. ECOLOGY & BIOGEOGRAPHY 831, 832 (2014); *see also* Williams & Baker, *supra* note 82, at 1050.

Technical Report cite Fulé et al. (2014) in criticism of Baker (2014)—the NRV Technical Report briefly outlines the supposed difficulty—these agency documents do not discuss the plausible response provided in Williams and Baker (2014) or cite this article.[88] The final EIS, and the revised draft EIS, also do not discuss or cite this response.[89]

The NRV Technical Report also briefly discusses Levine et al. (2017), in which a number of agency and university scientists present a detailed criticism of the reconstruction methods used in Baker (2014).[90] The final EIS, and the revised draft EIS, cite Levine et al. (2017) in support of the reasons given for dismissing Baker (2014) ("serious analytical and methodological issues," etc.).[91] As Carrie Levine and others write, "The management implications of these contrasting perspectives of the pre-settlement forest are significant."[92] If the view expressed by Baker is correct, they add, "ongoing efforts by forest managers to mitigate wildfire behavior are misguided."[93] Levine and others present the results of a test of the validity of Baker's procedure, through simulations of GLO survey methods in six forest sites in the Sierra Nevada, and comparisons of reconstructions using Baker's procedure with detailed survey results.[94] They conclude that Baker's procedure provides consistent, significant overestimates of forest density.[95]

In response, Baker and Williams (2018) claim that Levine and others did not properly replicate the reconstruction procedure used in Baker (2014).[96] One problem, they claim, is that Levine et al. did not use pooled corner data for the reconstructions, and they used tree diameter at breast height ("DBH") rather than diameter at stump height ("DSH") for the calculations.[97] They discuss other problems as well, and write, "[i]f

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[88] CONSERVATION ASSESSMENT, *supra* note 17, at 129; NRV TECHNICAL REPORT, *supra* note 38, at 49.
[89] INYO FINAL EIS, *supra* note 3, at 168; REVISED DRAFT EIS, *supra* note 4, at 172.
[90] *See* NRV TECHNICAL REPORT, *supra* note 38, at 49; *see also* Carrie R. Levine et al., *Evaluating a New Method for Reconstructing Forest Conditions from General Land Office Survey Records*, 27 ECOLOGICAL APPLICATIONS 1498, 1499 (2017).
[91] INYO FINAL EIS, *supra* note 3, at 168; REVISED DRAFT EIS, *supra* note 4, at 172.
[92] Levine et al., *supra* note 90, at 1510.
[93] *Id.*
[94] *Id.* at 1500–04.
[95] *Id.* at 1507–11.
[96] *See* William L. Baker & Mark A. Williams, *Land Surveys Show Regional Variability of Historical Fire Regimes and Dry Forest Structure of the Western United States*, 28 ECOLOGICAL APPLICATIONS 284, 287 (2018).
[97] *Id.*

correct DSH data, pools, and a harmonic mean in the pools are used, our method accurately estimates tree density."[98] They demonstrate this, they claim, for one of the sites surveyed by Levine and others for the test.[99] "[T]he failure," they write, "is from Levine et al. not replicating our method."[100] Baker and Williams discuss numerous efforts to validate their procedure, and conclude: "These tests against numerous, diverse, independent sources show that our reconstruction methods are valid, with known and relatively low error rates, for use in reconstructing historical forest structure and fire and guiding ecological restoration across dry forests of the western United States."[101]

Levine et al. (2017) is an important study for the Forest Service, as it apparently discredits Baker (2014) and other studies that rely on his procedure.[102] According to the NRV Technical Report, Levine and others have successfully "deconstructed" Baker's algorithm.[103] The NRV Technical Report and Conservation Assessment criticize Baker (2014) for reasons of bias in the selection of bearing trees, unacceptably low sampling density, and consistent overestimates of tree densities.[104] Within these agency documents, however, there is no consideration of the plausible replies to these criticisms found in Williams and Baker (2010), Baker (2014), Williams and Baker (2014), Baker (2015), and Baker and Williams (2018).[105] With the exception of Baker (2014), these studies are not cited.[106] The final EIS and revised draft EIS cite Levine et al. (2017) and Fulé et al. (2014) in support of the reasons given for dismissing Baker (2014) ("serious analytical and methodological issues" etc.), yet these NEPA documents do not discuss or cite the direct responses to these studies provided in Williams and Baker (2014) and Baker and Williams (2018).[107]

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[98] *Id.*
[99] *Id.*
[100] *Id.*
[101] *Id.* at 288.
[102] *See* Levine et al., *supra* note 90, at 1507–10.
[103] NRV TECHNICAL REPORT, *supra* note 38, at 98–99.
[104] *See* CONSERVATION ASSESSMENT, *supra* note 17, at 128; NRV TECHNICAL REPORT, *supra* note 38, at 49, 98–99.
[105] *See* CONSERVATION ASSESSMENT, *supra* note 17, at 127–29; NRV TECHNICAL REPORT, *supra* note 38, at 48–49, 98–99; *see also* Baker, *supra* note 67, at 13; Baker, *supra* note 46, at 7; Baker & Williams, *supra* note 96, at 287; Williams & Baker, *supra* note 47, at 707; Williams & Baker, *supra* note 87, at 832.
[106] CONSERVATION ASSESSMENT, *supra* note 17, at 127–29; NRV TECHNICAL REPORT, *supra* note 38, at 49, 98–99.
[107] *See* INYO FINAL EIS, *supra* note 3, at 168; REVISED DRAFT EIS, *supra* note 4, at 172;

Odion et al. (2014) also call into question agency claims concerning historic forest structure and fire severity.[108] These researchers discuss multiple lines of evidence, including forest stand-age data, to support the claim that high-severity fire played an ecologically significant role in Sierra Nevada forests prior to fire suppression efforts in the early 1900s.[109] According to Dennis Odion and others, historically these forests were highly diverse in structure, with old-growth stands, but were dominated mainly by young and intermediate-aged trees.[110] Irregular patches of early successional forest habitat (early seral forest), some very large, occurred at irregular intervals.[111] This highly heterogeneous forest structure was maintained, they claim, by periodic mixed-severity fire, which included significant proportions of high-severity fire.[112] Odion and others write:

> In all regions, there were tree-age data supporting considerable age-class diversity created by mixed severity fire, and a paucity of undisturbed park-like forests.[113]
>
> Prior to settlement and fire exclusion, these forests historically exhibited much greater structural and successional diversity than implied by the low/moderate-severity model.[114]
>
> We did not find evidence to support the hypothesis that fire exclusion has greatly increased the prevalence of severe fire in ponderosa pine and mixed conifer forests.[115]

The final EIS, and revised draft EIS, dismiss Odion et al. (2014) due to "serious analytical and methodological issues" and other reasons, and, though studies are cited, no explanation is provided as to how the cited studies support the given reasons for dismissal.[116] The agency's Conservation Assessment provides arguments, however, faulting Odion et al.

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see also Baker & Williams, *supra* note 96, at 287; Fulé et al., *supra* note 82, at 825–28; Levine et al., *supra* note 90, at 1507–10; Williams & Baker, *supra* note 87, at 831–34.

[108] *See* Odion et al., *supra* note 27, at 10–12.

[109] *Id.* at 1, 10–12.

[110] *Id.* at 2, 10.

[111] *Id.* at 2.

[112] *Id.* at 10–12.

[113] *Id.* at 9.

[114] *See* Odion et al. *supra* note 27, at 11.

[115] *Id.* at 10.

[116] INYO FINAL EIS, *supra* note 3, at 168; REVISED DRAFT EIS, *supra* note 4, at 172.

(2014) for the reason that the forest stand-age data used in the analysis were gathered from wilderness areas and national parks, which "tend to be in higher elevations."[117] According to the Conservation Assessment, the study is, therefore, of limited applicability across the broad range of ponderosa pine and mixed-conifer forests in the Sierra Nevada.[118] This criticism is repeated in the NRV Technical Report.[119] Presumably, the claim within the final EIS and revised draft EIS that Odion et al. (2014), and other studies, have been dismissed due to "science information placed in inappropriate ecological context" rests largely on this criticism.[120]

Yet, according to Odion et al. (2014), the stand-age data used in the analysis were gathered from wilderness areas, national parks, and inventoried roadless areas, and represent low- to mid-elevation forests.[121] Odion and others write, "A total of 2119 FIA [Forest Service Inventory and Analysis program] plots representing a sample population of about 5.1 million ha of unmanaged low- to mid-elevation, montane forests in six regions were included in our analysis."[122] There are several indications that the reported data represent low- to mid-elevation ponderosa and mixed-conifer forests in the Sierra Nevada, and the above criticism is apparently based on a misreading of the study.[123]

Another repeated criticism is that forest stand-age values cannot be used, as they are used in Odion et al. (2014), as estimates of the time since the last high-severity fire.[124] According to agency documents, citing Stevens et al. (2016), the problem, simply, is that such estimates are too inaccurate.[125]

The criticism, more precisely, is as follows. Odion et al. (2014) analyze stand-ages determined by the Forest Service for randomly selected

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[117] CONSERVATION ASSESSMENT, *supra* note 17, at 128.
[118] *Id.*
[119] NRV TECHNICAL REPORT, *supra* note 38, at 50.
[120] INYO FINAL EIS, *supra* note 3, at 168; REVISED DRAFT EIS, *supra* note 4, at 172.
[121] "We selected [stand-age] data from low- to mid-elevation forest types in Wilderness, Inventoried Roadless Areas, and National Parks . . . ." Odion et al., *supra* note 27, at 4.
[122] *Id.* at 7; *see also id.* at 5 (the "six regions" in the western United States include the Sierra Nevada).
[123] *See id.* at 6.
[124] CONSERVATION ASSESSMENT, *supra* note 17, at 128; NRV TECHNICAL REPORT, *supra* note 38, at 50.
[125] *See* CONSERVATION ASSESSMENT, *supra* note 17, at 128; NRV TECHNICAL REPORT, *supra* note 38, at 50; *see also* Jens T. Stevens et al., *Average Stand Age from Forest Inventory Plots Does Not Describe Historical Fire Regimes in Ponderosa Pine and Mixed Conifer Forests of Western North America*, PLOS ONE 1 (May 19, 2016), https://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0147688&type=printable [https://perma.cc/XS65-35HR].

forest stands in the Sierra Nevada, going back to the 1800s, using core samples of the dominant canopy trees and determining the average age for each stand.[126] Odion and others assume that trees significantly older than the stand-age value survived the last stand-replacing disturbance, high-severity fire.[127] Yet, as pointed out in Stevens et al. (2016), in the majority (58 percent) of the sampled plots, older trees make up too high a percentage of the stand basal area for the stand-age to provide an accurate estimate of the years since the last high-severity fire.[128] Jens Stevens et al. cite a previous study, according to which, they claim, it is relatively uncommon that trees in these forests survive an occurrence of high-severity fire.[129] Indeed, they adopt a definition according to which "high-severity fire" results in greater than 90 percent basal area mortality.[130] Stevens et al. reanalyze the data used in the Odion analysis, and they find, based on their definition of "high-severity fire," that Odion and others significantly overestimate the extent and frequency of high-severity fire in the Sierra Nevada.[131]

In their response, Odion et al. (2016) claim that the narrower definition adopted in Stevens et al. (2016) is not consistent with the traditional understanding of high-severity fire found in the literature.[132] "High-severity fire" has traditionally been understood, Odion and others point out, as resulting in greater than 70 percent basal area mortality rather than 90 percent.[133] These researchers note that within the study cited by Stevens et al. in support of the narrower definition, the data do not show that it is uncommon that trees survive high-severity fire.[134] "[S]urviving trees in high-severity fire plots were not rare," they write.[135] Odion and others conclude that the criticism presented by Stevens et al.

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[126] Odion et al., *supra* note 27, at 4–7.
[127] *Id.*
[128] Stevens et al., *supra* note 125, at 11. "Basal area" is defined as "the area of a breast-high cross section of a tree or of all the trees in a stand." *Basal Area*, MERRIAM-WEBSTER, https://merriam-webster.com/dictionary/basal%20area [https://perma.cc/M4QP-W5J8] (last visited Nov. 12, 2019).
[129] Stevens et al., *supra* note 125, at 7.
[130] *Id.* at 13.
[131] *Id.* at 11–15.
[132] *See* Dennis C. Odion et al., *Areas of Agreement and Disagreement Regarding Ponderosa Pine and Mixed Conifer Forest Fire Regimes: A Dialogue with Stevens et al.*, 11 PLOS ONE 1, 3, 5 (May 19, 2016), https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0154579 [https://perma.cc/22JC-SUHD].
[133] *Id.* at 3, 5.
[134] *Id.* at 3.
[135] *Id.*

does not refute their study.[136] "[The criticism] is based," they write, "on a different definition of high-severity fire than the classical definition used by Odion et al. (2014), which is consistent with scientific literature."[137] They add, "The new definition proposed by Stevens et al. is based on errors and mischaracterizations of cited sources."[138] They point out that in the reanalysis of the stand-age data presented by Stevens et al., 70 to 89 percent basal area mortality was not uncommon in the sampled plots prior to fire suppression.[139] They assume that such mortality levels are too high to correspond to low- to moderate-severity fire, thus narrowing the definition of high-severity fire to above 90 percent mortality is not justified, they argue.[140]

Odion et al. (2016) agree with the assertion in Stevens et al. (2016) that, historically, tree recruitment processes occurred in the Sierra Nevada in the absence of high-severity fire.[141] Yet they defend their claim that high-severity fire was predominantly responsible for the diverse stand ages found in the Sierra Nevada prior to fire suppression.[142] According to Odion and others, in the Sierra Nevada and other regions of the western United States:

> [T]he onset of fire suppression about a century ago coincides with a dramatic reduction in the initiation of trees that form the dominant overstory size classes. Thus, the removal of fire had a profound effect on the process of recruitment over vast areas. Recruitment following fire suppression, as hypothesized by Stevens et al., could not account for the pattern of abundant establishment of the dominant size classes of trees before fire suppression. If high-severity fire was a minor process in creating new stand ages, establishment of the dominant overstory trees would not have declined so dramatically with fire suppression.[143]

These authors do not accept the claim by Stevens et al. that recruitment processes in the absence of high-severity fire can account for the high

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[136] *Id.* at 5.
[137] *Id.*
[138] *See* Odion et al., *supra* note 132, at 5.
[139] *Id.* at 3.
[140] *Id.*
[141] *Id.* at 2.
[142] *Id.* at 4–5.
[143] *Id.*

historic diversity in stand ages, considering that fire suppression during the past approximately 100 years has led to such dramatic declines in tree recruitment.[144]

Odion et al. (2016) provide a plausible response to Stevens et al. (2016).[145] According to Odion and others, in spite of the high variability in tree ages, with often a relatively high percentage of older trees, stand-age values provide a reasonable estimate of the time since the last high-severity fire.[146] Citing Stevens et al. (2016), the Conservation Assessment and NRV Technical Report criticize the use of stand-age values to estimate the frequency and extent of historic high-severity fire.[147] Yet these agency documents do not discuss or cite Odion et al. (2016).[148] Citing Stevens et al. (2016), the final EIS for Inyo plan revision, and the revised draft EIS for Sequoia and Sierra plan revision, dismiss Odion et al. (2014) on the grounds of "serious analytical and methodological issues" and other reasons, with no discussion or citation of Odion et al. (2016).[149]

The final EIS and revised draft EIS cite Miller and Safford (2017), which supposedly provides corroborating evidence of agency claims concerning historic fire severity in the Sierra Nevada and also provides extensive criticisms of Baker (2014, 2015) and Odion et al. (2014).[150] According to Miller and Safford (2017), in their analyses Baker, Odion, and others mistakenly assume that "tree regeneration in dry forests could only have arisen after high-severity fire."[151] Jay Miller and Hugh Safford assert that tree establishment in these forests "is more closely linked to periodic wet episodes or longer fire free periods," citing Fulé et al. (2014).[152]

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[144] *See* Odion et al., *supra* note 132, at 4–5. "Disturbance processes dramatically declined following the onset of fire exclusion, suggesting fire was the primary disturbance agent." Odion et al., *supra* note 27, at 10.
[145] *See* Odion et al., *supra* note 132, at 3–5.
[146] *Id.*
[147] CONSERVATION ASSESSMENT, *supra* note 17, at 128; NRV TECHNICAL REPORT, *supra* note 38, at 50.
[148] CONSERVATION ASSESSMENT, *supra* note 17, at 128; NRV TECHNICAL REPORT, *supra* note 38, at 50.
[149] INYO FINAL EIS, *supra* note 3, at 168; REVISED DRAFT EIS, *supra* note 4, at 172.
[150] *See* INYO FINAL EIS, *supra* note 3, at 168; REVISED DRAFT EIS, *supra* note 4, at 172; *see also* Jay D. Miller & Hugh D. Safford, *Corroborating Evidence Of a Pre-Euro-American Low- to Moderate-Severity Fire Regime in Yellow Pine–Mixed Conifer Forests of the Sierra Nevada, California, USA*, 13 FIRE ECOLOGY 58, 74–80 (2017).
[151] Miller & Safford, *supra* note 150, at 78.
[152] *Id.*

Yet, as mentioned, in their response to Fulé et al. (2014), Williams and Baker (2014) point out that they have discussed alternative possible causes of tree regeneration in the Sierra Nevada and other western United States landscapes, concluding that the alternatives do not account for the structural patterns within reconstructed historic landscapes.[153] As also mentioned, Odion et al. (2016) acknowledge that, historically, tree recruitment occurred in the Sierra Nevada in the absence of high-severity fire.[154] They defend their claim that high-severity fire was predominantly responsible for the diverse stand ages found in the Sierra Nevada prior to fire suppression.[155] Miller and Safford (2017) do not consider these responses—they do not discuss or cite Williams and Baker (2014) or Odion et al. (2016).[156] In fact, Baker, Odion, and others do not assume that tree regeneration occurs only after high severity fire.[157]

Miller and Safford (2017) also criticize Baker (2014, 2015) for consistently overestimating tree densities, citing Collins et al. (2011), Hagmann et al. (2013, 2014), and Stephens et al. (2015).[158] Yet, as mentioned, Baker (2015) claims that the early 1900s timber-inventory data analyzed in these studies lacks information concerning smaller trees and denser forests, and that the inventories were conducted in areas that had been subjected to human alterations such as logging.[159] In addition, according to Baker, these studies did not take into account records of fire severity that were included with the inventory data provided for the sampled plots.[160] Baker claims that the estimates of historic forest density and fire severity presented in Collins et al. (2011), Hagmann et al. (2013, 2014), Stephens et al. (2015) and other such studies are not representative "of even the overall inventory area, much less the larger surrounding landscape."[161] Ironically, Miller and Safford (2017) criticize Baker (2014, 2015) for providing overestimates of tree densities, without considering

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[153] *See* Williams & Baker, *supra* note 87, at 832; Williams & Baker, *supra* note 82, at 1050.
[154] Odion et al., *supra* note 132, at 2.
[155] *Id.* at 4–5.
[156] Miller & Safford, *supra* note 150, at 78, 81–90.
[157] *See* Odion et al., *supra* note 27, at 10; Williams & Baker, *supra* note 87, at 832; Williams & Baker, *supra* note 82, at 1050. Odion and others write, "We did not intend to suggest that tree recruitment occurred only with fire." Odion et al., *supra* note 132, at 2.
[158] Miller & Safford, *supra* note 150, at 78. In this study, these scientists acknowledge that the method used by Baker involves pooling the data, and they do not criticize Baker for relying on an unacceptably low sampling density. *Id.*
[159] Baker, *supra* note 67, at 12–13.
[160] *Id.* at 12.
[161] *Id.*

the detailed criticisms offered by Baker (2015) of those studies they cite in support of their claim that Baker (2014, 2015) provides overestimates.[162]

Without consideration of the published responses, the criticisms of Baker (2014) and Odion et al. (2014) presented within the Conservation Assessment, NRV Technical Report, and Miller and Safford (2017) are merely superficial, not based on fair consideration of the scientific literature.[163] The final EIS for Inyo plan revision, and the revised draft EIS for Sequoia and Sierra plan revision, present reasons for dismissing the Baker and Odion studies ("serious analytical and methodological issues," etc.), citing in support Levine et al. (2017), Stevens et al. (2016), Fulé et al. (2014), and Miller and Safford (2017).[164] Yet without consideration of the published responses to the criticisms raised within these studies, the reasons for dismissal listed within the final EIS and revised draft EIS are also merely superficial, not based on fair consideration of the literature.[165] Generally, within the final EIS, revised draft EIS, and other documents involved in plan revision in the Sierra Nevada, Baker (2014) and Odion et al. (2014) have been dismissed without adequate justification.[166]

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[162] Miller & Safford, *supra* note 150, at 78.

[163] CONSERVATION ASSESSMENT, *supra* note 17, at 128–29; NRV TECHNICAL REPORT, *supra* note 38, at 49–50; Miller & Safford, *supra* note 150, at 78. Miller and Safford (2017) also criticize Baker (2014, 2015) for errors in methodology, citing unpublished data provided by Levine. *Id.* Levine's claim of flawed methodology is addressed in Baker and Williams (2018). Baker & Williams, *supra* note 96, at 287. Miller and Safford (2017) present this interesting new criticism: "many areas identified" in Baker (2014) "as having experienced high-severity fire are unsuitable" for ponderosa pine and mixed-conifer forests due to their topographical settings (excessively low elevations or steep south- or west-facing canyon slopes). Miller & Safford, *supra* note 150, at 78–79. In addition, these areas include chaparral that does not transition into conifer forest. *Id.* at 79. Their point is that Baker has overestimated the occurrence of high-severity fire in Sierra Nevada ponderosa pine and mixed-conifer forests. *Id.* at 78–80. Baker has not yet published a response. One difficulty is that Miller and Safford do not specify how many of the areas identified by Baker as having experienced high-severity fire are unrepresentative of ponderosa pine and mixed-conifer forests. *Id.* The diagrams they present are misleading, as the circled areas on the maps that supposedly indicate unrepresentative areas in fact include many areas that are identified in the maps as pine and mixed-conifer forest. *Id.* at 79. The critics do not specify how many areas are located in unfavorable topographical settings. *Id.* at 78–79. In short, the criticism may be fair to some extent, but, for all we know at this point, only relatively minimal adjustments are required to Baker's overall estimates to compensate for unrepresentative areas.

[164] INYO FINAL EIS, *supra* note 3, at 168; REVISED DRAFT EIS, *supra* note 4, at 172.

[165] INYO FINAL EIS, *supra* note 3, at 168; REVISED DRAFT EIS, *supra* note 4, at 172.

[166] *See* CONSERVATION ASSESSMENT, *supra* note 17, at 128–29; INYO FINAL EIS, *supra* note 3, at 168; NRV TECHNICAL REPORT, *supra* note 38, at 49–50; REVISED DRAFT EIS, *supra* note 4, at 172; Miller & Safford, *supra* note 150, at 77–80.

Especially troubling is that, within the final EIS and other documents, there is no consideration of the claim by Baker that his procedure has been corroborated by numerous and varied tests—there is no consideration of the corroborating results reported by Baker.[167]

The final EIS dismisses Hanson and Odion (2016) from consideration in plan revision due to "serious analytical and methodological issues," and other reasons left unexplained.[168] Hanson and Odion (2016) present an analysis of data from the 1910/1911 Forest Service timber inventories, in which surveyors noted logging history, species composition, understory structure (small trees and shrubs), and fire effects within plots covering a total of 65,296 ha in the Stanislaus National Forest.[169] These timber inventories were conducted prior to fire suppression efforts.[170] Chad Hanson and Dennis Odion note that their findings are contrary to Collins et al. (2011, 2015), Stephens et al. (2015), and other studies that also involve analysis of the agency's 1910/1911 timber-inventory data, studies cited within agency documents in support of claims concerning historic forest structure and fire severity.[171] Hanson and Odion state:

> [W]e found considerable evidence for substantial portions of large areas affected by high-severity fires. . . . [I]t was clear that mixed-severity fire regimes were characteristic of ponderosa pine and mixed conifer forests of the western slope . . . before fire suppression.[172]

> The 1910/1911 Forest Survey data did not support the hypothesis of relatively homogeneous, open, pine-dominated forests and sparse understories that were maintained by low-severity fire across this Sierra Nevada landscape. Rather, the data describe forests that were characterized

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[167] *See* CONSERVATION ASSESSMENT, *supra* note 17, at 128–29; INYO FINAL EIS, *supra* note 3, at 168; NRV TECHNICAL REPORT, *supra* note 38, at 49–50; REVISED DRAFT EIS, *supra* note 4, at 172; Miller & Safford, *supra* note 150, at 78; *see also* Baker, *supra* note 46, at 11, 15, 22, 26; Baker, *supra* note 67, at 13, 20.

[168] *See* INYO FINAL EIS, *supra* note 3, at 168. *See generally* Hanson & Odion, *supra* note 10. The revised draft EIS for Sequoia and Sierra forests does not discuss or cite Hanson and Odion (2016). *See* REVISED DRAFT EIS, *supra* note 4; *see also id.* at 172, 765–832.

[169] Hanson & Odion, *supra* note 10, at 9, 11.

[170] *Id.* at 9.

[171] *See id.* at 15; *see also* DRAFT EIS, *supra* note 2, at 137, 150, 318; INYO FINAL EIS, *supra* note 3, at 163, 172–73, 334; NRV TECHNICAL REPORT, *supra* note 38, at 44–45, 49, 98–99; REVISED DRAFT EIS, *supra* note 4, at 167, 179–80, 461.

[172] Hanson & Odion, *supra* note 10, at 14–15.

> by strong contrasts and dynamic natural processes. These historical patterns were also consistent with the widely contrasting habitat associations reported for California Spotted Owls and Pacific Fishers in terms of very dense, old forest for nesting/roosting and denning/resting habitat, and complex early-seral forest, created by moderate/high-severity fire, for foraging.[173]

Hanson and Odion (2016) attribute the discrepancies between their results and those reported in Collins et al. (2011, 2015), Stephens et al. (2015), and other timber-inventory studies to several factors, including that in these studies only a relatively small number of plots were analyzed, and the results were then extrapolated to entire landscapes.[174] According to Hanson and Odion, an accurate representation of historic conditions in the Sierra Nevada requires examining inventory data at appropriately large spatial scales.[175] "Spatial scale was an important issue in our results," they write.[176] "Had we analyzed only the smaller 1910 portion of our study area, or a small subset of the 1911 portion, as had been done previously, we might also have reached overly narrow conclusions."[177]

The final EIS dismisses from consideration Hanson and Odion (2016) due to "serious analytical and methodological issues" and other reasons, citing Miller and Safford (2017), which finds corroboration for agency claims concerning historic forest conditions in the results of Collins et al. (2011, 2015), Stephens et al. (2015), and other timber-inventory studies.[178] Ironically, Hanson and Odion (2016) is dismissed in the final EIS based largely upon the results of timber-inventory studies the methodology of which has plausibly been called into question by the very study that is dismissed, without consideration of the alleged difficulties.[179] The final EIS, and other documents involved in plan revision, fail to consider or cite Baker and Hanson (2017), which provides more detailed criticisms of these timber-inventory studies.[180] According to Baker and Hanson (2017):

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[173] *Id.* at 17.
[174] *Id.* at 16. They also attribute the discrepancies to the fact that these studies did not take into account notes concerning fire severity included with the inventory data provided for the sampled plots. *Id.* at 15.
[175] *Id.* at 16–17.
[176] *Id.* at 16.
[177] Hanson & Odion, *supra* note 10, at 16.
[178] INYO FINAL EIS, *supra* note 3, at 168; Miller & Safford, *supra* note 150, at 78.
[179] INYO FINAL EIS, *supra* note 3, at 168.
[180] *See* INYO FINAL EIS, *supra* note 3; NRV TECHNICAL REPORT, *supra* note 38; REVISED DRAFT EIS, *supra* note 4; *see also* William L. Baker & Chad T. Hanson, *Improving the Use*

"Early timber inventories were intentionally biased toward areas of large, merchantable trees and against younger, denser forests, significantly limiting evidence about both overall stand-level and landscape-level heterogeneity. Yet . . . timber-inventory data with these known biases were often used with no mention of these biases."[181] As with Baker (2014) and Odion et al. (2014), within the final EIS, Hanson and Odion (2016) has been dismissed without adequate justification.[182]

Finally, it should be mentioned that Forest Service claims concerning historic forest structure and fire severity in the Sierra Nevada do not enjoy especially strong support. The agency's NRV Technical Report provides a number of descriptions of historic Sierra Nevada forests recorded by early observers.[183] Show and Kotok (1924) write, for example, "[e]xtensive crown fires, though common in the forests of the western white pine region, are almost unknown in the California pine region."[184] Sudworth (1900) writes, "The fires of the present time are peculiarly of a surface nature, and with rare exception there is no reason to believe that any other type of fire has occurred here."[185] With respect to forest structure, in a well-known passage Muir (1894) writes:

> The inviting openness of the Sierra woods is one of their most distinguishing characteristics. The trees of all the species stand more or less apart in groves, or in small, irregular groups, enabling one to find a way nearly everywhere, along sunny colonnades and through openings that

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of Early Timber Inventories in Reconstructing Historical Dry Forests and Fire in the Western United States, 8 ECOSPHERE 1 (2017), https://esajournals.onlinelibrary.wiley.com/doi/full/10.1002/ecs2.1935 [https://perma.cc/5T4S-KJJX].

[181] Baker & Hanson, *supra* note 180, at 13.

[182] *See* INYO FINAL EIS, *supra* note 3, at 168. The revised draft EIS for Sequoia and Sierra forests dismisses Baker (2014), Odion et al. (2014), and other studies (for "serious analytical and methodological issues," etc.), citing, among other studies, Collins et al. (2011, 2015) and Stephens et al. (2015). REVISED DRAFT EIS, *supra* note 4, at 172. Yet, in this revised draft EIS, there is no discussion or citation of Baker (2015), Hanson and Odion (2016), or Baker and Hanson (2017), which plausibly criticize the methodology used in such timber-inventory studies. *Id.*

[183] NRV TECHNICAL REPORT, *supra* note 38, at 38–39, 42–44, 78–79, 93–96, 146–49, 162–64, 171.

[184] *See id.* at 39; *see also* S.B. SHOW & E.I. KOTOK, U.S. DEP'T OF AGRIC., THE ROLE OF FIRE IN THE CALIFORNIA PINE FORESTS, BULLETIN 1294 31 (1924).

[185] *See* NRV TECHNICAL REPORT, *supra* note 38, at 43; *see also* G.B. Sudworth, *Stanislaus and Lake Tahoe Forest Preserves, California and Adjacent Territory*, 21 ANNUAL REPORT OF THE U.S. GEOLOGICAL SURVEY 505, 557 (1900).

> have a smooth, park-like surface, strewn with brown needles and burs.[186]

Yet early observers also describe Sierra Nevada forests as dense, highly heterogeneous, and showing signs of high-severity fire.[187] As acknowledged in the NRV Technical Report, "[B]oth Leiberg (1902) and Sudworth (1900) described highly heterogeneous forest structure in the Sierra Nevada."[188] As quoted in this report, Leiberg (1902) writes: "In the central district, outside the canyon areas, the forest is of moderate density and is rarely what might be called open, except in stands of very old growth. Elsewhere, large quantities of white fir and Douglas-fir with oak combine to form thickset stands."[189] Hanson and Odion (2016) also quote from Leiberg (1902): "All the slopes of Duncan Canyon from its head down show the same marks of fire—dead timber, dense undergrowth, stretches of chaparral, thin lines of trees or small groups rising out of the brush, and heavy blocks of forest surrounded by chaparral."[190] According to Hanson and Odion, "Leiberg observed this juxtaposition of dense, old forest and high-severity fire patches in numerous mixed-conifer forest locations in the Sierra Nevada."[191]

Baker (2014) provides a number of descriptions from early observers.[192] According to Baker, "Early observations also support the idea that [Sierran mixed-conifer] forests were dense."[193] Eyewitness accounts do not provide strong support for agency assertions concerning historic forest structure and fire severity in the Sierra Nevada, as these accounts are highly variable.[194]

As explained in the NRV Technical Report, the agency also relies upon studies of current reference forests to estimate historic fire regimes.[195] "We used modern-day data from reference ecosystems whenever possible,"

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[186] *See* NRV TECHNICAL REPORT, *supra* note 38, at 94; *see also* JOHN MUIR, THE MOUNTAINS OF CALIFORNIA ch. 8 (1894).
[187] *See, e.g.*, NRV TECHNICAL REPORT, *supra* note 38, at 94.
[188] *Id.*
[189] *See id.* (quoting JOHN B. LEIBERG, FOREST CONDITIONS IN THE NORTHERN SIERRA NEVADA, CALIFORNIA 32 (1902)).
[190] Hanson & Odion, *supra* note 10, at 17 (quoting JOHN B. LEIBERG, FOREST CONDITIONS IN THE NORTHERN SIERRA NEVADA, CALIFORNIA 171 (1902)).
[191] Hanson & Odion, *supra* note 10, at 17.
[192] Baker, *supra* note 46, at 35–57.
[193] *Id.* at 3.
[194] *See id.* at 35–57.
[195] NRV TECHNICAL REPORT, *supra* note 38, at 41–42.

the report states.[196] The reference forests, considered relatively unaltered by human activity, include forests in Yosemite National Park and the Sierra de San Pedro Mártir, northern Baja California, Mexico.[197] As is explained in the technical report, studies of fire severity in these forests utilize a methodology allowing detection of high-severity burn patches only where tree mortality due to fire is greater than 90 or 95 percent ("tree mortality is almost complete").[198] According to this report, however, traditionally high-severity fire has been understood as resulting in tree mortality of greater than 75–80 percent.[199] According to studies cited in the NRV Technical Report, only relatively low percentages of high-severity fire occur in these reference forests, but with such extreme mortality values used to detect high-severity burn patches, the reported percentages likely underestimate the occurrence of high-severity fire as traditionally understood.[200]

Agency claims concerning historic forest structure and fire severity in the Sierra Nevada are not well supported by eyewitness accounts or by studies of current reference forests. In models that have been developed, high-severity fire was relatively infrequent in Sierra Nevada forests, and, in recent decades, this level of severity has been increasingly frequent and extensive, but such models have been criticized as based on unrealistic assumptions.[201] Miller and Safford (2017) develop a model of historic forest structure and fire severity, claiming that, to account for the relatively

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[196] *Id.* at 23.
[197] *Id.* at 41.
[198] *Id.* at 41–42.
[199] *Id.* at 41. According to Odion and others, "high-severity fire" has traditionally been understood as resulting in greater than 70 percent basal area mortality, and they argue that an overly extreme and narrow definition of high-severity fire is unwarranted. Odion et al., *supra* note 132, at 3, 5.
[200] NRV TECHNICAL REPORT, *supra* note 38, at 41–42. According to studies, high-severity fire has important ecological effects, for example, the creation of early successional forest habitat required by black-backed woodpeckers (*Picoides arcticus*) and many other native species. Hanson & Odion, *supra* note 10, at 17. According to Hanson and Odion, the early successional forest habitat created by such fire "supports high levels of native biodiversity . . . ." *Id.* In these studies, "high-severity fire" is understood as resulting in greater than approximately 70 percent basal area mortality. Odion et al., *supra* note 132, at 3. In short, there are apparently good ecological reasons why high-severity fire has traditionally been characterized using lower mortality values, for example, 70 percent basal area mortality.
[201] For example, Hanson and Odion (2016) are critical of the model of fire behavior in Mallek et al. (2013) for the reason that Mallek and others assume "very low levels of high-severity fire in historical forests," which are likely an underestimate. *See* Hanson & Odion, *supra* note 10, at 8, 13; Chris Mallek et al., *Modern Departures in Fire Severity and Area Vary by Forest Type, Sierra Nevada and Southern Cascades, California, USA*, 4 ECOSPHERE 1 (2013).

high proportion of late-successional forests that existed historically, only low levels of high severity fire (7 percent) could have been present.[202] If current levels of high-severity fire (30 percent) are assumed, they add, too low a proportion of historic ponderosa pine and mixed-conifer forests would have been in the late-successional stage.[203] To confirm their estimate of the proportion of late-successional forests that existed historically, Miller and Safford rely on certain descriptions recorded by early observers, on studies of modern reference forests, and on Collins et al. (2011, 2015), Stephens et al. (2015), and other timber-inventory studies—failing to discuss Baker (2015) and Hanson and Odion (2016).[204]

As pointed out in Hanson et al. (2018), "multiple studies have indicated that there is no long-term increasing trend in high-severity fires in the Sierra Nevada, or in the vast majority of the western U.S."[205] The alternative view of historic forests and fire severity in the Sierra Nevada presented by Baker, Odion, Hanson, and others is actually quite plausible given fair consideration of the literature.

II. HIGH-SEVERITY FIRE AND CALIFORNIA SPOTTED OWLS

According to the draft EIS for plan revision, "Large, high-severity fires, which are occurring more frequently in the Sierra Nevada, are a major threat to the California spotted owl."[206] The revised draft EIS for plan revision for the Sequoia and Sierra forests states, "[h]igh-severity fire and widespread loss of habitat is perhaps the biggest threat to spotted owls."[207] The revised draft EIS does not provide much discussion, however.[208] Within the draft EIS, there is brief discussion of Lee et al. (2012), according to which California spotted owls "continue to occupy sites where almost one third (32 percent) of suitable habitat had been burned at high severity."[209] In this study, Derek Lee and others "hypothesize that there may be a critical spatial threshold (proportion of a site) above which a burn

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[202] Miller & Safford, *supra* note 150, at 59.
[203] *Id.*
[204] *See id.* at 75–77; *see also* Baker, *supra* note 67; Hanson & Odion, *supra* note 10.
[205] Hanson et al., *supra* note 27, at 102.
[206] DRAFT EIS, *supra* note 2, at 336 (stating that there are no spotted owls within Inyo National Forest).
[207] REVISED DRAFT EIS, *supra* note 4, at 470; *see also id.* at 463.
[208] *Id.*
[209] DRAFT EIS, *supra* note 2, at 338; Derek E. Lee et al., *Dynamics of Breeding-Season Site Occupancy of the California Spotted Owl in Burned Forests*, 114 CONDOR 792, 800 (2012).

at high severity could adversely affect California spotted owl occupancy."[210] This is a recurring theme within documents involved in plan revision, including the draft EIS and Conservation Assessment (cited within the revised draft EIS): there may be a critical spatial threshold for spotted owl tolerance of high-severity fire.[211] The uncertainty underlies the supposed threat. The Conservation Assessment states, "While recent studies indicate that California spotted owls continue to occupy sites that experience low-moderate severity and mixed-severity wildfire, the threshold of the proportion of high-severity fire that owls can tolerate within their territory is unknown."[212]

Yet the draft EIS, revised draft EIS, Conservation Assessment, and other documents do not discuss in adequate detail Lee and Bond (2015), which involves an analysis of spotted owl survey data collected during the breeding season following the historically large Rim Fire in the Sierra Nevada.[213] In this study, researchers found that even large areas of high-severity fire, with up to 70 percent of suitable habitat burned within a territory, did not affect occupancy.[214] Derek Lee and Monica Bond claim that their results "add to observations that California Spotted Owls continue to use post-fire landscapes, even when the fires were large and where large areas burned at high severity, suggesting that owls are not generally negatively impacted by high-severity fire."[215] According to Lee and Bond, as suggested by their data and other recent studies, high-severity fire "is not a major threat to the persistence of California Spotted Owls in the Sierra Nevada."[216] These researchers recommend that land managers "not immediately assume spotted owls vacate burned sites, even with large areas of high severity fire in a PAC [protected activity center]," and that managers "forgo logging activities in burned forests within 1.5 km" of owl nest sites.[217]

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[210] DRAFT EIS, *supra* note 2, at 338; Lee et al., *supra* note 209, at 800.
[211] CONSERVATION ASSESSMENT, *supra* note 17, at 64–65, 203; DRAFT EIS, *supra* note 2, at 338; REVISED DRAFT EIS, *supra* note 4, at 470.
[212] CONSERVATION ASSESSMENT, *supra* note 17, at 203; *see id.* at 64–65.
[213] *See* Lee & Bond, *supra* note 13, at 228–31; *see also* CONSERVATION ASSESSMENT, *supra* note 17, at 26–27, 64–65, 202–03, 267, 285; FOREST SERV., U.S. DEP'T OF AGRICULTURE, CONSERVATION STRATEGY FOR THE CALIFORNIA SPOTTED OWL IN THE SIERRA NEVADA 10–11 (April 2019) [hereinafter CONSERVATION STRATEGY]; DRAFT EIS, *supra* note 2, at 336–39; REVISED DRAFT EIS, *supra* note 4, at 470.
[214] Lee & Bond, *supra* note 13, at 234.
[215] *Id.* at 228.
[216] *Id.* at 234.
[217] *Id.* A "protected activity center" (PAC) is defined as 300 acres (121 ha) of suitable habitat approximately centered on the nest tree. *Id.* at 228.

The draft EIS, and revised draft EIS, do not discuss or cite Lee and Bond (2015).[218] The Conservation Assessment cites this study in support of the modest claim that spotted owls are able to tolerate high-severity fire within their territories.[219] The agency's more recent California Spotted Owl Conservation Strategy (Conservation Strategy) states that, according to Lee and Bond (2015), some high-severity fires may increase forest heterogeneity in ways beneficial to owls.[220] These are not adequate representations of this study. Within the documents involved in plan revision, generally, there is no detailed consideration of the results and conclusions of Lee and Bond (2015).[221] According to Lee and Bond, the threshold of high-severity fire owls can tolerate within their territories may be as high as 70 percent, and available data suggests, they add, that high-severity fire generally does not negatively impact spotted owls in the Sierra Nevada.[222] The repeated assertion within agency documents that there may be a critical spatial threshold for high-severity fire within owl territories, without adequate consideration of Lee and Bond (2015), is misleading.[223] One may easily assume that this threshold is relatively low and that spotted owls are in imminent danger from high-severity fire, although this seems not to be the case.[224]

Within the draft EIS, in support of the claim that large, high-severity fires "are a major threat to the California spotted owl," there is brief discussion of Clark (2007) and Clark et al. (2011).[225] According to the

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[218] *See* DRAFT EIS, *supra* note 2, at 336–39; REVISED DRAFT EIS, *supra* note 4, at 470. The final EIS for Inyo plan revision does not discuss or cite this study; again, there are no spotted owls in this forest. *See* DRAFT EIS, *supra* note 2, at 336; *see also* INYO FINAL EIS, *supra* note 3.

[219] *See* CONSERVATION ASSESSMENT, *supra* note 17, at 202; *see also id.* at 27, 285.

[220] CONSERVATION STRATEGY, *supra* note 213, at 11. The Conservation Strategy "provides scientific information and management recommendations" for the ten Sierra Nevada national forests. *Id.* at 1–2. This document is cited within the revised draft EIS for Sequoia and Sierra forests plan revision. REVISED DRAFT EIS, *supra* note 4, at 14, 489.

[221] *See* CONSERVATION ASSESSMENT, *supra* note 17, at 26–27, 64–65, 202–03, 267, 285; CONSERVATION STRATEGY, *supra* note 213, at 10–11; DRAFT EIS, *supra* note 2, at 336–39; REVISED DRAFT EIS, *supra* note 4, at 470.

[222] Lee & Bond, *supra* note 13, at 228, 233–34.

[223] *See* CONSERVATION ASSESSMENT, *supra* note 17, at 64–65, 203; DRAFT EIS, *supra* note 2, at 338.

[224] Lee & Bond, *supra* note 13, at 228, 233–34.

[225] DRAFT EIS, *supra* note 2, at 336–37. *See generally* Darren A. Clark et al., *Survival Rates of Northern Spotted Owls in Postfire Landscapes of Southwest Oregon*, 45 J. RAPTOR RES. 38 (2011); Darren A. Clark, Demography and Habitat Selection of Northern Spotted Owls in Post-Fire Landscapes of Southwest Oregon (Sept. 6, 2007) (unpublished MS Thesis, Oregon State University).

draft EIS, in these studies of northern spotted owls (*Strix occidentalis caurina*), it was found that "annual survival rates were lower in . . . owls inhabiting burned areas or displaced by the wildfire as compared to owls that inhabited areas outside the burn perimeter."[226] In these studies, however, Darren Clark and others do not distinguish the effects of high-severity fire from the effects of post-fire salvage logging within owl territories.[227] These researchers caution against interpreting the lower survival rates as due to high-severity fire.[228] Clark (2007) states, "I did not examine the impacts of wildfire and salvage separately in this analysis."[229] Clark et al. (2011) acknowledge that logging and salvage logging occurred within the owl territories they examined, and they state, "[t]his undoubtedly exacerbated or confounded our ability to assess the effects of wildfire on survival rates in this study."[230] Due to these confounding factors, not acknowledged in the draft EIS, Clark (2007) and Clark et al. (2011) do not provide support for the claim that large, high-severity fire poses a major threat to spotted owls.[231]

In support of the claim that large, high-severity fire threatens spotted owls, the revised draft EIS and other documents rely on Jones et al. (2016a).[232] This study involves a comparison of spotted owl territory occupancy measured during the breeding season following the King Fire of 2014, to territory occupancy measured annually for the previous two decades in the study area.[233] Jones et al. (2016a) state:

> The probability of owl site extirpation was seven times higher after the fire than before the fire at severely burned sites, contributing to the greatest annual population decline observed during our 23-year study.[234]
>
> Our study demonstrates that increasingly frequent megafires pose a threat to spotted owls and likely other old-forest

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[226] DRAFT EIS, *supra* note 2, at 337.
[227] *See* Clark, *supra* note 225, at 124–25; *see also* Clark et al., *supra* note 225, at 45.
[228] *See* Clark, *supra* note 225, at 124–25; *see also* Clark et al., *supra* note 225, at 45.
[229] *See* Clark, *supra* note 225, at 122; *see also id.* at 124–25.
[230] Clark et al., *supra* note 225, at 45.
[231] *See* DRAFT EIS, *supra* note 2, at 336–37.
[232] CONSERVATION ASSESSMENT, *supra* note 17, at 27, 267, 285; CONSERVATION STRATEGY, *supra* note 213, at 10–11; REVISED DRAFT EIS, *supra* note 4, at 470. *See generally* Gavin M. Jones et al., *Megafires: An Emerging Threat to Old-Forest Species*, 14 FRONTIERS OF ECOLOGY AND ENV'T 300 (2016).
[233] Jones et al., *supra* note 232, at 301–03.
[234] *Id.* at 300.

> species and, as a result, suggests that forest ecosystem restoration and old-forest species conservation may be more compatible than previously believed.[235]

As pointed out in DellaSala et al. (2017), however, the spotted owl territories examined in Jones et al. (2016a) were likely subjected to pre- and post-fire logging, factors that would negatively affect territory occupancy.[236] Indeed, Jones and others acknowledge that forests within their study area "have a complex history of management, logging, and fire suppression dating back at least 100 years."[237] They acknowledge that 40 percent of their study area is located on private forestlands, and that recently there has been more emphasis on clear-cutting these lands.[238] As DellaSala and others imply, the territory abandonment reported in the Jones study may be due to logging rather than the effects of fire.[239] Jones et al. (2016a) report that, in the year following the King Fire, they found "the greatest annual population decline observed during our twenty-three-year study," which is evidence, they claim, that mega-fire poses a threat to spotted owls.[240] Yet the spotted owl population in their study area had been in steady decline during the past 22 years, likely due to logging and other management interventions.[241] As pointed out by critics, the downward trend in population, from year to year, would account for the greater observed population loss following the King Fire.[242] One would expect that the population loss observed by Jones and others after the fire would be greater when compared to annual losses in previous years, even in the absence of fire.[243]

For several reasons, the results reported by Jones et al. (2016a) are not compelling or persuasive.[244] More recently, Hanson et al. (2018)

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[235] *Id.* at 305.
[236] Dominick A. DellaSala et al., *Accommodating Mixed-Severity Fire to Restore and Maintain Ecosystem Integrity with a Focus on the Sierra Nevada of California, USA*, 13 FIRE ECOLOGY 148, 159 (2017).
[237] Jones et al., *supra* note 232, at 301.
[238] *Id.*
[239] DellaSala et al., *supra* note 236, at 159.
[240] *See* Jones et al., *supra* note 232, at 300; *see also id.* at 305.
[241] *Id.* at 301, 303–04.
[242] *See Jones et al. "Megafire" paper is bad science*, WILD NATURE INST., http://www.wildnatureinstitute.org/blog/jones-et-al-megafire-paper-is-bad-science [https://perma.cc/Z8US-XGBL] (last updated Jan 2019) [hereinafter WILD NATURE INST.].
[243] *See id.*
[244] Jones et al. (2016a) includes graphs that supposedly show the effect of the King Fire on the proportion of owl territories occupied and on the rate of change in territory occupancy, but these graphs do not show convincingly that the King Fire had any appreciable effect.

criticize the Jones study for the reason that the owl territories they report as burned at high severity, with greater than 50 percent habitat loss and abandoned post-fire, had not been occupied prior to the fire.[245] This is shown, according to Hanson and others, by owl survey data acquired from the Forest Service.[246] According to Jones et al. (2016a), their data indicate that spotted owls avoid high-severity burned areas when foraging; this is yet another problem discussed by Hanson and others, as Jones et al. "included recent pre- and post-fire clearcut areas in their analysis of . . . high-severity fire areas for foraging."[247] Citing relevant studies, Hanson and others report that spotted owls tend to avoid clear-cut areas when foraging.[248]

Jones et al. (2016a) is another important study for the Forest Service, documenting (it is claimed) negative impacts of large, high-severity fire on California spotted owls.[249] According to the Conservation Strategy, Jones et al. (2016a) shows that "occupancy of severely burned territories declined substantially, and severely burned areas were avoided by owls, even when foraging."[250] The Revised Draft EIS, Conservation Assessment, and Conservation Strategy rely on this study but do not disclose its weaknesses, although they are discussed in the literature and online.[251] These agency documents fail to discuss or cite DellaSala et al. (2017), and the Revised Draft EIS dismisses Hanson et al. (2018) from consideration without adequate justification.[252]

See Jones et al., *supra* note 232, at 303. The proportion of territories occupied after the King Fire seems to fit into the general decline in proportion of territories occupied over approximately the past twenty years. *Id.* It seems an exaggeration to interpret these graphs as showing an appreciable impact of the King Fire. *See id.*

[245] Hanson et al., *supra* note 27, at 101.

[246] *Id.*

[247] *Id.*; Jones et al., *supra* note 232, at 300.

[248] Hanson et al., *supra* note 27, at 101.

[249] *See* CONSERVATION ASSESSMENT, *supra* note 17, at 27; Jones et al., *supra* note 232, at 300, 305.

[250] CONSERVATION STRATEGY, *supra* note 213, at 10. "Jones et al. (2016) demonstrated a strong first-year impact of the King Fire in the central Sierra Nevada on California spotted owls." CONSERVATION ASSESSMENT, *supra* note 17, at 27.

[251] *See* CONSERVATION ASSESSMENT, *supra* note 17, at 27, 267; CONSERVATION STRATEGY, *supra* note 213, at 10–11; REVISED DRAFT EIS, *supra* note 4, at 470; *see also* DellaSala et al., *supra* note 236, at 159; Hanson et al., *supra* note 27, at 101; WILD NATURE INST., *supra* note 242.

[252] CONSERVATION ASSESSMENT, *supra* note 17, at 27, 267; CONSERVATION STRATEGY, *supra* note 213, at 10–11; REVISED DRAFT EIS, *supra* note 4, at 470. The revised draft EIS dismisses Hanson et al. (2018) for reasons that include "drawing unsupported conclusions," citing Peery et al. (2019). *See* REVISED DRAFT EIS, *supra* note 4, at 172–73; *see also* M. Zachariah Peery et al., *The Conundrum of Agenda-Driven Science in Conservation*,

The Conservation Strategy cites Stephens et al. (2016), according to which, given current trends in fire size and severity, moderate- and high-severity fire may substantially alter a majority of spotted owl nesting habitat in the future.[253] The Conservation Strategy repeats this apparently alarming claim in Stephens et al. (2016): according to their model, "within the next 75 years . . . the cumulative amount of nesting habitat burned at high or moderate-to-high severity (more than 50 percent basal area mortality) will exceed the total amount of habitat existing today."[254] Scott Stephens and others conclude that fire of moderate- and high-severity may pose "a substantial threat to [spotted owl] persistence," and the Conservation Strategy asserts, citing this study, "[l]arge, high-severity wildfire threatens [California spotted owl] persistence across the landscape."[255] Stephens and others add, "[M]ore comprehensive forest restoration activities may be needed in [spotted owl] habitat to avoid significant losses of older forests."[256]

Yet, as acknowledged by Stephens et al. (2016), fire of different severity levels naturally occurs in patches across a landscape, and their study "cannot address the issue of the forest patch size at which a significant loss of canopy cover reduces habitat use."[257] In other words, this study provides no information on the spatial extent of moderate- and high-severity fire patches beyond which there would be deleterious effects on

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FRONTIERS IN ECOLOGY AND THE ENV'T 80 (2019). Peery et al. (2019) claim that Hanson and others rely on erroneous data and improper analysis for their criticism of Jones et al. (2016a). A major difficulty, they claim, is that Hanson and others fail to consider data reported by Jones et al. for four severely burned territories, each burned over 90 percent of its area, which clearly show abandonment. *Id.* at S4. According to Bond et al. (2019), however, these territories had been logged post-fire, and so cannot be used in the analysis of possible fire effects. *See* Monica L. Bond et al., *We Refute the "Conundrum of Agenda-Driven Science": Commentary on Peery et al. 2019* 8 (2019), https://www.researchgate.net/publication/332233878_We_Refute_the_Conundrum_of_Agenda-Driven_Science_Commentary_on_Peery_et_al_2019 [https://perma.cc/BTD4-KDGU]. Bond and others do not accept the claim (which they find puzzling) that the analysis in Hanson et al. (2018) involves generally erroneous data. *Id.* at 7. Bond et al. (2019), a draft document, is a plausible response to Peery et al. (2019), yet is not discussed or cited in the revised draft EIS. REVISED DRAFT EIS, *supra* note 4, at 172–73.

[253] *See* CONSERVATION STRATEGY, *supra* note 213, at 10; *see also* Scott L. Stephens et al., *Wildfire Impacts on California Spotted Owl Nesting Habitat in the Sierra Nevada*, 7 ECOSPHERE 1, 11 (2016).

[254] *See* CONSERVATION STRATEGY, *supra* note 213, at 10; Stephens et al., *supra* note 253, at 1, 9.

[255] Stephens et al., *supra* note 253, at 1; CONSERVATION STRATEGY, *supra* note 213, at 10.

[256] Stephens et al., *supra* note 253, at 1.

[257] *Id.* at 13.

owls.[258] This is the important issue, however. That an extensive amount of habitat may burn in the future at moderate and high severities does not, in itself, imply significant impacts on spotted owls.[259] Much depends on whether there is a critical spatial threshold beyond which the owls are harmed.[260] The study is quite limited in what is established, and these researchers acknowledge that their results "should be viewed with some caution in estimating impacts to the [spotted owl]."[261] This study does not support the conclusion that moderate- and high-severity fire threaten, or may threaten, spotted owl persistence, since fire of such severities is natural in these forests and is patchy, and the owls may generally be unaffected by large patches of such fire within their territories.[262]

According to the Conservation Strategy, citing a number of studies, "[l]arge, high-severity patches are linked to decreases in spotted owl occupancy, colonization, and habitat use."[263] This claim is also found (essentially) in the Conservation Assessment.[264] In both documents, Roberts et al. (2011) is cited in support, but the results and conclusions of this study do not support the above statement.[265] Roberts et al. (2011) provides an analysis of two years of survey data of spotted owl territory occupancy in Yosemite National Park.[266] These researchers conclude that fire of varying severities in the park did not affect territory occupancy.[267] "Our burned areas burned at all severities," Roberts and others write, "predominantly . . . low to moderate," but some areas at high-severity.[268] Both documents also cite Tempel et al. (2014), in which these researchers conclude, "high-severity fire negatively influenced the probability of territory colonization."[269] According to Lee and Bond (2015), however, this conclusion

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[258] *See id.*
[259] *See id.*
[260] *Id.* at 3.
[261] *Id.*
[262] *See* M.L. Bond, *The Heat is On: Spotted Owls and Wildfire*, *in* EARTH SYSTEMS AND ENVTL. SCIENCES 1, 10 (2016) (ebook).
[263] CONSERVATION STRATEGY, *supra* note 213, at 10 (internal citations omitted).
[264] *See* CONSERVATION ASSESSMENT, *supra* note 17, at 60 (discussing the link between high-severity patches and owl behavior).
[265] *See* CONSERVATION ASSESSMENT, *supra* note 17, at 60; CONSERVATION STRATEGY, *supra* note 213, at 10; *see also* Susan L. Roberts et al., *Effects of Fire on Spotted Owl Occupancy in a Late-Successional Forest*, 144 BIOLOGICAL CONSERVATION 610, 614–17 (2011).
[266] Roberts et al., *supra* note 265, at 611–13.
[267] *Id.* at 616–17.
[268] *Id.* at 610.
[269] Douglas J. Tempel et al., *Effects of Forest Management on California Spotted Owls: Implications for Reducing Wild Fire Risk in Fire-Prone Forests*, 24 ECOLOGICAL APPLICATIONS

is problematic for the reason that Tempel and others found that only a relatively small number of owl territories had been abandoned post-fire and were available for colonization.[270] In addition, territories in the study area were affected by post-fire salvage logging.[271]

In support of the above statement, the Conservation Strategy and Conservation Assessment also cite Eyes (2014), according to which, within Yosemite National Park, foraging owls avoided patches burned at high severity.[272] Yet Eyes found that foraging owls favored the high contrast edges created by high-severity fire.[273] She writes, "[P]erhaps small proportions of high severity fire nested within a larger matrix of low and moderate severity fire may be beneficial for owl foraging by creating high contrast edges."[274] As acknowledged within the Conservation Assessment, Bond et al. (2009) found that spotted owls preferentially use high-severity burned patches for foraging; these researchers suggest that the owls are attracted to these areas due to the abundance of small mammals in the growing hardwood, shrub, and herbaceous vegetation.[275] The Conservation Assessment is critical of the study reported in Bond et al. (2009) for the reason that the sample size was small, and data was gathered during only one breeding season, four years post-fire.[276] Bond and others recognize these limitations.[277] Yet it is fair to say that the effects of high-severity fire on

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2089, 2089 (2014); CONSERVATION ASSESSMENT, *supra* note 17, at 60; CONSERVATION STRATEGY, *supra* note 213, at 10.

[270] *See* Lee & Bond, *supra* note 13, at 234.

[271] *See id.* According to Hanson and others, the owl territories under study in Tempel et al. (2014) were "heavily post-fire logged on both private timberlands and National Forest lands." Hanson et al., *supra* note 27, at 101–02 (internal citations omitted). This confounding factor "was not reported by Tempel et al. (2014)," they write. *Id.*

[272] *See* CONSERVATION ASSESSMENT, *supra* note 17, at 60; CONSERVATION STRATEGY, *supra* note 213, at 10; *see also* Stephanie A. Eyes, The Effects of Fire Severity on California Spotted Owl Habitat Use Patterns (July 2014) (unpublished MS Thesis, Humboldt State University) (on file with the Humboldt State University Library System).

[273] Eyes, *supra* note 272, at 42.

[274] *Id.* at 47.

[275] Monica L. Bond et al., *Habitat Use and Selection by California Spotted Owls in a Postfire Landscape*, 73 J. WILDLIFE MGMT. 1116, 1121–22 (2009) [hereinafter Bond et al., *Habitat Use and Selection by California Spotted Owls*]; CONSERVATION ASSESSMENT, *supra* note 17, at 61. The owls foraged in reportedly large, high-severity patches. *See* Monica L. Bond et al., *Diet and Home-Range Size of California Spotted Owls in a Burned Forest*, 44 WESTERN BIRDS 114, 119 (2013) [hereinafter Bond et al., *Diet and Home-Range Size of California Spotted Owls*].

[276] *See* CONSERVATION ASSESSMENT, *supra* note 17, at 61, 203.

[277] Bond et al., *Diet and Home-Range Size of California Spotted Owls, supra* note 275, at 120.

spotted owl foraging is controversial, and it seems premature to assert that large high-severity burned patches significantly reduce spotted owl foraging ("use") of burned forests.[278] As stated in the Conservation Assessment, sensibly, "[f]urther research is needed on owl foraging habitat use."[279]

According to the Conservation Strategy, citing Lee et al. (2013), "[l]arge, high-severity patches are linked to . . . increases in owl extinction probability."[280] This is not a fair use of this study, however. Lee et al. (2013) are concerned with spotted owl territory occupancy, post-fire, in mountain ranges of southern California.[281] These researchers report no statistically significant impact of fire on territory occupancy.[282] They found some evidence, however, that for those territories in which (on average) greater than twenty-five percent of suitable habitat burned at high severity, there was a higher probability of territory abandonment.[283] According to Lee and others, compared to the Sierra Nevada, less forested habitat exists pre-fire within owl territories in these southern California mountains.[284] They speculate that the possible negative impacts of high-severity fire on territory occupancy in these mountains is a function of the relatively poor quality pre-fire habitat.[285] Lee and others recommend that "forested habitat should be safeguarded from human-caused alteration wherever possible."[286]

Lee et al. (2013) caution that, for several reasons, their results may not be applicable to spotted owls in Sierra Nevada forests.[287] Yet authors of the Conservation Strategy assume, without explanation, that this study is applicable.[288] In summary, the claim within agency documents, "[l]arge,

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[278] CONSERVATION ASSESSMENT, *supra* note 17, at 61; CONSERVATION STRATEGY, *supra* note 213, at 10.
[279] CONSERVATION ASSESSMENT, *supra* note 17, at 203.
[280] *See* CONSERVATION STRATEGY, *supra* note 213, at 10. *See generally* Derek E. Lee et al., *Influence of Fire and Salvage Logging on Site Occupancy of Spotted Owls in the San Bernardino and San Jacinto Mountains of Southern California*, 77 J. WILDLIFE MGMT. 1327 (2013).
[281] Lee et al., *supra* note 280, at 1328–30.
[282] *Id.* at 1334.
[283] *Id.*
[284] *Id.* at 1336–37.
[285] *Id.*
[286] *Id.* at 1339. They add, "Conserving maximum amounts of owl habitat, including large trees and dense canopy cover, could provide resiliency to potential adverse effects of severe fire." Lee et al., *supra* note 280, at 1339.
[287] *Id.* at 1335–37, 1339.
[288] Authors of the Conservation Assessment note limitations of this study. *See* CONSERVATION ASSESSMENT, *supra* note 17, at 26–27, 202–03. Authors of the Conservation Strategy are not careful. *See* CONSERVATION STRATEGY, *supra* note 213, at 10.

high-severity patches are linked to decreases in spotted owl occupancy, colonization, and habitat use," does not have strong support.[289] The Conservation Strategy asserts, in addition, "[l]arge, high-severity patches are linked to . . . increases in owl extinction probability," but the cited study, Lee et al. (2013), does not support this claim in the context of Sierra Nevada forests.[290]

The Conservation Strategy states, citing a number of studies, "Given [California spotted owls] use mixed-severity fire areas dominated by low and moderate severity and generally avoid larger areas of high severity, the historic fire regime was likely beneficial to the species."[291] Given the cited studies, these authors are apparently speaking quite broadly, claiming that spotted owls use areas dominated by low- and moderate-severity fire for nesting, roosting, and foraging, and generally avoid or abandon larger areas burned at high severity.[292]

Yet the cited studies, which include Roberts et al. (2011), Jones et al. (2016a), Lee et al. (2012), Lee et al. (2013), and Eyes et al. (2017), do not provide strong support.[293] Again, Roberts et al. (2011) conclude that fire of varying severities did not affect territory occupancy.[294] Lee et al. (2012) found that spotted owls persist in territories in which high-severity fire burned, on average, approximately one third of suitable habitat.[295] Although Lee and others hypothesize that there is a critical spatial threshold for high-severity fire, according to Lee and Bond (2015) available data suggests that high-severity fire generally does not adversely affect spotted owls.[296] Especially in light of Lee and Bond (2015), Lee et al. (2012) cannot reasonably be cited in support of the claim that spotted owls abandon territories in which large areas have burned at high-severity.

Again, as discussed, Jones et al. (2016a) is problematic.[297] Eyes et al. (2017) claim that spotted owls may avoid large areas burned at high

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[289] CONSERVATION STRATEGY, *supra* note 213, at 10; CONSERVATION ASSESSMENT, *supra* note 17, at 60.
[290] CONSERVATION STRATEGY, *supra* note 213, at 10; Lee et al., *supra* note 280, at 1335–37, 1339.
[291] CONSERVATION STRATEGY, *supra* note 213, at 18.
[292] *Id.*
[293] *See* Stephanie A. Eyes et al., *California Spotted Owl* (Strix occidentalis occidentalis*) Habitat Use Patterns in a Burned Landscape*, 119 CONDOR 375, 384 (2017). *See generally* Jones et al., *supra* note 232; Lee et al., *supra* note 209; Lee et al., *supra* note 280; Roberts et al., *supra* note 265.
[294] Roberts et al., *supra* note 265, at 616–17.
[295] *See* Lee et al., *supra* note 209, at 800.
[296] *Id.*; Lee & Bond, *supra* note 13, at 228, 233–34.
[297] *See* Hanson et al., *supra* note 27, at 101. *See generally* Jones et al., *supra* note 232.

severity for foraging.[298] Again, however, Bond et al. (2009) found that spotted owls preferentially use high-severity burned patches for foraging, including large, high-severity patches.[299]

Authors of the Conservation Strategy also cite Rockweit et al. (2017) in support of the above statement.[300] Rockweit et al. (2017) is a long-term survey study of northern spotted owls in the Klamath Mountains region of northwest California.[301] Rockweit and others found a negative relationship between the extent and severity of fire within owl territories, and the probability of survival and continued territory occupancy.[302] "[I]t is likely," they write, "that postfire habitat conditions become unsuitable for nesting and roosting by spotted owls following wildfires with large, extensive patches of high severity fire."[303] These researchers affirm that post-fire salvage logging did not occur in their study area, but they note, "spotted owls occupied a continuum of habitats that range from low to high quality."[304] In an earlier study conducted in the same study area, the researchers state, "[t]he mosaics of older forest and other vegetation types that we observed on spotted owl territories resulted from human-caused (e.g., logging) and natural disturbances (e.g., fire)," with present disturbances identified as primarily logging.[305] Logging and other management interventions have been ongoing in their study area since the 1960s, they report, including clear-cutting.[306]

Not discussed in Rockweit et al. (2017), or in the Conservation Strategy, is the possibility that the reported negative effects of moderate- and high-severity fire on territory occupancy and survival are due to relatively low quality pre-fire habitat resulting from logging.[307] Authors of

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[298] Eyes et al., *supra* note 293, at 384.
[299] Bond et al., *Habitat Use and Selection by California Spotted Owls*, *supra* note 275, at 1121–22; Bond et al., *Diet and Home-Range Size of California Spotted Owls*, *supra* note 275, at 119.
[300] *See* CONSERVATION STRATEGY, *supra* note 213, at 18. *See generally* Jeremy T. Rockweit et al., *Differential Impacts of Wildfire on the Population Dynamics of an Old-Forest Species*, 98 ECOLOGY 1574 (2017).
[301] Rockweit et al., *supra* note 300, at 1574–77.
[302] *Id.* at 1574, 1578–79.
[303] *Id.* at 1579.
[304] *Id.* at 1580; *see id.* at 1575.
[305] Alan B. Franklin et al., *Climate, Habitat Quality, and Fitness in Northern Spotted Owl Populations in Northwestern California*, 70 ECOLOGICAL MONOGRAPHS 539, 580 (2000); *see id.* at 545, 550.
[306] *Id.* at 545.
[307] Rockweit et al., *supra* note 300, at 1575, 1580; CONSERVATION STRATEGY, *supra* note 213, at 18.

the Conservation Strategy assume that the results of Rockweit et al. (2017) are applicable to California spotted owls in Sierra Nevada forests, but this may not be the case since pre-fire habitat conditions may be substantially different between this study area and public forestlands in the Sierra Nevada.[308] In short, the statement in the Conservation Strategy that, in the Sierra Nevada, spotted owls generally avoid or abandon larger areas burned at high severity, does not have strong support.[309]

Finally, it should be pointed out that although Ganey et al. (2017), and Peery et al. (2019), are cited within the revised draft EIS and other agency documents in support of various claims, these studies are not considered in a full and fair manner.[310] This is a major omission since both studies fail to support agency claims concerning the impacts of high-severity fire on spotted owls. Ganey et al. (2017) review the literature concerning the effects of high-severity fire on spotted owls, including Lee and Bond (2015) and Jones et al. (2016a).[311] "Based on the existing literature," Joseph Ganey and others write, "we argue that considerable uncertainty remains regarding the response of spotted owls to high-severity wildfire, especially over longer time frames."[312] They add, "[A]vailable data suggests considerable variation in responses of owls to wildfire."[313] The conclusions expressed by Ganey et al. (2017) are more moderate than claims within the draft EIS, revised draft EIS, and other agency documents.[314]

Peery et al. (2019) attempt to account for the discrepancies between the results of Lee and Bond (2015) and Jones et al. (2016a), claiming that spotted owls may respond differently to "varying spatial patterns of severe fire."[315] If this is true, they write, the management implications

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[308] *See* CONSERVATION STRATEGY, *supra* note 213, at 18. Another difficulty is that this study is based on a small number of burned territories. *See* Rockweit et al., *supra* note 300, at 1576, 1578.

[309] *See* CONSERVATION STRATEGY, *supra* note 213, at 18.

[310] *See* CONSERVATION STRATEGY, *supra* note 213, at 10; REVISED DRAFT EIS, *supra* note 4, at 172–73, 470. *See generally* Joseph L. Ganey et al., *Conflicting Perspectives on Spotted Owls, Wildfire, and Forest Restoration*, 13 FIRE ECOLOGY 146 (2017); Peery et al., *supra* note 252.

[311] Ganey et al., *supra* note 310, at 147, 149, 156.

[312] *Id.* at 147.

[313] *Id.* at 149. They also state, "Available evidence suggests that high-severity wildfire can be detrimental . . . depending on spatial pattern and extent." *Id.* at 147, 156. "[T]he cumulative effects of these fires could be significant," they write. *Id.* at 156.

[314] *Id.* at 147, 149; CONSERVATION ASSESSMENT, *supra* note 17, at 26–27, 60, 267; CONSERVATION STRATEGY, *supra* note 213, at 10; DRAFT EIS, *supra* note 2, at 336; REVISED DRAFT EIS, *supra* note 4, at 470.

[315] *See* Peery et al., *supra* note 252, at S1.

are complex.[316] "Specifically," they write, "the benefits of reducing severe fire to owls will depend in part on when, and how frequently, severe fire exceeds some currently unknown threshold size and level of homogeneity."[317] They add, "We therefore believe much remains to be learned about wildfire effects on spotted owls and additional study is warranted."[318]

According to the Conservation Strategy, "Large, high-severity wildfire threatens [California spotted owl] persistence across the landscape," citing Peery et al. (2019) and Stephens et al. (2016).[319] As discussed, however, Stephens et al. (2016) is quite limited and does not support the claim that high-severity fire poses a substantial threat to spotted owls.[320] Peery et al. (2019) also does not support such a strong claim, but presents a more moderate assessment: spotted owls may respond differently to high-severity fire depending on circumstances, and further research is needed.[321] Although the Conservation Strategy and other agency documents cite Ganey et al. (2017) and Peery et al. (2019), these studies are not accurately represented.[322] Indeed, according to Jones et al. (2016b), also cited within the Conservation Strategy, "there is considerable uncertainty regarding the effects of high-severity fire on spotted owls."[323]

Within the draft EIS, revised draft EIS, Conservation Assessment, and other documents involved in plan revision, agency scientists and other professionals engage in a selective use of science. Within these documents, claims concerning the impacts of high-severity fire on spotted owls—for example, "[l]arge, high-severity fires . . . are a major threat to the California spotted owl," and "[h]igh-severity fire and widespread loss of habitat is perhaps the biggest threat to spotted owls"—are not well supported by the cited studies.[324] Especially problematic is the failure to consider the difficulties facing Jones et al. (2016a), and the use of other

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[316] *Id.* at S1–S2.
[317] *Id.* at S2.
[318] *Id.*
[319] CONSERVATION STRATEGY, *supra* note 213, at 10. *See generally* Peery et al., *supra* note 252; Stephens et al., *supra* note 253.
[320] *See* Stephens et al., *supra* note 253, at 13.
[321] Peery et al., *supra* note 252, at S2.
[322] CONSERVATION STRATEGY, *supra* note 213, at 10; REVISED DRAFT EIS, *supra* note 4, at 172–73, 470.
[323] Gavin M. Jones et al., *Using Dynamic Occupancy Models to Inform Climate Change Adaptation Strategies for California Spotted Owls*, 53 J. APPLIED ECOLOGY 895, 903 (2016); *see* CONSERVATION STRATEGY, *supra* note 213, at 7, 35.
[324] *See* DRAFT EIS, *supra* note 2, at 336; REVISED DRAFT EIS, *supra* note 4, at 470; CONSERVATION ASSESSMENT, *supra* note 17, at 60; CONSERVATION STRATEGY, *supra* note 213, at 10, 18.

studies (including Clark (2007), Clark et al. (2011), Stephens et al. (2016), Tempel et al. (2014), Lee et al. (2013), and Rockweit et al. (2017)) without consideration of weaknesses or limitations in application.[325] The draft EIS and revised draft EIS do not discuss or cite Lee and Bond (2015), and within the Conservation Assessment and Conservation Strategy this study is used to support only modest claims, including claims concerning spotted owl persistence in sites burned at high-severity.[326] Without detailed consideration of the results and conclusions of Lee and Bond (2015), the repeated claim that a critical spatial threshold likely exists for high-severity fire within spotted owl territories is misleading.[327]

The draft EIS, revised draft EIS, Conservation Assessment, and other Forest Service documents entirely fail to consider or cite published studies that call into question agency claims concerning the impacts of high-severity fire on spotted owls, including Hanson et al. (2009), DellaSala and Hanson (2015) (an edited volume concerning the ecological importance of mixed- and high-severity fire), Bond (2016), DellaSala et al. (2017), and Lee (2018).[328] Within the revised draft EIS, Hanson et al. (2018) (which presents criticisms of Jones et al. (2016a)) is dismissed from consideration without adequate justification.[329] Ganey et al. (2017) and Peery et al. (2019) are not discussed in a full and fair manner.[330] Generally, the draft EIS, revised draft EIS, Conservation Assessment, and other agency documents do not reveal the extent of the controversies within the scientific literature concerning high-severity fire and spotted owls, and make

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[325] DRAFT EIS, *supra* note 2, at 336–37; *see* CONSERVATION ASSESSMENT, *supra* note 17, at 26–27, 60–61, 267, 285; CONSERVATION STRATEGY, *supra* note 213, at 10, 18; REVISED DRAFT EIS, *supra* note 4, at 470. Authors of the Conservation Assessment acknowledge that results reported in Tempel et al. (2014) may have been confounded by post-fire logging. CONSERVATION ASSESSMENT, *supra* note 17, at 27, 60. Authors of the Conservation Strategy cite this study without noting its limitations. CONSERVATION STRATEGY, *supra* note 213, at 10.

[326] *See* CONSERVATION ASSESSMENT, *supra* note 17, at 27, 202, 285; CONSERVATION STRATEGY, *supra* note 213, at 11; DRAFT EIS, *supra* note 2, at 336–37; REVISED DRAFT EIS, *supra* note 4, at 470.

[327] *See* CONSERVATION ASSESSMENT, *supra* note 17, at 64–65, 202; DRAFT EIS, *supra* note 2, at 338.

[328] *See generally* DELLASALA & HANSON, *supra* note 29; Bond, *supra* note 262; DellaSala et al., *supra* note 236; Chad T. Hanson et al., *Overestimation of Fire Risk in the Northern Spotted Owl Recovery Plan,* 23 CONSERVATION BIOLOGY 1314 (2009); Derek E. Lee, *Spotted Owls and Forest Fire: A Systematic Review and Meta-analysis of the Evidence,* 9 ECOSPHERE 1 (2018).

[329] *See* Hanson et al., *supra* note 27, at 101; REVISED DRAFT EIS, *supra* note 4, at 172–73; *see also supra* note 252.

[330] *See* CONSERVATION STRATEGY, *supra* note 213, at 10; REVISED DRAFT EIS, *supra* note 4, at 172–73, 470.

it appear that the agency's position has stronger support than it actually has.[331] According to Lee (2018), a review and analysis of the literature on fire and spotted owls:

> Spotted Owls appear fairly resistant and/or resilient to effects from recent hot, large fires, wherever these fires fall in the long-term range of variability for size and amount of high-severity burn. . . . Contrary to current perceptions, recovery efforts, and forest management projects for the Spotted Owl[,] mixed-severity fire as it has been burning in recent decades does not appear to be an immediate, dire threat to owl populations that require landscape-level fuel-reduction treatments to mitigate fire severity.[332]

III. IMPACTS OF PROPOSED FOREST TREATMENTS

The Conservation Assessment candidly discusses the negative impacts of proposed forest restoration and fuel-reduction treatments on California spotted owls.[333] In order to restore historic conditions and lower the risk of large, high-severity fires, the agency engages in selective harvesting, mechanical (commercial) thinning, and other activities over broad landscapes.[334] Yet such activities degrade spotted owl habitat and may disturb nesting owls, potentially resulting in abandoned territories and population loss.[335] Authors of the Conservation Assessment discuss Stephens et al. (2014), according to which 43 percent of owl territories were abandoned subsequent to forest restoration and fuel-reduction treatments.[336] "Recent evidence," the Conservation Assessment states, suggests that mechanical forest thinning "may have negative effects on California spotted owls."[337] According to these authors, "[T]he declining owl populations on the three national forest study areas coupled with two studies that show declines related to forest management indicate that forest management

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[331] *See* CONSERVATION ASSESSMENT, *supra* note 17, at 26–27, 60–61, 64–65, 202–03, 267–68, 285; CONSERVATION STRATEGY, *supra* note 213, at 10–11, 18; DRAFT EIS, *supra* note 2, at 336–37; REVISED DRAFT EIS, *supra* note 4, at 470–71.
[332] Lee, *supra* note 328, at 16–18.
[333] CONSERVATION ASSESSMENT, *supra* note 17, at 185–96.
[334] *Id.*
[335] *Id.*
[336] *Id.* at 192; Scott L. Stephens et al., *California Spotted Owl, Songbird, and Small Mammal Responses to Landscape Fuel Treatments*, 64 BIOSCIENCE 893, 902–03 (2014).
[337] CONSERVATION ASSESSMENT, *supra* note 17, at 194.

remains a threat to California spotted owls and their habitat throughout the Sierra Nevada."[338]

These authors emphasize the importance of retaining essential nesting and foraging habitat within spotted owl territories.[339] "Research on owl habitat associations at the territory-scale clearly demonstrate," they write, "the importance of dense-canopy stands composed of medium-large trees for owl reproduction, survival, occupancy, and population trends."[340]

A spotted owl territory, the area an individual owl or a mated pair will defend against other owls, has been estimated as approximately 500 to 2,000 acres.[341] A territory includes the "protected activity center" ("PAC"), which consists of 300 acres of suitable habitat approximately centered on the nest tree.[342] Authors of the Conservation Assessment suggest that, within a PAC, low-intensity vegetation treatments, such as limited prescribed burning and hand removal of small trees, are most conducive to achieving a proper balance of fuel reduction and spotted owl conservation.[343] They caution against use of treatments that "appreciably affect forest overstory structure at this scale," that is, they caution against use of higher-intensity treatments—selective logging and mechanical thinning.[344] These authors suggest that, within a territory, though some such treatments may be used, managers maintain high canopy cover, large trees, and other forest components associated with spotted owl occupancy.[345] Decisions concerning how much high canopy cover to maintain within territories are somewhat subjective, they claim.[346] "[T]he amount of [high] canopy cover necessary to allow owl persistence remains uncertain," they write.[347]

A spotted owl home range is estimated as approximately 2,000 to 5,000 acres, including the territory.[348] According to the Conservation Assessment, at the home range scale and in the broader landscape "there is an opportunity to place greater emphasis on fuels management and

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[338] *Id.* at 195.
[339] *Id.* at 195–96.
[340] *Id.* at 195.
[341] *Id.* at 15–17, 52–53, 294.
[342] *Id.* at 16, 270.
[343] CONSERVATION ASSESSMENT, *supra* note 17, at 270–71.
[344] *Id.* at 270–71.
[345] *Id.* at 271–72.
[346] *Id.* at 271.
[347] *Id.* at 272.
[348] *Id.* at 50, 58–59 ("A 'home range' is defined as the area used by an individual to meet its requirements for survival and reproduction.").

forest restoration," with use of a broad array of treatments, including selective logging and mechanical thinning.[349]

The draft EIS for plan revision, and the revised draft EIS for Sequoia and Sierra forests plan revision, emphasize the need for an aggressive approach.[350] According to the draft EIS, "The rate of loss of protected activity centers from wildfire in the Sierra Nevada is alarming."[351] The preferred alternative, discussed within the draft EIS and revised draft EIS, calls for selective harvesting, mechanical thinning, and prescribed burning within PACs to bring them to the desired conditions for these forests.[352] According to the revised draft EIS:

> Most of the restoration would occur in forest ecosystems of the montane zone that are departed from desired conditions (or outside the natural range of variation). Restoration in these areas would move at least 30 percent of these landscapes toward desired conditions, including in some portions of the wildlife habitat management area. . . . There would be some restoration of California spotted owl protected activity centers that occur primarily on dry sites, allowing mechanical treatment in up to one-third of a protected activity center per decade.[353]

This document states, "There is a high concentration of California spotted owl protected activity centers in much of the montane landscape," and "[m]uch of the montane zone is considered suitable habitat for fisher or California spotted owl."[354] In addition, "Prioritize ecological restoration of protected activity centers, and areas within them, that have departed furthest from vegetation desired conditions."[355]

According to the revised draft EIS, under the preferred alternative trees greater than thirty inches diameter at breast height will not be removed, but exceptions are allowed for removing trees between thirty and forty inches diameter to accomplish restoration objectives.[356] The revised draft EIS discusses potential ecological benefits of removing some

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[349] CONSERVATION ASSESSMENT, *supra* note 17, at 269–70.
[350] DRAFT EIS, *supra* note 2, at 336–39; REVISED DRAFT EIS, *supra* note 4, at 205, 259.
[351] DRAFT EIS, *supra* note 2, at 337.
[352] *Id.* at 372–78, REVISED DRAFT EIS, *supra* note 4, at 205, 259.
[353] REVISED DRAFT EIS, *supra* note 4, at 205.
[354] *Id.* at 206, 212.
[355] *Id.* at 259.
[356] *Id.*

large trees, for example, improving tree spacing, alleviating competition, etc.[357] Trees greater than forty inches diameter may be removed only for reasons of "public or firefighter safety," in situations in which "human safety is imminently threatened."[358] The agency is apparently proposing additional protections for spotted owl PACs and territories, for example, a twenty-four-inch diameter limit is indicated for PACs within the community fire-protection zone.[359] Yet the agency proposes a number of intersecting zones for fire and wildlife management, and allows various exceptions to the basic diameter limits, and, frankly, the proposed diameter limits for tree removal are not made clear.[360] Indeed, at one point, the revised draft EIS states that no diameter limits apply within the extensive community and natural resources fire-protection zones.[361]

The preferred alternative lowers protections for breeding spotted owls.[362] The revised draft EIS states that, under this alternative, a "limited operating period" is to be applied during the breeding season (March 1–August 15), during which time harvesting and mechanical thinning operations may not be conducted within .25 miles of the nest or known roost site (if the nest location is not known).[363] The limited operating period may be waived, however, "if nesting owls are absent," and it may be waived "for

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[357] *Id.* at 242, 259. In addition, the commercial harvest of large trees will help alleviate the costs of restoration and fuel-reduction treatments. The draft EIS faults Alternative C for the reason that it does not allow removal of larger trees, thus treatments will be more costly and slower to implement. DRAFT EIS, *supra* note 2, at 107; REVISED DRAFT EIS, *supra* note 4, at 137.

[358] REVISED DRAFT EIS, *supra* note 4, at 259, 261.

[359] *See id.* at 260; s*ee also* FOREST SERV., U.S. DEP'T OF AGRIC., REVISED DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR REVISION OF THE SEQUOIA AND SIERRA NATIONAL FORESTS LAND MANAGEMENT PLANS, VOLUME 2: APPENDICES D-15 (2019) [hereinafter REVISED DRAFT EIS APPS.].

[360] *See* REVISED DRAFT EIS, *supra* note 4, at 125, 132–35, 206, 259, 261; REVISED DRAFT EIS APPS., *supra* note 359, at D-15.

[361] REVISED DRAFT EIS, *supra* note 4, at 206. According to the draft EIS, natural resources considered at risk from fire include spotted owl nest sites and territories. DRAFT EIS, *supra* note 2, at 25–26, 29, 92, 99.

[362] *See, e.g.*, DRAFT EIS, *supra* note 2, at 29.

[363] REVISED DRAFT EIS APPS., *supra* note 359, at D-51. According to an amendment to management plans currently in effect in the Sierra Nevada, during the limited operating period to be applied during the breeding season, vegetation treatments are prohibited within approximately a quarter mile of the boundaries of a PAC. *See* FOREST SERV., U.S. DEP'T OF AGRIC., SIERRA NEVADA FOREST PLAN AMENDMENT, FINAL SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT, VOL. 1 384 (2004). In general, the proposed new guideline is less protective of breeding owls. *See id.*; *see also* FOREST SERV., U.S. DEP'T OF AGRIC., SIERRA NEVADA FOREST PLAN AMENDMENT, FINAL SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT, RECORD OF DECISION 3 (2004) (accepting alternative S2).

activities of limited scope and duration" given that "a biologist determines that such projects are unlikely to result in breeding disturbance considering their intensity, duration, timing and specific location."[364] The buffer distance may be modified "based upon a biologist's evaluation . . . ."[365] Indeed, the limited operating period may be waived simply "when benefit to California spotted owl habitat resilience outweighs potential short term risk."[366] The proposed new guideline, with exceptions, allows logging and other operations within PACs and in close proximity to nesting owls.[367]

In discussions of the potential impacts of proposed forest treatments on spotted owls, both the draft EIS and Conservation Strategy place the proposed treatments in a favorable light.[368] There is discussion in the Conservation Strategy of Stephens et al. (2014) (stating that 43 percent of owl territories were abandoned subsequent to treatments), but, according to the Conservation Strategy, in this study territory abandonment was associated with alterations resulting in "wide swaths of homogenous open habitat."[369] Implied is that this study is not representative of the typical treatments proposed for Sierra Nevada forests.[370]

As the Conservation Strategy notes, Seamans and Gutiérrez (2007), and Tempel et al. (2014), found that reductions in canopy cover and other alterations were associated with declines in territory occupancy.[371] Seamans and Gutiérrez (2007) report that occupancy declined when more than fifty acres (20 ha) of mature forest were altered within a territory.[372] Yet the Conservation Strategy is critical of these studies, faulting Seamans and Gutiérrez (2007) for several reasons, including that alterations of mature forest in the study area were the result of several factors, including timber harvest and fire.[373] Tempel et al. (2014) found that reductions in

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[364] REVISED DRAFT EIS APPS., *supra* note 359, at D-51 to D-52.
[365] *Id.* at D-52.
[366] *Id.*
[367] *Id.* at D-51 to D-52.
[368] CONSERVATION STRATEGY, *supra* note 213, at 11–12; DRAFT EIS, *supra* note 2, at 338–39. The revised draft EIS does not provide much discussion of this topic. REVISED DRAFT EIS, *supra* note 4, at 470–71.
[369] *See* CONSERVATION STRATEGY, *supra* note 213, at 12; Stephens et al., *supra* note 336, at 902–03.
[370] *See* CONSERVATION STRATEGY, *supra* note 213, at 12.
[371] *Id.* at 11; Mark E. Seamans & R.J. Gutiérrez, *Habitat Selection in a Changing Environment: The Relationship between Habitat Alteration and Spotted Owl Territory Occupancy and Breeding Dispersal*, 109 CONDOR 566, 573–74 (2007); Tempel et al., *supra* note 269, at 2104–05.
[372] Seamans & Gutiérrez, *supra* note 371, at 566, 573–75.
[373] CONSERVATION STRATEGY, *supra* note 213, at 11.

canopy cover as a result of selective logging and mechanical thinning were associated with territory abandonment, but these researchers also found evidence that high-intensity logging, for example clear-cutting, may benefit owls, "possibly due to the creation" of edge habitat.[374] The Conservation Strategy asserts, in summary, "[t]hese studies did not detect a clear adverse impact on owls from timber harvest."[375]

The Conservation Strategy briefly discusses Irwin et al. (2015), according to which, subsequent to mechanical thinning and other treatments within approximately 1,000 acres surrounding nest sites, "[w]e did not observe site abandonment . . . ."[376] No territory abandonment is reported, even with up to 58 percent of the area treated.[377] With respect to occupancy and foraging, Larry Irwin and others write, "[t]he majority of harvests essentially had no detectable effects on the associated spotted owls."[378] The Conservation Strategy also discusses Tempel et al. (2016), according to which territory occupancy is associated with mature forests of medium canopy cover (40–69 percent) as well as high canopy cover (greater or equal to 70 percent).[379] Douglas Tempel and others suggest that, given this result, restoration and fuel-reduction treatments that reduce canopy cover to below 70 percent could be used within territories without significant impacts on occupancy.[380]

According to the Conservation Strategy, "collectively," studies of the impacts of forest management and other disturbances on spotted owls (including fire) "suggest there may be tradeoffs in the near term in habitat quality for long-term habitat sustainability."[381] The challenge is to balance these tradeoffs, "promoting management activities that will maintain or increase key owl habitat elements."[382] "[F]orest management that increases heterogeneity and resilience to disturbance may benefit the [spotted owl]."[383] Referring to Tempel et al. (2014, 2016) and Irwin et

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[374] *Id.*
[375] *Id.*
[376] *See id.*; *see also* Larry L. Irwin et al., *Forest Ecosystem Restoration: Initial Response of Spotted Owls to Partial Harvesting*, 234 FOREST ECOLOGY & MGMT. 232, 239 (2015).
[377] Irwin et al., *supra* note 376, at 239.
[378] *Id.*
[379] *See* CONSERVATION STRATEGY, *supra* note 213, at 12; *see also* Douglas J. Tempel et al., *Meta-analysis of California Spotted Owl* (Strix occidentalis occidentalis) *Territory Occupancy in the Sierra Nevada: Habitat Associations and their Implications for Forest Management*, 118 CONDOR 747, 759 (2016).
[380] Tempel et al., *supra* note 379, at 747, 761.
[381] CONSERVATION STRATEGY, *supra* note 213, at 12.
[382] *Id.*
[383] *Id.*

al. (2015), the Conservation Strategy declares that "[t]he lack of impacts detected in these studies" may demonstrate the improved ability of forest managers to engage in mechanical thinning and other operations while maintaining habitat components critical to spotted owl occupancy.[384] Within the Conservation Strategy, mechanical thinning, and other restoration and fuel-reduction treatments, are portrayed in a favorable light as tools that may be used, where site-specific analyses indicate the need, without significant adverse impacts on spotted owls.[385]

Not mentioned in the Conservation Strategy, however, is that Tempel et al. (2016) hasten to add that any reduction of canopy cover must be limited in degree and spatial extent, leaving enough area of high canopy cover to meet the needs of nesting owls.[386] They stress that forests of medium canopy cover cannot simply be substituted for those of high canopy cover.[387] Tempel and others also point out that restoration and fuel-reduction treatments bring about alterations of forest components other than canopy cover, such as tree density, large tree density, and vertical structure, and they recommend that further studies be done to understand the effect alterations in these components may have on occupancy.[388] In addition, and not discussed in the Conservation Strategy, according to Tempel et al. (2016) the suggestion that canopy cover can be reduced without deleterious effects on occupancy does not apply to PACs.[389] They write, "[F]uture treatments within PACs could negatively affect spotted owl territory occupancy because these are centers of owl activity."[390]

Also not discussed in the Conservation Strategy is that Irwin et al. (2015) stress the need to provide protected areas around spotted owl nests and roosts, writing, "[i]n all areas, nesting and roosting habitat must be protected because spotted owls may abandon territories if significant and intense harvesting occurs within close proximity of their nest trees."[391] Based on studies of northern spotted owls, Irwin and others suggest that up to approximately 124 acres (50 ha) surrounding nest trees should be protected from mechanical thinning and other operations.[392]

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[384] *Id.*
[385] *Id.* at 11–12.
[386] *See id.* at 12; Tempel et al., *supra* note 379, at 761–62.
[387] Tempel et al., *supra* note 379, at 762.
[388] *Id.* at 761.
[389] *See id.* at 762.
[390] *Id.*
[391] Irwin et al., *supra* note 376, at 240.
[392] *Id.*

The draft EIS for plan revision also places proposed forest treatments in a favorable light. According to this document, simulation modeling suggests that some fuel-reduction treatments—implied is that this includes some degree of mechanical thinning—would have "minimal effects on owl reproduction."[393] The draft EIS also cites Rich (2007), an agency poster presentation that concludes that mechanical thinning and prescribed fire within PACs "may often be compatible with continued owl occupancy and successful reproduction."[394] This poster presentation is concerned, however, with treatment effects on owls in only three selected PACs.[395] The draft EIS also cites Tempel et al. (2014), which found that spotted owl "population growth and survival were positively associated with amount of edge . . . habitat created" with high-intensity treatments.[396] On the other hand, according to the draft EIS, Tempel et al. (2014) also found "a negative association of medium-intensity timber harvest [selective logging, mechanical thinning] with California spotted owl reproduction."[397] The discussion in the draft EIS favors the view that forest treatments will have minimal effects on owls; there is no discussion of Stephens et al. (2014) (43 percent of owl territories were abandoned subsequent to treatments).[398]

In contrast to the draft EIS and Conservation Strategy, the Conservation Assessment and two review studies are cautionary. Authors of the Conservation Assessment review Stephens et al. (2014) and Tempel et al. (2014), and, citing these studies, state that mechanical thinning treatments "may have negative effects on California spotted owls."[399] As these authors acknowledge, Tempel et al. (2014) found some positive benefit associated with the creation of edge habitat through intensive logging

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[393] DRAFT EIS, *supra* note 2, at 338. The draft EIS cites Keane (2014), which reports that, according to simulation modeling, some fuel-reduction treatments within spotted owl "core areas" (presumably territories) would have "minimal effects on owl reproduction." *See id.*; *see also* John J. Keane, *California Spotted Owl: Scientific Considerations for Forest Planning*, *in* SCIENCE SYNTHESIS TO SUPPORT SOCIOECOLOGICAL RESILIENCE IN THE SIERRA NEVADA AND SOUTHERN CASCADE RANGE, GENERAL TECHNICAL REPORT PSW-GTR-247 437, 446 (Jonathan W. Long et al. eds., U.S. Dep't of Agric., Forest Serv., Pac. Southwest Research Station 2014).

[394] *See* DRAFT EIS, *supra* note 2, at 339; *see also* Adam C. Rich, *Territory Status of California Spotted Owl (*Strix occidentalis occidentalis*) Following Fuel Reduction Treatments: Management Case Studies from the Stanislaus National Forest*, U.S. FOREST SERV. (Nov. 21, 2008), http://www.qlg.org/pub/miscdoc/owl_fuelreduction.pdf [https://perma.cc/L22F-69ZV].

[395] Rich, *supra* note 394.

[396] DRAFT EIS, *supra* note 2, at 339; Tempel et al., *supra* note 269, at 2089, 2103–04.

[397] DRAFT EIS, *supra* note 2, at 339; Tempel et al., *supra* note 269, at 2089, 2101–05.

[398] DRAFT EIS, *supra* note 2, at 338–39.

[399] *See* CONSERVATION ASSESSMENT, *supra* note 17, at 194.

practices such as clear-cutting, but with respect to possible impacts on spotted owls of medium-intensity treatments such as mechanical thinning, these authors candidly acknowledge the reported negative effects of such treatments.[400] Ganey et al. (2017) review the relevant literature, including Stephens et al. (2014), Tempel et al. (2014), and other studies, and conclude, "[e]xisting studies on the effects of fuels reduction treatments on spotted owls universally suggest negative effects from these treatments."[401]

Also reviewing the relevant literature, Wan et al. (2018) write, "[f]or the northern spotted owl and the California spotted owl, most existing studies indicate negative responses by owls to fuels reduction treatments."[402] These authors briefly discuss Irwin et al. (2015), adding, "[i]n contrast, Tempel et al. (2014, 2015) suggested that medium-intensity fuel treatments reduced habitat quality and reproductive success of the California spotted owl in the short term despite providing potential long-term benefits by reducing fire risks."[403] Wan and others consider Irwin et al. (2015) within its context in the literature, coming to a less optimistic assessment.[404] Both Ganey et al. (2017), and Wan et al. (2018), recommend that further studies of the effects of various types of forest treatments be conducted.[405] The Conservation Strategy does not discuss or cite these review studies.[406] The revised draft EIS for the Sequoia and Sierra forests plan revision does not discuss or cite Wan et al. (2018), and although Ganey et al. (2017) is cited, there is no discussion of the conclusions of this study with respect to proposed treatment impacts on spotted owls.[407]

According to biologists, habitat characteristics essential for spotted owl breeding include high canopy cover (at least 70 percent), abundant large trees but stands numerically dominated by medium-size trees (twelve to twenty-four inches diameter), multiple canopy layers,

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[400] *Id.* at 191–92, 194. In their discussion of Tempel et al. (2014), authors of the Conservation Strategy conflate high-intensity logging practices such as clear-cutting, and medium-intensity practices such as mechanical thinning, claiming that this study shows, overall, no clear negative effects on owls from "timber harvest." CONSERVATION STRATEGY, *supra* note 213, at 11.

[401] Ganey et al., *supra* note 310, at 156.

[402] Ho Yi Wan et al., *Managing Emerging Threats to Spotted Owls*, 82 J. WILDLIFE MGMT. 682, 689 (2018).

[403] *Id.*

[404] *Id.*

[405] Ganey et al., *supra* note 310, at 156; Wan et al., *supra* note 402, at 693.

[406] *See generally* CONSERVATION STRATEGY, *supra* note 213.

[407] REVISED DRAFT EIS, *supra* note 4, at 470. These review studies were published subsequent to the release of the draft EIS in 2016.

and higher-than-average tree density.[408] The revised draft EIS proposes a number of conservation measures designed to minimize impacts of the proposed forest treatments, including, "mechanical vegetation treatments that reduce habitat quality are limited to no more than one third of the protected activity center."[409] These measures require that a minimum of 50 percent canopy cover be retained, on average, over the entire PAC.[410] There is no requirement to maintain a minimum percentage of highest quality breeding habitat, with large trees, multiple layers, high density, and high canopy cover—as noted in the Conservation Assessment, the amount of high canopy cover "necessary to allow owl persistence remains uncertain."[411]

The proposed conservation measures include, "[d]o not mechanically treat within the 10-acre area surrounding the nest, or known roost site where nest site is unknown."[412] This proposed measure is presumably based, at least in part, on North et al. (2017).[413] According to the Conservation Strategy, spotted owls' "selection for tall tree cover is greatest within approximately 10 acres surrounding a nest," citing North et al. (2017).[414] The Conservation Strategy also states, "[o]ngoing research suggests [California spotted owls] select against areas of low canopy cover . . . within 10 acres of nest sites."[415] The agency's claim is that spotted owls are most selective for essential habitat characteristics, including tall trees and high canopy cover, and so they are likely most sensitive to alterations of such habitat features, within approximately 10 acres surrounding the nest.[416]

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[408] *See* CONSERVATION ASSESSMENT, *supra* note 17, at 49–52; CONSERVATION STRATEGY, *supra* note 213, at 9.
[409] REVISED DRAFT EIS APPS., *supra* note 359, at D-50.
[410] CONSERVATION STRATEGY, *supra* note 213, at 28; REVISED DRAFT EIS APPS., *supra* note 359, at D-50.
[411] CONSERVATION ASSESSMENT, *supra* note 17, at 272; REVISED DRAFT EIS APPS., *supra* note 359, at D-50. Within a PAC undergoing treatment, "habitat quality must be maintained in the highest quality nesting and roosting habitat." REVISED DRAFT EIS APPS., *supra* note 359, at D-50. Yet the expression, "highest quality nesting and roosting habitat," is misleading, understood within agency documents as consisting of large/tall trees but with canopy cover of greater than 40 percent, with no criteria calling for high density or multiple canopy layers. *See* CONSERVATION STRATEGY, *supra* note 213, at 5.
[412] REVISED DRAFT EIS APPS., *supra* note 359, at D-50.
[413] *See* CONSERVATION STRATEGY, *supra* note 213, at 9. *See generally* Malcolm P. North et al., *Cover of Tall Trees Best Predicts California Spotted Owl Habitat*, 405 FOREST ECOLOGY & MGMT. 166 (2017).
[414] CONSERVATION STRATEGY, *supra* note 213, at 9.
[415] *Id.* at 6. No clear citation is provided in support of this statement concerning ongoing research. *See id.*
[416] *See id.* at 6, 9; *see also* CONSERVATION ASSESSMENT, *supra* note 17, at 49–52.

Yet, according to North et al. (2017), the data suggests that as owls choose nest sites, they select for tall trees possibly extending "beyond the bounds of the PAC (618 meter radius)."[417] These researchers believe the cover provided by tall trees may be beneficial to owls since "they often travel away from the nest to forage."[418] North and others also found that canopy cover was "generally higher within about 500 meters of nests compared . . . to the surrounding landscape."[419] According to this study, then, spotted owls may select for essential habitat characteristics, including tall trees and high canopy cover, at distances approximating, and possibly exceeding, PAC boundaries.[420] To be sure, the data shows that total canopy cover, and the cover provided by tall trees, is highest at the nest and decline with distance from the nest, but the decline is gradual, and, as indicated by North et al., the nest area (10 acres) and PAC have very similar distributions of habitat structural features.[421] The data suggests, according to these researchers, that the owls are selecting for tall trees and high canopy cover over approximately the PAC scale, extending well beyond the 10 acres immediately surrounding the nest.[422]

North et al. (2017) does not support the claim that selection for essential habitat characteristics (tall trees, high canopy cover) is greatest within approximately ten acres of the nest, implying that the owls are less selective in the PAC outside this area—indeed, North and others do not make such a claim.[423] A number of scientists discuss the importance of maintaining essential nesting and roosting habitat within PACs, for example, the Conservation Assessment states:

> California spotted owl activity centers are typically characterized by old-forest conditions (i.e., large trees, complex

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[417] North et al., *supra* note 413, at 171.
[418] *Id.* at 175.
[419] *See id.*; *see also id.* at 173.
[420] *Id.* at 171–75.
[421] *Id.* at 171–72, 174.
[422] North et al., *supra* note 413, at 171–75.
[423] *See* CONSERVATION STRATEGY, *supra* note 213, at 9; North et al., *supra* note 413, at 171–75. According to North et al. (2017), the most distinctive habitat feature within PACs is the cover provided by tall trees, and they claim that tall tree cover is, therefore, "the most important canopy feature in PACs." North et al., *supra* note 413, at 175. They suggest managing for tall trees rather than for canopy cover *per se*, allowing thinning of small and intermediate-size trees within PACs for fuel-reduction purposes. *Id.* at 176. Yet, from the data, it appears that the owls are selective for high canopy cover within PACs; North et al. do not address the problem that mechanical thinning has been associated with territory abandonment. *Id.* at 171–76.

> structure . . .) and maintaining such conditions within activity centers is likely important for promoting owl reproduction and population viability. Protected activity centers (PACs) were designed . . . to protect 120 ha (300 ac) of the "best available" nesting and roosting habitat within known spotted owl territories and appear to have been a useful management construct based on research demonstrating long-term use of these areas by owls.[424]

As stated, studies have shown that a PAC is generally a "useful management construct."[425] Tempel et al. (2016) caution against forest treatments that reduce canopy cover within PACs.[426] They write (again), "[F]uture treatments within PACs could negatively affect spotted owl territory occupancy because these are centers of owl activity."[427] As mentioned, Irwin et al. (2015) recommend protecting from forest treatments an area of up to approximately 124 acres surrounding the nest.[428]

Given this information and recommendations, with respect to proposed logging and mechanical thinning, a ten-acre buffer area surrounding the nest seems far too small, and the cited study, North et al. (2017), does not support protecting such a small area.[429]

The proposed conservation measures include a "limited operating period," which, as mentioned, is to be applied during the breeding season.[430] During this period, managers may not engage in harvesting and mechanical thinning within .25 miles of the nest, yet this guideline allows such operations well within PACs during the breeding season.[431] As specified in one exception clause, the limited operating period may be waived "when benefit to California spotted owl habitat resilience outweighs potential short-term risk," with no requirement for a biologist's evaluation.[432]

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[424] CONSERVATION ASSESSMENT, *supra* note 17, at 270 (internal citations omitted).
[425] *Id.*
[426] Tempel et al., *supra* note 379, at 762.
[427] *Id.*
[428] Irwin et al., *supra* note 376, at 240.
[429] *See* CONSERVATION STRATEGY, *supra* note 213, at 9; North et al., *supra* note 413, at 171–75.
[430] REVISED DRAFT EIS APPS., *supra* note 359, at D-51.
[431] *Id.* A PAC extends 618 meters (2,028 feet) from the nest. North et al., *supra* note 413, at 171. Operations conducted a quarter mile (1,320 feet) from the nest fall well within PAC boundaries.
[432] REVISED DRAFT EIS APPS., *supra* note 359, at D-52.

No distance restrictions are specified for the use of chainsaws and other such power equipment within PACs.[433] Delaney et al. (1999), cited within the Conservation Strategy, report results of their study of Mexican spotted owl (*Strix occidentalis lucida*) responses to noise from chainsaws and helicopters.[434] Delaney and others recommend that use of chainsaws be prohibited within 350 feet of an owl nest site.[435] They express concern that chainsaw use within this distance may adversely affect "prey delivery rates," the rates at which owls deliver prey to the nest and nestling owls, and they recommend that this distance be maintained throughout the breeding season, including the nestling phase.[436] Although the Conservation Strategy discusses this study and the concern with possible impacts on prey delivery rates, no distance restrictions for use of chainsaws and other such power equipment are recommended within the Conservation Strategy, or are proposed in the revised draft EIS for Sequoia and Sierra plan revision.[437]

It is interesting, and troubling, that the agency has proposed restoration and fuel-reduction treatments in such close proximity to spotted owl nests. The proposed conservation measures allow much management discretion, many lack scientific support (for example, with respect to mechanical treatments, a ten-acre buffer area surrounding the nest), and the protections for owls and their habitat are minimal.[438]

IV. AGENCY OPTIMISM AND FOREST RECONSTRUCTION

According to historian Paul Hirt, one aspect of the entrenched optimism within the Forest Service is "a willful decision to look only at certain pieces of the puzzle . . . while neglecting others that . . . [do] not contribute to a preconceived notion of what the finished puzzle should look like."[439] Within the draft EIS, final EIS for Inyo forest, revised draft EIS for Sequoia and Sierra forests, NRV Technical Report, Conservation Strategy, and other documents involved in plan revision, there is definite bias in the assessment and use of scientific information. In these documents,

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[433] *Id.* at D-49 to D-53.
[434] *See* CONSERVATION STRATEGY, *supra* note 213, at 16. *See generally* David K. Delaney et al., *Effects of Helicopter Noise on Mexican Spotted Owls*, 63 J. OF WILDLIFE MGMT. 60 (1999).
[435] Delaney et al., *supra* note 434, at 74.
[436] *Id.* at 70–71, 74.
[437] *See* CONSERVATION STRATEGY, *supra* note 213, at 16, 25–29; REVISED DRAFT EIS APPS., *supra* note 359, at D-49 to D-53.
[438] *See* REVISED DRAFT EIS APPS., *supra* note 359, at D-49 to D-53.
[439] HIRT, *supra* note 18, at xlviii.

there is an effort to promote a story of increasingly destructive high-severity fire, the severe threat such fire poses to California spotted owls, and the need to restore historic forest structure and fire regimes, achieving a proper balance of restoration and conservation.[440] According to the draft EIS, "[T]he potential for short-term risks [to spotted owls] is lessened and balanced with the need for restoration."[441]

Agency documents show a deep commitment to the concept of intensive management.[442] Hirt writes that, for many years, Forest Service managers have assumed that "choices do not really have to be made" if scientifically trained foresters "simply appl[y] more intensive management."[443] There is much discussion of intensive management in the literature.[444] For example, referring to harvesting and other silvicultural operations, Oliver et al. (1999) write, "different structures and patterns are maintained and/or created . . . which provide employment and commodities in the process of maintaining or enhancing biodiversity."[445]

Reflecting their commitment to this management paradigm, Forest Service scientists and other professionals express high confidence that selective logging, mechanical thinning, and other treatments within spotted owl PACs and territories will not significantly affect the owls given that the proposed conservation measures are put into place.[446] As discussed, the draft EIS and Conservation Strategy present the proposed treatments in a favorable light.[447] The results reported in Irwin et al. (2015) are presented as representative of what can be accomplished: needed forest treatments together with effective owl conservation.[448] According to Ganey et al. (2017), on the other hand, recent studies generally support the claim that proposed treatments have negative impacts on spotted owls.[449] Little or no assurance is provided within agency documents that the recommended conservation measures will be adequate.[450] For example, effectively no scientific support is provided for prohibiting mechanical

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[440] *See, e.g.*, DRAFT EIS, *supra* note 2, at 336–39.
[441] *Id.* at 375.
[442] *See, e.g.*, CONSERVATION STRATEGY, *supra* note 213, at 25–35.
[443] HIRT, *supra* note 18, at xxi.
[444] *See generally* Oliver et al., *supra* note 21.
[445] *Id.* at 573.
[446] *See, e.g.*, DRAFT EIS, *supra* note 2, at 375.
[447] *See* CONSERVATION STRATEGY, *supra* note 213, at 11–12; DRAFT EIS, *supra* note 2, at 338–39, 375.
[448] CONSERVATION STRATEGY, *supra* note 213, at 11–12.
[449] Ganey et al., *supra* note 310, at 156.
[450] *See* CONSERVATION STRATEGY, *supra* note 213, at 25–39.

treatments within ten acres surrounding the nest.[451] The cited study does not justify protecting such a small area, and, in fact, suggests that habitat selectivity approximates or exceeds PAC boundaries.[452]

Within agency documents, the favorable discussions of treatment impacts on spotted owls reflect the agency's commitment to intensive management and, likely, misplaced optimism.[453] Generally, the use and misuse of scientific information in the draft EIS, final EIS, revised draft EIS, Conservation Strategy, and other documents involved in plan revision is consistent with the account of entrenched agency optimism discussed by Hirt.[454] There is a concerted effort within these documents to consider "only . . . certain pieces of the puzzle . . . while neglecting others that . . . [do] not contribute to a preconceived notion of what the finished puzzle should look like."[455] Among the various misuses of science, within agency documents a number of citations are ineffective, providing little or no support for the proposed conservation measures and for claims concerning the impacts of high-severity fire and forest treatments on spotted owls.[456]

According to Oliver et al. (1999), under intensive management the focus is on creating and maintaining the structures and patterns necessary for desired outcomes, through logging and other means, rather than on maintaining natural or historic forest conditions.[457] As Hirt writes, "'Intensive management' . . . reflect[s] a growing enthusiasm for reordering nature on a massive scale to maximize its social utility."[458]

Reordering nature on Forest Service lands in the Sierra Nevada has been ongoing for years, through "restoration" and fuel-reduction treatments

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[451] *Id.* at 6, 9.
[452] North et al., *supra* note 413, at 171, 175.
[453] *See* CONSERVATION STRATEGY, *supra* note 213, at 11–12; DRAFT EIS, *supra* note 2, at 338–39, 375.
[454] *See* HIRT, *supra* note 18, at xv–liv. Jeffrey Rudd discusses the Forest Service's resistance to new scientific information during the planning process. *See* Jeffrey Rudd, *The Forest Service's Epistemic Judgments: Enhancing Transparency to Ensure "New Knowledge" Informs Agency Decision-Making Processes*, 23 TEMP. ENVTL. L. & TECH. J. 145 (2004). Rudd writes: "I argue for a fundamental, institutional shift away from the traditional view that courts should defer to agency 'expertise' when interpreting and applying NFMA-related regulations. . . . Traditional judicial deference to the Forest Service's decision-making processes in scientific issues is insufficient to ensure that scientific claims are evaluated fairly." *Id.* at 149. Rudd encourages the courts' use of independent experts "to thoroughly evaluate agency decision-making processes." *Id.*
[455] HIRT, *supra* note 18, at xlviii.
[456] *See, e.g.*, CONSERVATION STRATEGY, *supra* note 213, at 9, 10, 18.
[457] *See, e.g.*, Oliver et al., *supra* note 21, at 573.
[458] HIRT, *supra* note 18, at xxi.

(selective logging, thinning, etc.), and by means of salvage logging and establishing tree plantations in burned areas.[459] According to World Wildlife Fund, in the Sierra Nevada, "[t]he vast majority of native forests have already been largely converted to tree plantations."[460] Plantations typically consist of stands dominated by one or two conifer species, with trees evenly spaced.[461] Within the draft EIS for plan revision, and the revised draft EIS, the preferred alternative calls for only 10 percent of a large area burned at moderate and high severity to be set aside for recovery through natural reforestation.[462] Through various operations, including selective logging, thinning, salvage logging, and the creation of conifer plantations, Sierra Nevada forests are becoming increasingly artificial and homogeneous, reshaped in accordance with agency designs.[463]

According to the revised draft management plan for Sierra National Forest, desired conditions include open, park-like forests, with generally sparse understory vegetation and low to moderate canopy cover (ranging from 10 to 50 percent).[464] Desired conditions also include small patches of dense trees, with numerous small gaps in the forest canopy, generally from .05 to .5 acres in size.[465] Forests will be maintained primarily by regular rotations of low and moderate-severity fire, with minimal patches burned at high severity.[466] Desired conditions reflect the historic conditions accepted by the agency.[467] As described in the NRV Technical Report, historic Sierra Nevada forests featured "fine-grained structural heterogeneity," that is, they supposedly lacked the large patches of early successional forest habitat and the extended contrasts and abrupt shifts in structure that result from large, high-severity fire and other major disturbances.[468]

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[459] *See, e.g.*, Hanson et al., *supra* note 27, at 102; Odion et al., *supra* note 27, at 2.
[460] D. Olson & J. Sawyer, *Types and Severity of Threats, Sierra Nevada Forests*, WORLD WILDLIFE FUND, https://www.worldwildlife.org/ecoregions/na0527 [https://perma.cc/SC7H-6HCF] (last visited Nov. 12, 2019). According to this organization, only approximately 25 percent of natural habitats are still intact in the Sierra Nevada. *Id.*
[461] Marjie Brown, *In Plantations or Natural Stands: Ponderosa Is Programmed to Partner with Fire*, 56 FIRE SCI. BRIEF 2 (Joint Fire Science Program, 2009). According to Brown, nearly 400,000 acres of California's national forests are managed as ponderosa pine plantations. *Id.* at 1.
[462] DRAFT EIS, *supra* note 2, at 235–36; REVISED DRAFT EIS, *supra* note 4, at 262.
[463] *See, e.g.*, Baker, *supra* note 46, at 1; Hanson & Odion, *supra* note 10, at 17–18.
[464] FOREST SERV., U.S. DEP'T OF AGRIC. REVISED DRAFT LAND MANAGEMENT PLAN FOR THE SIERRA NATIONAL FOREST 31, 33–34 (Pac. Southwest Region 2019).
[465] *Id.*
[466] *Id.* at 26, 29.
[467] *See* NRV TECHNICAL REPORT, *supra* note 38, at 139.
[468] *Id.*; s*ee also id.* at 92.

Critics are concerned that the reconstructed forests will be less able to support viable populations of California spotted owls and other native species.[469] According to critics, the agency is gradually removing those old-growth characteristics—dense, large-tree stands with high canopy cover required by spotted owls for nesting, and gradually eliminating (through salvage logging and replanting) the early successional forest habitat, with dense snags and downed wood, preferred by the owls for foraging.[470] Again, some scientists believe that spotted owls prefer areas burned at high severity for foraging due to the larger populations of small mammals associated with the increased growth of hardwoods, shrubs, and herbaceous vegetation.[471] Snags (standing dead trees) provide necessary perches for foraging owls.[472] The elimination of early successional forest habitat (early seral forest) also threatens black-backed woodpeckers (*Picoides arcticus*) and other early successional species, many of which are in decline in the Sierra Nevada.[473]

Based on his analysis of General Land Office survey data, Baker (2014) writes, "[p]roposals to reduce fuels and fire severity would actually reduce, not restore, historical forest heterogeneity important to wildlife and resiliency."[474] Sierra Nevada forests are inherently susceptible to large, high-severity fire, Baker claims, and this "cannot be changed without creating artificial forests over large land areas."[475] Hanson and Odion (2016) write, "Our results . . . indicate that current plans by the US Forest Service to create, though logging, a landscape dominated by open pine forests maintained by lower severity fire would result in novel, overly homogeneous conditions that could exacerbate risks to California Spotted Owls and Pacific Fishers."[476] Hanson et al. (2018) express the problem of forest reconstruction in this succinct manner:

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[469] *See, e.g.*, Hanson & Odion, *supra* note 10, at 17–18; Hanson et al., *supra* note 27, at 102.
[470] *See, e.g.*, Hanson et al., *supra* note 27, at 102. In Stephens et al. (2016), agency scientists and others express this interesting puzzle that arises under their accepted beliefs: how did California spotted owls, which are dependent upon dense, old-growth forests, survive in historic conditions with relatively open canopies and park-like conditions? Stephens et al., *supra* note 253, at 13. They do not consider the possible solution that their beliefs concerning historic Sierra Nevada forests are incorrect. *Id.*
[471] Bond et al., *Habitat Use and Selection by California Spotted Owls, supra* note 275, at 1121–22; Hanson et al., *supra* note 27, at 100.
[472] Hanson et al., *supra* note 27, at 100.
[473] *See, e.g.*, Hanson & Odion, *supra* note 10, at 17; Chad T. Hanson, *Land Heterogeneity Following High-Severity Fire in California's Forests*, 42 WILDLIFE SOC'Y BULLETIN 264, 264–65 (2018).
[474] Baker, *supra* note 46, at 1.
[475] *Id.*
[476] Hanson & Odion, *supra* note 10, at 17–18.

> [Our] results and other research indicate that post-fire logging of complex early seral forests is not consistent with California spotted owl conservation and mechanical thinning has been associated with dramatic and rapid population declines for this subspecies in the Sierra Nevada. Further, multiple studies have indicated that there is no long-term increasing trend in high-severity fires in the Sierra Nevada . . . .[477]

V. NEPA AND APA: LIMITS OF AGENCY DISCRETION IN THE USE OF SCIENCE

The 2012 Planning Rule governs the revision of land management plans for national forests throughout the country.[478] This rule requires use of the best available scientific information as management plans are developed or revised.[479] This requirement is highly qualified or tempered, however. According to the 2012 rule, the responsible Forest Service official is to determine which scientific information is relevant, accurate, and reliable for the issues under consideration.[480] This language limits the relevant, accurate, and reliable scientific information to just that information the responsible official determines has these properties. As management plans are developed or revised, such qualifying language allows the selective use of just those studies, and interpretations of those studies, that support the agency's traditional beliefs and proposed actions.

On the other hand, the 2012 rule requires that an EIS be prepared to evaluate the environmental impacts of a proposed, newly developed or revised management plan.[481] NEPA regulations governing the preparation of an EIS require use of the best available scientific information in the analyses of environmental impacts, and this requirement is not qualified.[482] Strict adherence to NEPA regulations would help ensure that the best available scientific information is brought to bear in plan

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[477] Hanson et al., *supra* note 27, at 102.
[478] 36 C.F.R. § 219 (2012).
[479] *Id.* § 219.3 ("The responsible official shall use the best available scientific information to inform the planning process required by this subpart. In doing so, the responsible official shall determine what information is the most accurate, reliable, and relevant to the issues being considered.").
[480] *Id.*
[481] *Id.*§ 219.5.
[482] *See* 40 C.F.R. §§ 1500–1508 (1987), especially § 1500.1(b), § 1502.1, § 1502.15, § 1502.24.

revision, regardless of how well this information fits into traditionally accepted beliefs and proposed actions.

According to NEPA regulations, within an EIS a federal agency must "provide full and fair discussion of [the] significant environmental impacts" of the proposed action.[483] As this mandate has been interpreted by the courts, within an EIS an agency must take a "hard look" at the environmental impacts of the proposed action, and must not minimize adverse side effects.[484] In addition, according to NEPA regulations, an agency "shall insure the professional integrity, including the scientific integrity, of the discussions and analyses in environmental impact statements."[485] In accordance with these requirements, analyses of impacts within an EIS are to be thorough, accurate, well reasoned, and must be based on the best available scientific information. Use of the best available scientific information is an essential aspect of providing a "full and fair discussion" of environmental impacts (a "hard look"), and providing a discussion that has professional and scientific integrity.[486] NEPA regulations mandate that descriptions of the affected environment required within an EIS be accurate and in sufficient detail.[487]

With respect to either an EIS or Environmental Assessment ("EA"), NEPA regulations require use of "high quality" information.[488] "[A]ccurate scientific analysis . . . [is] essential [for] implementing NEPA," these regulations state, which is fairly interpreted as requiring that analyses of impacts within a document prepared under NEPA be thorough, accurate, well reasoned, and based on the best available scientific information.[489]

Under legal precedent, a court reviewing alleged violations of NEPA regulations by the Forest Service must adopt a highly deferential attitude toward the agency's use of scientific information.[490] In *Lands Council v. McNair*, decided by the U.S. Ninth Circuit Court of Appeals in 2008, the court deliberated *en banc* in an effort to clarify the standards it must apply when reviewing the Forest Service's use of science.[491] According to the

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[483] *Id.* § 1502.1.
[484] *See, e.g.*, Earth Island Inst. v. U.S. Forest Serv., 442 F.3d 1147, 1153–54, 1159–60 (9th Cir. 2006); Ocean Advocates v. U.S. Army Corps of Eng'rs, 402 F.3d 846, 864–65, 870–71 (9th Cir. 2004); Blue Mountains Biodiversity Project v. Blackwood, 161 F.3d 1208, 1211–12 (9th Cir. 1998).
[485] 40 C.F.R. § 1502.24 (1987).
[486] *Id.* § 1502.1; *id.* § 1502.24.
[487] *Id.* § 1502.15.
[488] *Id.* § 1500.1(b).
[489] *Id.*
[490] *See, e.g.*, Lands Council v. McNair, 537 F.3d 981, 984 (9th Cir. 2008).
[491] *Id.*

author of the *Lands Council* opinion, Judge Milan Smith, the court's review "'is narrow, and [we do] not substitute [our] judgment for that of the agency.'"[492] Indeed, in *Lands Council*, the Ninth Circuit overturned previous Ninth Circuit decisions for the reason that, in these decisions, the court did not apply the proper level of deference toward the agency.[493] In their reviews of this case, legal scholars have emphasized the deferential attitude the courts must adopt toward the agency, some going as far as to claim that NEPA regulations, as applied by the courts, do not effectively constrain the agency's use of science.[494] It is important to emphasize, as well, the limits to the discretion granted the agency.

In this case, Lands Council and other environmental organizations sought to halt the Forest Service's Mission Brush project in the Panhandle National Forest of Idaho.[495] The project involved silvicultural treatments, including selective logging, mechanical thinning, and salvage harvesting of dead, damaged, or dying trees, for the purpose of restoring over 3,829 acres to their historic structure and composition, rendering these forests more resistant to high-severity fire and other disturbances.[496] The project included restoring old-growth forests to improve overall quality.[497] The agency anticipated three timber sales; the project was expected to generate 23.5 million board feet of timber.[498]

In their complaint, Lands Council and other organizations charged the Forest Service with violations of NEPA and the National Forest Management Act (NFMA), arguing that the agency failed to properly assess project impacts on the flammulated owl (*Psiloscops flammeolus*).[499] Citing a previous Ninth Circuit decision, the plaintiffs claimed that the agency was required to demonstrate that proposed forest treatments would not render the owl population inviable by conducting on-the-ground monitoring of owls in previously treated areas.[500] In fact, the Forest Service did rely on a monitoring report of flammulated owls in previously treated areas, but, according to the plaintiffs, the report was flawed, and the agency did

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[492] *Id.* at 987 (quoting Earth Island Inst. v. U.S. Forest Serv., 442 F.3d 1147, 1156 (9th Cir. 2006)).
[493] *Id.* at 981, 990–94.
[494] *See* Sara Clark, *Taking a Hard Look at Agency Science: Can the Courts Ever Succeed?*, 36 ECOLOGY L.Q. 317, 342–43 (2009).
[495] 537 F.3d at 984.
[496] *Id.* at 984–86.
[497] *Id.* at 986.
[498] *Id.*
[499] *Id.* at 984, 987–88.
[500] 537 F.3d 981, 990.

not provide an adequate demonstration of continued viability.[501] Plaintiffs also charged that the project EIS "did not adequately address the uncertainty concerning its proposed treatment as a strategy to maintain species viability."[502] Although a three-judge panel of the Ninth Circuit had previously sided with the plaintiffs, in *Lands Council* the court *en banc* reversed the earlier decision and ruled that the district court properly denied the request for an injunction.[503]

According to the Ninth Circuit in *Lands Council*, although the applicable forest plan specifically requires maintaining the viability of flammulated owls and other wildlife species in this national forest, neither the forest plan nor NFMA mandate that the Forest Service demonstrate continued viability using on-the-ground observations or any other specific methodology.[504] The court noted that the agency relied on a monitoring report of owls in previously treated areas, but, according to the court, the agency was not required to do this.[505] The court in *Lands Council* upheld the agency's use of this report to support its conclusion of continued viability, disagreeing with the earlier three-judge panel.[506] The court noted that the agency also relied upon a habitat suitability model to analyze potential impacts of the proposed project on the owls, and it relied, as well, on studies in the scientific literature documenting the presence of owls after silvicultural treatments of the types proposed for the Mission Brush area.[507] "[I]t is for the Forest Service to determine how the project will affect the habitat of flammulated owls," Judge Smith writes.[508] According to the judge: "To always require a particular type of proof that a project would maintain a species' population in a specific area would inhibit the Forest Service from conducting projects in the national forests. We decline to constrain the Forest Service in this fashion."[509]

This is an important principle of environmental jurisprudence adopted by the Ninth Circuit in *Lands Council*, that the court may not require the agency to support a claim of continued species viability through on-the-ground observations or any other specific methodology.[510] "[W]e defer

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[501] *Id.* at 994–95.
[502] *Id.* at 988.
[503] *See id.* at 984, 1005–06; Lands Council v. McNair, 494 F.3d 771, 780 (9th Cir. 2007).
[504] 537 F.3d at 987–94.
[505] *Id.* at 994–95.
[506] *Id.* at 995; 494 F.3d at 776–77.
[507] 537 F.3d at 994–96.
[508] *Id.* at 997.
[509] *Id.*
[510] *See id.* at 987–97; *see also* the helpful discussion in Ryan G. Weldon & Michael E.

to the Forest Service as to what evidence is, or is not, necessary to support wildlife viability analyses," Judge Smith writes.[511] "[O]ur proper role," he continues, "is simply to ensure that the Forest Service made no 'clear error of judgment' that would render its action 'arbitrary and capricious.'"[512]

As explained in the *Lands Council* opinion, the court's review of Forest Service viability determinations is constrained by the Administrative Procedure Act (APA), which "provides the authority for [the court's] review" of alleged violations of NFMA and NEPA.[513] Under the arbitrary and capricious standard provided in APA, the court's review of a viability determination is necessarily narrow.[514] As noted by the judge, in a previous decision the Ninth Circuit declared that, in its review under the arbitrary and capricious standard, a court must defer "to an agency's determination in an area involving 'a high level of technical expertise.'"[515] Other opinions issued by the Ninth Circuit, as well as other federal appellate courts, establish the need for a "particularly deferential review" under the arbitrary and capricious standard.[516] As noted by Judge Smith, the U.S. Supreme Court has provided guidance for the lower courts as they decide whether an agency has acted arbitrarily and capriciously under APA.[517] A court's review is limited to determining whether the agency has committed a "clear error of judgment," to be determined according to criteria specified by the Supreme Court (see below).[518] Thus, as Judge Smith argues, a court may not simply substitute its judgment for that of the agency.[519] He writes, "We will conclude that the Forest Service acts arbitrarily and capriciously only when the record plainly demonstrates that the Forest Service made a clear error in judgment in concluding that a project meets the requirements of the NFMA and relevant Forest Plan."[520]

The Ninth Circuit in *Lands Council* explicitly relied on the four criteria specified by the Supreme Court for deciding whether an agency

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Patterson, *Maintaining the Ninth Circuit's Clarified Arbitrary and Capricious Standard of Review for Agency Science after Lands Council v. McNair*, 31 PUB. LAND & RESOURCES L. REV. 55, 76, 79 (2010).

[511] 537 F.3d at 992.

[512] *Id.* at 993.

[513] *Id.* at 987.

[514] *Id.*

[515] *Id.* at 993.

[516] 537 F.3d at 993.

[517] *See id.*; *see also* Weldon & Patterson, *supra* note 510, at 58–59.

[518] 537 F.3d at 993.

[519] *Id.* at 987, 993–94.

[520] *Id.* at 994.

has committed a clear error of judgment, and so has acted arbitrarily and capriciously, under APA: 1. The agency "relied on factors which Congress has not intended it to consider," 2. The agency "entirely failed to consider an important aspect of the problem," 3. The agency "offered an explanation for its decision that runs counter to the evidence before the agency," and 4. The agency offered an explanation "so implausible that it could not be ascribed to a difference in view or the product of agency expertise."[521]

In *Lands Council*, the Ninth Circuit sought a proper balance of deference and careful review. "[W]e defer to the Forest Service," Judge Smith writes (again), "as to what evidence is, or is not, necessary to support wildlife viability analyses."[522] Yet, according to the judge, "The Forest Service must explain the conclusions it has drawn from its chosen methodology, and the reasons it considers the underlying evidence to be reliable."[523] In *Lands Council*, the Ninth Circuit carefully considered the evidence relied upon by the agency for its conclusion that the flammulated owl population would remain viable: the habitat suitability model, the monitoring report of owls in previously treated areas, and studies from the literature.[524] The court considered the reasoning behind the habitat suitability model, and the agency's explanation that suitable owl habitat will not be lost short-term, and will actually be enhanced long-term.[525] The court found "eminently reasonable" the agency's conclusion that the project will maintain a viable population of flammulated owls in the Mission Brush area.[526]

In accordance with *Lands Council*, the Ninth Circuit will not impose upon the Forest Service a specific methodology for determining species viability, yet the court's deference is not absolute.[527] As in *Lands Council*, the court will carefully review the agency's evidence, explanations, and conclusions to determine whether it has "overlooked any relevant factors or made any clear errors of judgment."[528] Legal scholars Ryan Weldon and Michael Patterson argue, citing this and previous Ninth Circuit decisions, that the court "may not abrogate its province and duty to provide a 'searching and careful' review."[529]

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[521] *Id.* at 993.
[522] *Id.* at 992.
[523] 537 F.3d at 994.
[524] *Id.* at 994–96.
[525] *Id.* at 996.
[526] *Id.*
[527] *Id.* at 992–97.
[528] *Id.* at 992 (quoting from Seattle Audobon Soc'y v. Moseley, 80 F.3d 1401, 1404 (9th Cir. 1996)).
[529] Weldon & Patterson, *supra* note 510, at 84.

With respect to the monitoring report of flammulated owls in previously treated areas, the "Dawson Ridge Study," the plaintiffs' concern was that researchers detected only one owl response in the 2006 survey conducted subsequent to all logging and prescribed fire treatments.[530] The agency interpreted this report as indicating the presence of owls in treated areas.[531] The three-judge panel had expressed concern over the small number of responses (a "solitary hoot"), but in the subsequent *en banc* decision, the Ninth Circuit adopted a more deferential approach.[532] According to the court, "It is within the Forest Service's expertise, not ours, to determine the significance of these responses."[533] Judge Smith writes, "[W]e hold that the Forest Service must support its conclusions that a project meets the requirements of the NFMA and relevant Forest Plan with studies that the agency, in its expertise, deems reliable."[534] In *Lands Council*, the Ninth Circuit deferred to the agency in its choice of studies to support its viability determination, and in its interpretation of the recorded data in the owl monitoring study.[535]

This is the second important principle of environmental jurisprudence adopted by the Ninth Circuit in *Lands Council*: the court must not impose upon the agency its own judgment concerning which studies the agency relies upon in its environmental analyses under NFMA and NEPA.[536] With respect to the alleged violations of NEPA, the court found that the agency had indeed provided the required "hard look" at the environmental impacts of proposed forest treatments, refusing to fault the Dawson Ridge Study or other evidence.[537] According to the Ninth Circuit, the court's review of studies relied upon by the agency must not be too detailed or "fine-grained," approaching scientific peer review.[538] As emphasized by Judge Smith, judges are not scientists.[539] The Ninth Circuit in *Lands Council* overruled the court's earlier decision in *Ecology Center v. Austin*, criticizing (among other details) that panel's "fine-grained" assessment of a soil sample analysis relied upon by the Forest Service.[540] "Essentially," Judge Smith writes, "we assessed the quality and detail of

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[530] 537 F.3d at 994; 494 F.3d at 775–77.
[531] 537 F.3d at 995; 494 F.3d at 776.
[532] 537 F.3d at 995; 494 F.3d at 776–77.
[533] 537 F.3d at 995.
[534] *Id.* at 994.
[535] *Id.* at 994–99.
[536] *See id.* at 993–94; *see also* Weldon & Patterson, *supra* note 510, at 76–77, 79.
[537] 537 F.3d at 1001–02.
[538] *See id.* at 992–93; *see also* Weldon & Patterson, *supra* note 510, at 73, 79.
[539] 537 F.3d at 988, 993–94.
[540] *Id.* at 990–93.

on-site analysis and made 'fine-grained judgments of its worth.'"[541] He adds, "It is not our proper role to conduct such an assessment."[542]

In accordance with *Lands Council*, then, under APA's arbitrary and capricious standard the court must conduct a "searching and careful review" of studies the agency relies upon to ensure there have been no clear errors of judgment.[543] As Judge Smith writes, "[W]e look to the evidence the Forest Service has provided to support its conclusions, along with other materials in the record, to ensure the Service has not, for instance, 'relied on factors which Congress has not intended it to consider . . . .'"[544] The court must not go beyond this to essentially dictate to the agency which studies it may use and how to interpret the data.[545]

It is worth noting that, in *Lands Council*, the court reviewed the Dawson Ridge Study in detail.[546] Referring to the data (only one owl response), Judge Smith admits, "this record is relatively sparse."[547] The court allowed the agency's interpretation of the data to stand (owls are present in treated areas), but expressed reservations.[548] This report "approaches the limits of our deference," the judge writes.[549] In the view of the court, the agency's interpretation of the data, and its claim that this report supports its viability determination, were barely credible.[550] The court also reviewed those studies from the scientific literature relied upon by the Forest Service, and affirmed that these studies documented the presence of owls in treated forests.[551] Implied is that, in the judgment of the court, these studies were credible.[552] The court noted that the agency provided a detailed explanation of the habitat suitability model, properly acknowledging the assumptions underlying the model.[553] The court concluded that the agency's habitat suitability analysis was reasonable and that it had met its obligations to maintain species viability.[554]

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[541] *Id.* at 993.
[542] *Id.*
[543] *See id.*; Weldon & Patterson, *supra* note 510, at 84.
[544] 537 F.3d at 993.
[545] *Id.* at 992–97; Weldon & Patterson, *supra* note 510, at 76–77, 79.
[546] 537 F.3d at 995.
[547] *Id.*
[548] *Id.*
[549] *Id.*
[550] 537 F.3d at 995
[551] *Id.* at 994–95.
[552] *Id.*
[553] *Id.* at 998.
[554] *Id.* at 998–99.

In their review of *Lands Council*, Weldon and Patterson provide a fair assessment, claiming that the Ninth Circuit "articulates a standard of review that precludes courts from either acting as rubber stamps or substituting their judgments for that of the agency and its science."[555] In *Lands Council*, the Ninth Circuit grants the Forest Service much discretion in its analyses of impacts and use of scientific information, but also sets limits. According to the court, the agency must meet the requirements of NFMA and the relevant forest management plan.[556] The Forest Service has discretion to choose its methodology in viability determinations, the studies it brings to bear, and how the data are to be interpreted.[557] However, the agency must provide adequate support for its conclusions concerning viability, and explain why the underlying evidence is reliable.[558] The court will conduct a searching and careful review of the agency's evidence, explanations (including its interpretations of data), and conclusions to ensure that no relevant factors have been overlooked and that, generally, there are no clear errors of judgment, rendering the agency's decision arbitrary and capricious.[559] As in *Lands Council*, studies relied upon by the agency will be reviewed to assess their credibility and significance, that is, whether they in fact support the agency's conclusions.[560]

The Ninth Circuit will also enforce NEPA regulations regarding the need, within an EIS, for a full and fair discussion of the environmental impacts of a proposed agency action, a "hard look."[561] The agency has discretion to rest its analyses of impacts on studies it considers appropriate, with the data interpreted as it deems appropriate.[562] The court will conduct a searching and careful review of the studies the agency relies upon, assessing their credibility and significance, to ensure there have been no clear errors of judgment.[563] As established in *Lands Council* and other Ninth Circuit decisions, the Forest Service does not have final authority to determine which studies are relevant, accurate, and reliable in the preparation of an EIS under NEPA. Final authority is reserved for the reviewing court.[564] As in *Lands Council*, the court will review the agency's

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[555] Weldon & Patterson, *supra* note 510, at 56.
[556] 537 F.3d at 988–89.
[557] *Id.* at 992–97.
[558] *Id.* at 994.
[559] *Id.* at 994–99.
[560] *Id.*
[561] *Id.* at 1000–01.
[562] 537 F.3d at 992–97.
[563] *Id.* at 994–99.
[564] As indicated in *Lands Council*, this authority is provided by NFMA, NEPA, and, more fundamentally, the arbitrary and capricious standard in APA. *Id.* at 987.

interpretations of data and its analyses of impacts and conclusions, deferring to the agency as long as there have been no clear errors of judgment.[565]

Legal scholars have expressed differing views concerning *Lands Council*. Laura Nelson writes, "*Lands Council* 'clarification' has not proven itself very useful in recent cases . . . ."[566] "No clear judicial review doctrine emerged from *Lands Council*," she adds.[567] She notes inconsistencies in later Ninth Circuit decisions.[568] Discussing subsequent decisions, she writes, "[e]ach of these cases cited *Lands Council* for the proposition that elevated deference is owed to an agency's scientific and technical expertise, yet the application of that standard of review seems inconsistent."[569] Weldon and Patterson also express concern with the subsequent inconsistent application of the standard of judicial review articulated in *Lands Council*.[570]

This standard of judicial review is indeed vague, and, as a result, some inconsistency in application is to be expected. With respect to viability determinations, the court is to conduct a searching and careful review of the agency's evidence, explanations, and conclusions, but the court is left with discretion, from case to case, to decide how detailed its review should be.[571] The court's review of scientific studies must not be too fine-grained (judges are not scientists), but the court is left to use its best judgment as to the appropriate level of detail.[572] Under NEPA regulations, within an EIS the agency must provide a full and fair discussion of the impacts of a proposed agency action, a "hard look."[573] Yet what constitutes a "full and fair discussion" (a "hard look") is not precisely specified within the regulations.[574] For years, the courts have sought to clarify what constitutes a "full and fair discussion" (a "hard look"), and a reviewing court has some latitude in deciding how extensive and detailed an analysis must be to comply with NEPA.[575]

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[565] *Id.* at 995–99.
[566] Laura Anzie Nelson, *Delineating Deference to Agency Science*, 40 ENVTL. L. 1057, 1062 (2010).
[567] *Id.* at 1070.
[568] *Id.* at 1080–82.
[569] *Id.* at 1082.
[570] Weldon & Patterson, *supra* note 510, at 57, 113, 118.
[571] Lands Council v. McNair, 537 F.3d 981, 993–99 (9th Cir. 2008).
[572] *Id.* at 992–93.
[573] 40 C.F.R. § 1502.1 (1987).
[574] *Id.*
[575] There is extensive literature on this topic. *See, e.g.*, Loretta V. Chandler, *Taking the "Hard Look": 9th Circuit Review of Forest Service Actions under NEPA, NFMA, and NHPA*, 4 GREAT PLAINS NAT. RESOURCES J. 204 (2000); William Griffin, *NEPA and the Roan*

Although the standard of review articulated in *Lands Council* is vague, and courts must use best judgment, the standard is still useful since courts have criteria to apply and models to follow provided by this and other precedent cases. Legal scholar Sara Clark is highly critical of *Lands Council*, writing, "the Ninth Circuit essentially permits the agency to make any decision it likes, as long as it generates 'scientific' conclusions to support it."[576] Yet it is not accurate to claim that, in accordance with *Lands Council,* the courts must entirely defer to the agency with respect to its use of scientific information—that "anything goes" as long as the agency provides a show of science. Weldon and Patterson are more positive, arguing that *Lands Council* articulates an appropriate balance of deference and careful judicial review, although they stress the deference owed the agency.[577] These scholars appropriately state that *Lands Council* articulates "a thin line upon which the courts must balance, and the plaintiff carries the burden when trying to prove that the agency's decision was arbitrary and capricious."[578]

Decided by the U.S. District Court for the Eastern District of California in 2014, and (on appeal) the Ninth Circuit in 2015, *Center for Biological Diversity v. Skalski* adds to our understanding of the standard of review the courts must apply to the agency's use of scientific information.[579] In this case, Center for Biological Diversity and other citizen organizations alleged that the Forest Service failed to take the required "hard look" at the environmental impacts of a proposed salvage logging and forest recovery project in the Sierra Nevada.[580] Following the historically large Rim Fire, the agency proposed salvage logging and fuel-reduction treatments on approximately 15,500 acres of burned conifer forestland.[581] The plaintiffs alleged numerous flaws in the project EIS, including failure to adequately consider relevant studies, failure to adequately consider recent California spotted owl survey results, inadequate support for the assertion of

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Plateau: Forcing the Bureau of Land Management to take a Hard Look, 40 B.C. ENVTL. AFF. L. REV. 553 (2013); Devin Kirby, *What is the "Hard Look" That the Ninth Circuit is Looking for When Reviewing Forest Service Actions under NEPA?*, 10 MO. ENVTL. L. & POL'Y REV. 213 (2003) ("The Ninth Circuit has exhibited different levels of deference to the Forest Service . . . .").

[576] Clark, *supra* note 494, at 343.

[577] Weldon & Patterson, *supra* note 510, at 55–57, 80–84.

[578] *Id.* at 58.

[579] Ctr. for Biological Diversity v. Skalski, 613 Fed. Appx. 579 (9th Cir. 2015); Ctr. for Biological Diversity v. Skalski, 61 F. Supp. 3d 945 (E.D. Ca. 2014).

[580] 61 F. Supp. 3d at 953.

[581] This is "Modified Alternative 4." *Id.* at 950.

continued viability of spotted owls, and failure to consider scientists' recommendation to avoid salvage logging within 1.5 km of nest sites.[582]

The agency gave assurances that viable populations of spotted owls and other native species would be maintained, but the support provided was anecdotal (superficial or sketchy).[583] With respect to spotted owls, for example, the agency committed to flagging and avoiding nest trees during hazardous tree removal, and, during all operations, to leave a higher volume of large snags and downed wood than was originally proposed.[584] No detailed, scientific discussion was provided.[585] The plaintiffs correctly pointed out that the agency did not provide a quantitative discussion of the effect that loss of occupancy of territories may have on the already declining population of spotted owls in this area, and there was no indication of how small the population can become and remain viable.[586]

The courts sided with the Forest Service, accepting that the agency provided reasonably thorough analyses, and that its conclusions were reasonably well justified.[587] According to the district court, the agency was under no obligation to provide a quantitative viability analysis, with exact numbers of individuals required for a viable population, as demanded by plaintiffs.[588] The district court cited *Lands Council*, according to which the Forest Service should not be restricted to one particular type of proof.[589] The court found that the agency adequately considered those studies cited by the plaintiffs, and properly discussed the limited applicability of some of these studies to the Rim Fire area.[590] As the court pointed out, for example, in the EIS the Forest Service cited Lee et al. (2012) for claims concerning spotted owls and fire (modest claims).[591] The court noted, however, "[T]he [EIS] cautions against extrapolating too much from Lee et al. (2012)."[592] The problem, according to the agency and discussed by the

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[582] *See* Complaint for Declaratory and Injunctive Relief at 3–5, 11–14, Ctr. for Biological Diversity v. Skalski, 61 F. Supp. 3d 945 (E.D. Ca. 2014) (No. 1:14-at-00662).
[583] *See* FOREST SERV., U.S. DEP'T OF AGRIC., RIM FIRE RECOVERY PROJECT, ENVIRONMENTAL IMPACT STATEMENT ch. 3 (Stanislaus National Forest 2014).
[584] *Id.* at 346, 348.
[585] *Id.*
[586] Complaint for Declaratory and Injunctive Relief, Ctr. for Biological Diversity v. Skalski, *supra* note 582, at 5.
[587] Ctr. for Biological Diversity v. Skalksi, 613 Fed. Appx. 579, 580–81 (9th Cir. 2015); 61 F. Supp. 3d at 956–60.
[588] 61 F. Supp. 3d at 960.
[589] *Id.* (citing Lands Council v. McNair, 537 F.3d 981, 997 (9th Cir. 2008)).
[590] *Id.* at 955–59.
[591] *See id.* at 957; *see generally* Lee et al., *supra* note 209.
[592] 61 F. Supp. 3d at 957.

court, is that in the study area only a relatively small number of spotted owl territories experienced significant habitat loss due to high-severity fire.[593] The agency argued that, due to the small sample size, this study does not adequately support the generalization that large patches of high-severity fire do not reduce occupancy.[594]

The district court considered plaintiffs' specific allegations regarding the agency's use of scientific studies.[595] Plaintiffs questioned the agency's interpretation of Clark (2007), that spotted owl use of areas burned at high severity is very low, arguing that, according to a figure included in the Clark study, northern spotted owls use high-severity burned areas disproportionately to their occurrence in the landscape.[596] The district court disagreed with plaintiffs' understanding of this figure, believing that information in the figure did not contradict the agency's interpretation of the study.[597] In the opinion of the court, within the EIS the agency adequately considered the information that spotted owls forage in high-severity burned areas within 1.5 km of their nest sites, properly factoring this information into their analysis of impacts.[598]

The district court believed that plaintiffs' allegations amounted to "a battle of the experts," in which studies cited by the plaintiffs (authored by Lee, Bond, Clark, DellaSala) are set against Keane (2014), authored by an agency scientist.[599] The court examined Keane (2014), a review of "more than a decade of published scientific research" on spotted owls and fire, indicating that, in its view, this study is credible and its conclusions reasonable.[600] According to the district court, citing legal precedent, in a "battle of the experts" the agency has discretion to rely on its own qualified experts.[601] The court is not to take sides, attempting to second-guess the agency's position.[602] Yet the agency must provide a reasonable explanation for why it sides with its own experts and discounts opposing studies and expertise.[603] Importantly, the agency may not simply pick sides without

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[593] *Id.*
[594] *Id.*
[595] *Id.* at 958–59.
[596] *Id.* at 958.
[597] *Id.* at 958–59.
[598] 61 F. Supp. 3d at 957–58.
[599] *See id.* at 958. *See generally* Keane, *supra* note 393.
[600] 61 F. Supp. 3d at 958.
[601] *Id.* at 956, 958.
[602] *Id.*
[603] *Id.* at 958.

reasonable explanation.[604] The district court brought into consideration this statement from a preceding Ninth Circuit opinion: "Nor will we 'take sides in a battle of the experts,' as the Forest Service . . . provided a thorough and reasoned explanation for its rejection of [the opposing] position."[605] Again, according to the district court, the agency adequately considered the Lee, Bond, Clark, and other studies cited by plaintiffs, sufficiently discussing the limited applicability of some of these studies to the present project.[606]

The district court contrasted this case with *Earth Island Institute v. United States Forest Service*, which also involved a proposed Forest Service salvage logging project in the Sierra Nevada.[607] In *Earth Island Institute*, the agency concluded that the proposed project would not reduce the amount of suitable spotted owl habitat available, ignoring an earlier study by Bond indicating that spotted owls indeed use high-severity burned areas for foraging, and that salvage logging in these areas renders them unsuitable for owls.[608] In this case, the Ninth Circuit decided in favor of the plaintiffs.[609] In *Center for Biological Diversity*, on the other hand, in the opinion of the court the agency adequately considered Bond et al. (2009) and other relevant studies, acknowledging the potential loss of suitable spotted owl habitat.[610] In *Center for Biological Diversity*, the district court and (on appeal) the Ninth Circuit found no indication that the agency engaged in arbitrary and capricious decision making under APA.[611]

These three cases, *Lands Council*, *Center for Biological Diversity*, and *Earth Island Institute*, illustrate the highly deferential approach toward the Forest Service's use of scientific information required of the courts. These cases also illustrate, to a greater or lesser extent, the careful and searching review required in order to determine whether any clear errors of judgment have been committed, rendering an agency decision arbitrary and capricious under APA. In *Earth Island Institute*, Judge William

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[604] *Id.*
[605] *Id.* (quoting from Native Ecosystems Council v. U.S. Forest Serv., 428 F.3d 1233, 1244 (9th Cir. 2005)).
[606] 61 F. Supp. 3d at 955–59.
[607] *See id.* at 959–60; Earth Island Inst. v. U.S. Forest Serv., 442 F.3d 1147, 1152 (9th Cir. 2006).
[608] 61 F. Supp. 3d at 959; 442 F.3d at 1172–73. *See generally* Bond et al., *Habitat Use and Selection by California Spotted Owls*, *supra* note 275.
[609] 61 F. Supp. 3d at 960; 442 F.3d at 1173, 1178.
[610] *See* 61 F. Supp. 3d at 957, 959–60.
[611] Ctr. for Biological Diversity v. Skalski, 613 Fed. Appx. 579, 581 (9th Cir. 2015); 61 F. Supp. 3d at 960.

Fletcher writes, "[C]ourts must independently review the record in order to satisfy themselves that the agency has made a reasoned decision based on its evaluation of the evidence."[612] The agency is required to "take a hard look at the issues . . . ," the judge adds.[613] In this case, the Ninth Circuit examined in close detail the Forest Service's presentation and use of tree mortality data, finding that the agency was proposing to salvage log an excessive volume of burned timber, which would result in impacts on California spotted owls that were not adequately analyzed in the project EIS.[614]

In *Center for Biological Diversity*, the courts erred in allowing the agency's interpretation of Clark (2007) to stand, failing to notice that, as acknowledged by the author, post-fire logging confounded the results of the study.[615] The agency's interpretation, that spotted owl use of high-severity burned areas is very low, was not justified.[616] The plaintiffs did not raise this issue, however, focusing instead on a figure that supposedly indicated disproportionately high spotted owl use of these areas.[617] The important point here is that the court reviewed the study, especially the figure in question, in some detail in order to address plaintiffs' concern.[618]

In accordance with *Lands Council* and other Ninth Circuit decisions, the courts are to conduct a searching and careful review of the Forest Service's evidence, explanations, and conclusions, not for the purpose of dictating to the agency which methodology to use, which studies to rely on, how to interpret the data, or to take sides when experts disagree, but to determine whether relevant factors have been overlooked and, in general, whether there have been any clear errors of judgment.[619] As indicated in *Earth Island Institute*, the courts will insist that the agency consider relevant scientific studies, even those that are preliminary.[620] Weldon and Patterson fairly argue that *Lands Council* articulates an appropriate balance of deference and careful judicial review.[621] The courts must walk a thin line, they claim, and, as they write, "the plaintiff carries the burden when trying to prove that the agency's decision was arbitrary

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[612] Earth Island Inst. v. U.S. Forest Serv., 442 F.3d 1147, 1160 (9th Cir. 2006) (quoting Marsh v. Or. Natural Res. Council, 490 U.S. 360, 378 (1989)).
[613] *Id.* at 1160 (quoting Earth Island Inst. v. U.S. Forest Serv., 351 F.3d 1291, 1301 (2003)).
[614] *Id.* at 1160–67, 1172.
[615] 613 Fed. Appx. at 580–81; 61 F. Supp. 3d at 958–59; Clark, *supra* note 225, at 122, 124–25.
[616] 61 F. Supp. 3d at 958–59.
[617] *Id.*
[618] *Id.*
[619] *See, e.g.*, Lands Council v. McNair, 537 F.3d 981, 987–99 (9th Cir. 2008).
[620] 442 F.3d at 1173.
[621] Weldon & Patterson, *supra* note 510, at 56–57, 80–81, 84.

and capricious."[622] With respect to the Forest Service's use of scientific information, the plaintiffs must state clearly what the problem is and why it matters.

VI. RELEVANT FACTORS OVERLOOKED IN PLAN REVISION

Within the draft EIS, final EIS for Inyo forest, revised draft EIS for the Sequoia and Sierra forests, Conservation Strategy, and other documents involved in plan revision, Forest Service scientists and others engage in a selective use of science, in violation of NEPA regulations. A major difficulty is that Baker (2014) and Odion et al. (2014), studies that call into question agency claims concerning historic forest structure and fire regimes in the Sierra Nevada, have been dismissed from consideration without adequate justification.[623] The stakes are indeed high. Again, as acknowledged by Levine et al. (2017), if Baker's conclusions are correct, the proposed forest restoration and fuel-reduction treatments are misguided.[624]

According to the final EIS and revised draft EIS, Baker (2014) and Odion et al. (2014) have been dismissed due to "a series of analytical and methodological issues," "unreasonable inferences and inappropriate conclusions drawn," and other reasons.[625] These reasons are left unexplained, though citations are provided to Levine et al. (2017), Stevens et al. (2016), Fulé et al. (2014), Miller and Safford (2017), and other studies.[626] According to the final EIS and revised draft EIS, these studies disprove the "best available scientific information" status of Baker (2014) and Odion et al. (2014).[627] To be sure, in *Center for Biological Diversity*, the courts allowed the agency to declare that a cited study (Lee et al. (2012)) has limited applicability due to small sample size.[628] If criticisms of a study appear reasonable, the courts will let stand the agency's claim that a study has limited or no applicability.[629] The standard is not particularly high—the courts are required to be highly deferential to agency judgment.[630]

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[622] *Id.* at 58.
[623] *See* CONSERVATION ASSESSMENT, *supra* note 17, at 127–29; INYO FINAL EIS, *supra* note 3, at 168; NRV TECHNICAL REPORT, *supra* note 38, at 48–50. *See generally* Baker, *supra* note 46; Odion et al., *supra* note 27.
[624] Levine et al., *supra* note 90, at 1510.
[625] INYO FINAL EIS, *supra* note 3, at 168; REVISED DRAFT EIS, *supra* note 4, at 172.
[626] *See* INYO FINAL EIS, *supra* note 3, at 168; REVISED DRAFT EIS, *supra* note 4, at 172. *See generally* Fulé et al., *supra* note 82; Levine et al., *supra* note 90; Miller & Safford, *supra* note 150; Stevens et al., *supra* note 125.
[627] INYO FINAL EIS, *supra* note 3, at 168; REVISED DRAFT EIS, *supra* note 4, at 172.
[628] Ctr. for Biological Diversity v. Skalski, 61 F. Supp. 3d 945, 957 (E.D. Ca. 2014).
[629] *Id.* at 956–57.
[630] Lands Council v. McNair, 537 F.3d 981, 987–99 (9th Cir. 2008).

There are limits, however. As discussed, within agency documents Odion et al. (2014) is criticized for the reason that the forest stand-age data used in the analysis were collected from wilderness areas and national parks, and so mainly from higher elevations, and therefore the study is of limited applicability across the broad range of ponderosa and mixed-conifer forests in the Sierra Nevada.[631] As mentioned, the claim within the final EIS, and revised draft EIS, that Odion et al. (2014) and other studies have been dismissed due to "science information placed in inappropriate ecological context" apparently rests largely on this criticism.[632] Yet, as Odion et al. (2014) clearly indicate, data used in the analysis were gathered from wilderness areas, national parks, and inventoried roadless areas, from low and mid-elevation forests.[633] The criticism is apparently based on a misreading. The other main criticism, citing Stevens et al. (2016), is that this study overestimates the extent and frequency of high-severity fire.[634] Yet, as replied in Odion et al. (2016), this criticism relies on an unreasonably narrow definition of "high-severity fire," a definition not traditionally accepted within the scientific literature.[635]

Baker (2014) is criticized for unacceptably low sampling densities, bias in the selection of bearing trees in the GLO survey, and for consistent density overestimates when compared to other studies of historic forest structure.[636] As discussed, however, these criticisms have been addressed in Baker (2014) and other published studies, which report no bias in the selection of bearing trees, and little or no error in recording survey data.[637] Data were pooled for the reconstructions, and the procedure used by Baker has reportedly been confirmed through numerous and varied tests.[638] According to Baker and Williams, discrepancies between their results and other studies are due to errors in the other studies.[639]

The final EIS, revised draft EIS, Conservation Assessment, and NRV Technical Report fail to consider the relevant discussions in Baker

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[631] CONSERVATION ASSESSMENT, *supra* note 17, at 128; NRV TECHNICAL REPORT, *supra* note 38, at 50.
[632] INYO FINAL EIS, *supra* note 3, at 168; REVISED DRAFT EIS, *supra* note 4, at 172.
[633] *See* Odion et al., *supra* note 27, at 4–7.
[634] *See* CONSERVATION ASSESSMENT, *supra* note 17, at 128; NRV TECHNICAL REPORT, *supra* note 38, at 50. *See generally* Stevens et al., *supra* note 125.
[635] Odion et al., *supra* note 132, at 3, 5.
[636] CONSERVATION ASSESSMENT, *supra* note 17, at 128; NRV TECHNICAL REPORT, *supra* note 38, at 49.
[637] *See, e.g.*, Baker, *supra* note 46, at 6; Williams & Baker, *supra* note 47, at 718.
[638] Baker, *supra* note 67, at 13, 20; Baker, *supra* note 46, at 6–7, 11, 13, 15, 22, 26; Baker & Williams, *supra* note 96, at 287–88.
[639] Baker, *supra* note 67, at 12–13; Baker & Williams, *supra* note 96, at 287–88.

(2014), and they fail to discuss or cite Williams and Baker (2010), Williams and Baker (2014), Baker (2015), Odion et al. (2016), and Baker and Williams (2018), which provide plausible responses to the criticisms of Baker (2014) and Odion et al. (2014).[640] Failure to consider these responses, published in credible, peer-reviewed journals, renders the criticisms superficial, merely for appearance's sake, and Baker (2014) and Odion et al. (2014) have been dismissed without adequate justification.[641] Miller and Safford (2017), cited in the final EIS and revised draft EIS, seek to corroborate agency claims concerning historic forest structure and fire, and are critical of Baker (2014, 2015) and Odion et al. (2014).[642] Yet without consideration of the published responses to criticisms raised in this study—there is no discussion or citation of Williams and Baker (2014), Odion et al. (2016), Hanson and Odion (2016), and no detailed discussion of Baker (2015)—Miller and Safford (2017) do not provide a thorough, balanced discussion of the literature, and, again, Baker (2014) and Odion et al. (2014) have been unjustifiably dismissed.[643]

As discussed, in accordance with *Lands Council*, the courts may not impose upon the agency which studies it must consider.[644] Yet the courts will insist that, for a full and fair discussion of environmental impacts (a "hard look") under NEPA, the agency take into consideration relevant scientific studies, including, presumably, those that provide plausible responses to agency criticisms of Baker (2014) and Odion et al. (2014).[645] Indeed, if the conclusions of Baker (2014) and Odion et al. (2014) are correct, descriptions in the draft EIS, revised draft EIS, and final EIS of the affected environment are inaccurate—descriptions of historic forests as well as descriptions of current forests as they relate to historic conditions.[646]

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[640] *See* CONSERVATION ASSESSMENT, *supra* note 17, at 127–29; INYO FINAL EIS, *supra* note 3, at 168; NRV TECHNICAL REPORT, *supra* note 38, at 48–50; REVISED DRAFT EIS, *supra* note 4, at 172. *See generally* Baker, *supra* note 46; Baker, *supra* note 67; Baker & Williams, *supra* note 96; Odion et al., *supra* note 132; Williams & Baker, *supra* note 87; Williams & Baker, *supra* note 47.

[641] *See* CONSERVATION ASSESSMENT, *supra* note 17, at 127–29; INYO FINAL EIS, *supra* note 3, at 168; NRV TECHNICAL REPORT, *supra* note 38, at 48–50; REVISED DRAFT EIS, *supra* note 4, at 172.

[642] *See* Miller & Safford, *supra* note 150, at 74–80.

[643] *See id. See generally* Baker, *supra* note 67; Hanson & Odion, *supra* note 10; Odion et al., *supra* note 132; Williams & Baker, *supra* note 87.

[644] Lands Council v. McNair, 537 F.3d 981, 992–95 (9th Cir. 2008).

[645] *Id.* at 1000. According to the Ninth Circuit in *Lands Council*, "NEPA aims to make certain . . . 'that the relevant information will be made available to the larger [public] audience.'" *Id.* (quoting Earth Island Inst. v. U.S. Forest Serv., 490 U.S. 332, 349 (1989)). *See also* Earth Island Inst. v. U.S. Forest Serv., 442 F.3d 1147, 1173 (9th Cir. 2006).

[646] *See* DRAFT EIS, *supra* note 2, at 58–68, 86–95, 133–61, 204–22; INYO FINAL EIS, *supra*

Proposed forest treatments will take current forests further from historic conditions, contrary to claims in the draft EIS and other NEPA documents.[647] Hanson and Odion (2016) plausibly argue that proposed treatments will result in novel, overly homogeneous forests, which will place at increased risk spotted owls and Pacific fishers (*Pekania pennanti*).[648] This problem of creating novel, overly homogeneous forests to which native species are not adapted is not discussed within these NEPA documents.[649] In the final EIS, Hanson and Odion (2016) is dismissed without adequate justification; other documents involved in plan revision do not consider or cite this study.[650]

Dismissing as inapplicable Baker (2014) and Odion et al. (2014), without consideration of published responses to the criticisms of these studies, and failure to consider Hanson and Odion (2016) and other relevant studies, constitutes failure to provide a full and fair discussion of the environmental impacts of the proposed management plans (a "hard look"), in violation of NEPA regulations.[651] Discussions within the draft EIS, revised draft EIS, final EIS, and other documents involved in plan revision lack professional and scientific integrity.[652] Surely, professional and scientific integrity in the discussions of impacts implies broad consideration of the relevant literature, including studies that reflect diverse points of view, each study considered fully and in an unbiased manner in an effort to arrive at an accurate understanding of the issues. With respect to the standard of judicial review articulated in *Lands Council* and other Ninth Circuit decisions, within the draft EIS, revised draft EIS, final EIS, Conservation Assessment, and other documents involved in plan revision, relevant factors have been overlooked and, generally, there are clear errors of judgment in the use of scientific information.[653]

Another major difficulty faced by the Forest Service is failure to acknowledge flaws and limitations of those studies it relies on for its claims concerning historic forest structure and fire regimes, and the impacts of

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note 3, at 81–91, 110–20, 160–82, 205–20; REVISED DRAFT EIS, *supra* note 4, at 72–73, 78, 112–15, 167–82, 188, 204–25, 236–40, 250–82, 470–71.

[647] *See, e.g.*, DRAFT EIS, *supra* note 2, at 34, 72–73, 76–78, 82, 84–85, 133–34, 137, 142, 161–62, 166, 198; INYO FINAL EIS, *supra* note 3, at 105, 108, 132, 160–63, 168, 181–83.

[648] Hanson & Odion, *supra* note 10, at 17–18.

[649] *See generally* DRAFT EIS, *supra* note 2; INYO FINAL EIS, *supra* note 3.

[650] CONSERVATION ASSESSMENT, *supra* note 17, at 127–29; CONSERVATION STRATEGY, *supra* note 213, at 17–18; INYO FINAL EIS, *supra* note 3, at 168; NRV TECHNICAL REPORT, *supra* note 38, at 48–50; Miller & Safford, *supra* note 150, at 74–80; *see also supra* Part I.

[651] 40 C.F.R. § 1502.1 (1987).

[652] *Id.* § 1502.24.

[653] *See* Lands Council v. McNair, 537 F.3d 981 (9th Cir. 2008).

high-severity fire on spotted owls. Agency documents rely heavily on Collins et al. (2011, 2015), Hagmann et al. (2013, 2014), Stephens et al. (2015), and other studies of historic forest structure and fire.[654] Yet there is no detailed consideration of Baker (2015), and Hanson and Odion (2016), which provide plausible criticisms of the methodology used in these timber-inventory studies.[655] Alleged difficulties include analyzing only a relatively small number of unrepresentative plots, and then extrapolating the results to entire landscapes.[656] Miller and Safford (2017) (cited within the final EIS and revised draft EIS) rely upon these timber-inventory studies to corroborate agency claims and to criticize Baker (2014, 2015), but do not consider the problems of methodology discussed in Baker (2015) and Hanson and Odion (2016).[657] Within the draft EIS and other NEPA documents, the agency's descriptions of historic forest structure and fire severity rest upon studies (Collins et al. (2011, 2015), Stephens et al. (2015), etc.) that are problematic and may not be generally applicable to Sierra Nevada forests.[658]

Agency documents rely heavily on Jones et al. (2016a), without discussion of the problems facing this study.[659] Jones et al. (2016a) write, "Our study demonstrates that increasingly frequent megafires pose a threat to spotted owls and likely other old-forest species . . . ," yet, as discussed, DellaSala et al. (2017) point out that the spotted owl territories examined in this study were likely subjected to pre- and post-fire

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[654] *See* CONSERVATION ASSESSMENT, *supra* note 17, at 127–29, 272; CONSERVATION STRATEGY, *supra* note 213, at 17–18; DRAFT EIS, *supra* note 2, at 137, 150, 318; INYO FINAL EIS, *supra* note 3, at 172–73, 334; NRV TECHNICAL REPORT, *supra* note 38, at 49, 98–99, 107; REVISED DRAFT EIS, *supra* note 4, at 167, 179–80, 461. For references for the Collins, Hagmann, and Stephens studies, *see* NRV TECHNICAL REPORT, *supra* note 38, at 187, 193, 213.

[655] *See* CONSERVATION ASSESSMENT, *supra* note 17, at 127–29, 272; CONSERVATION STRATEGY, *supra* note 213, at 17–18; DRAFT EIS, *supra* note 2, at 137, 150, 318; INYO FINAL EIS, *supra* note 3, at 172–73, 334; NRV TECHNICAL REPORT, *supra* note 38, at 49, 98–99, 107; REVISED DRAFT EIS, *supra* note 4, at 167, 179–80, 461. *See generally* Baker, *supra* note 67; Hanson & Odion, *supra* note 10.

[656] Hanson & Odion, *supra* note 10, at 16.

[657] Miller & Safford, *supra* note 150, at 74–80. This study does not discuss or cite Hanson and Odion (2016). *Id.* As discussed, the revised draft EIS for Sequoia and Sierra forests dismisses Baker (2014), Odion et al. (2014), and other studies ("serious analytical and methodological issues," etc.) citing, among other studies, Collins et al. (2011, 2015) and Stephens et al. (2015). REVISED DRAFT EIS, *supra* note 4, at 172. Yet, within this revised draft EIS, there is no discussion or citation of Baker (2015), Hanson and Odion (2016), or Baker & Hanson (2017). *See id. See generally* Baker & Hanson, *supra* note 180.

[658] *See* Baker, *supra* note 67, at 12–13; Baker & Hanson, *supra* note 180, at 13; Hanson & Odion, *supra* note 10, at 15.

[659] CONSERVATION ASSESSMENT, *supra* note 17, at 27, 267; CONSERVATION STRATEGY, *supra* note 213, at 10–11, 18; REVISED DRAFT EIS, *supra* note 4, at 470.

logging.[660] Jones and others acknowledge that forests within their study area "have a complex history of management, logging, and fire suppression dating back at least 100 years."[661] Indeed, according to Hanson et al. (2018), examining Forest Service survey data, a number of territories in the study area reported as abandoned had not been occupied pre-fire.[662] As discussed, for several reasons, the data reported in Jones et al. (2016a) do not justify the conclusion that high-severity fire results in increased territory abandonment and population loss.[663] The revised draft EIS, Conservation Strategy, and other agency documents fail to discuss the difficulties with this study; they fail to discuss or cite DellaSala et al. (2017), and Hanson et al. (2018) has been dismissed without adequate justification.[664]

The Forest Service also relies on Clark (2007), Clark et al. (2011), Lee et al. (2013), Tempel et al. (2014), Stephens et al. (2016), Rockweit et al. (2017), and other studies, without acknowledging the limitations of these studies, even those readily acknowledged by the authors.[665] For example, for reasons articulated in Lee et al. (2013), the results of this study of spotted owls in the more sparsely vegetated mountains of southern California may not be applicable to spotted owls in the Sierra Nevada.[666] Tempel et al. (2014) is problematic, since, allegedly, salvage logging occurred in their study areas.[667] Similarly, Rockweit et al. (2017) is problematic due to prior logging within their study areas.[668]

Failure to discuss the flaws and limitations of those studies relied upon for the descriptions of historic forest conditions, and the impacts of high-severity fire on spotted owls, and failure to adequately consider those studies in the literature that discuss the alleged difficulties (for example,

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[660] *See* Jones et al., *supra* note 232, at 305; DellaSala et al., *supra* note 236, at 159.
[661] Jones et al., *supra* note 232, at 301.
[662] Hanson et al., *supra* note 27, at 101.
[663] *See supra* Part II.
[664] *See* CONSERVATION ASSESSMENT, *supra* note 17, at 27, 267; CONSERVATION STRATEGY, *supra* note 213, at 10–11, 18; REVISED DRAFT EIS, *supra* note 4, at 470. The revised draft EIS dismisses Hanson et al. (2018) from consideration, citing Peery et al. (2019). *See* REVISED DRAFT EIS, *supra* note 4, at 172–73. *See generally* Peery et al., *supra* note 252. Yet the revised draft EIS fails to discuss or cite Bond et al. (2019), which provides a plausible response to Peery et al. (2019). REVISED DRAFT EIS, *supra* note 4, at 172–73. *See generally* Bond et al., *supra* note 252.
[665] *See* CONSERVATION STRATEGY, *supra* note 213, at 10–11, 18; DRAFT EIS, *supra* note 2, at 336–37. *See generally* Clark et al., *supra* note 225; Clark, *supra* note 225; Lee et al., *supra* note 280; Rockweit et al., *supra* note 300; Stephens et al., *supra* note 253; Tempel et al., *supra* note 269.
[666] Lee et al., *supra* note 280, at 1335–37, 1339.
[667] Hanson et al., *supra* note 27, at 101–02; Lee & Bond, *supra* note 13, at 234.
[668] *See* Franklin et al., *supra* note 305, at 580; Rockweit et al., *supra* note 300, at 1580.

Hanson and Odion (2016), Hanson et al. (2018)), constitutes failure to provide a full and fair discussion of the impacts of the proposed management plans.[669] Discussions within the draft EIS, revised draft EIS, final EIS, and other documents involved in plan revision lack professional and scientific integrity.[670] Descriptions within the draft EIS and other NEPA documents of current and historic forest conditions, and the effects of high-severity fire on spotted owls, may be inaccurate.[671]

Agency documents fail to adequately consider Lee and Bond (2015).[672] As discussed, this study is used to support only modest claims, for example, that spotted owls persist in territories that have burned at high severity.[673] As illustrated in *Center for Biological Diversity*, the courts will allow the agency to use a study in this way, to support only modest claims, while setting aside the conclusions of the study as of limited applicability for reasons such as small sample size.[674] As in this case and in *Lands Council*, the courts will defer to the agency in its interpretations of the results of cited studies.[675] Indeed, agency documents provide criticisms of Lee and Bond (2015), for example, the study involves an analysis of data collected during only one breeding season, the year following the Rim Fire, and for this, and other reasons, "caution is advisable."[676]

Yet, as discussed, studies relied upon by the agency concerning the impacts of high-severity fire on spotted owls (for example, Clark (2007), Jones et al. (2016a), Tempel (2014)) are flawed or limited in applicability. Within the draft EIS, revised draft EIS, and other agency documents, claims concerning the impacts of high-severity fire on spotted owls ("[l]arge, high-severity fires . . . are a major threat to the California spotted owl," etc.) are not well supported by the cited studies.[677] Within the current

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[669] 40 C.F.R. § 1502.1 (1987).
[670] *Id.* § 1502.24.
[671] DRAFT EIS, *supra* note 2, at 58–68, 86–95, 133–61, 204–22; INYO FINAL EIS, *supra* note 3, at 81–91, 110–20, 160–82, 205–20; REVISED DRAFT EIS, *supra* note 4, at 72–73, 78, 112–15, 167–82, 188, 204–25, 236–40, 250–82, 470–71.
[672] *See* CONSERVATION ASSESSMENT, *supra* note 17, at 27, 202; CONSERVATION STRATEGY, *supra* note 213, at 10–11; DRAFT EIS, *supra* note 2, at 337. *See generally* Lee & Bond, *supra* note 13.
[673] *See* CONSERVATION ASSESSMENT, *supra* note 17, at 27, 202; *see also* CONSERVATION STRATEGY, *supra* note 213, at 11.
[674] Ctr. Biological Diversity v. Skalski, 61 F. Supp. 3d 945, 957 (E.D. Ca. 2014).
[675] *See id.*; Lands Council v. McNair, 537 F.3d 981, 995 (9th Cir. 2008).
[676] CONSERVATION ASSESSMENT, *supra* note 17, at 285; *see also* Peery et al., *supra* note 252, at S1–S2.
[677] *See* CONSERVATION ASSESSMENT, *supra* note 17, at 60; CONSERVATION STRATEGY, *supra* note 213, at 10, 18; DRAFT EIS, *supra* note 2, at 336; REVISED DRAFT EIS, *supra* note 4, at 463, 470; *see also supra* Part II.

literature, Lee and Bond (2015) assumes great importance in understanding the effects of high-severity fire on spotted owls, and the conclusions of this study—spotted owls continue to use territories burned at high severity, with up to 70 percent habitat loss; data suggests that such fire generally has no impact on the owls—cannot reasonably be set aside.[678] Again, without an adequate discussion of this study, claims concerning the possible existence of a critical spatial threshold for high-severity fire are misleading.[679]

Ganey et al. (2017) review the literature concerning the effects of high-severity fire on spotted owls, and they reach moderate conclusions.[680] "Based on the existing literature," Ganey and others write, "we argue that considerable uncertainty remains regarding the response of spotted owls to high-severity wildfire, especially over longer time frames . . . ."[681] They add, "[A]vailable data suggests considerable variation in responses of owls to wildfire."[682] According to Peery et al. (2019), "[I]t is not unreasonable to expect that varying spatial patterns of severe fire might affect spotted owls differently . . . ."[683] They add, "[M]uch remains to be learned about wildfire effects on spotted owls and additional study is warranted."[684] These studies do not support agency claims concerning the dire effects of high-severity fire on spotted owls, and although these studies are cited within the revised draft EIS and other agency documents, they are not considered in a fair and balanced way.[685]

Failure to adequately support claims within the draft EIS, revised draft EIS, and other agency documents concerning the threat of high-severity fire on spotted owls, and failure to adequately consider Lee and Bond (2015) and other studies that call into question such claims, constitutes failure to provide a full and fair discussion of the impacts of the proposed management plans, in violation of NEPA regulations.[686] Indeed, a number of relevant works are not discussed or cited within agency

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[678] *See* Lee & Bond, *supra* note 13, at 228, 233–34.
[679] CONSERVATION ASSESSMENT, *supra* note 17, at 64–65, 202; DRAFT EIS, *supra* note 2, at 338.
[680] Ganey et al., *supra* note 310, at 147, 149, 156.
[681] *Id.* at 147.
[682] *Id.* at 149.
[683] Peery et al., *supra* note 252, at S1.
[684] *Id.* at S2.
[685] CONSERVATION STRATEGY, *supra* note 213, at 7, 10, 35; REVISED DRAFT EIS, *supra* note 4, at 172–73, 470. The moderate conclusions expressed in Ganey et al. (2017) and Peery et al. (2019) are based, in part, on Jones et al. (2016a), with no discussion of the difficulties facing this study. *See* Ganey et al., *supra* note 310, at 151; Peery et al., *supra* note 252, at S1.
[686] *See* 40 C.F.R. § 1502.1 (1987); REVISED DRAFT EIS, *supra* note 4, at 470.

documents, including DellaSala and Hanson (2015), Bond (2016), DellaSala et al. (2017), and Lee (2018).[687] Again, descriptions of the affected environment may be inaccurate, and the agency's analysis of the impacts of proposed forest treatments on spotted owls, based on the premise that high-severity fire poses a severe threat, may be inaccurate.[688] Contrary to agency claims, the increased risk to owls resulting from eliminating essential elements of old-growth habitat within their territories may not be offset by reducing the risk to owls of high-severity fire.[689]

Within agency documents, a recurring general problem is that a cited study does not actually support the claim it appears to support. For example, Roberts et al. (2011) is cited in support of the claim: "[l]arge, high-severity patches are linked to decreases in spotted owl occupancy, colonization, and habitat use."[690] Yet, according to this study, fire of varying severities, including high-severity, did not affect territory occupancy.[691] The Conservation Strategy asserts that spotted owls "use mixed-severity fire areas dominated by low and moderate severity and generally avoid larger areas of high severity," citing, among other studies, Lee et al. (2012).[692] Yet, as discussed, especially in light of Lee and Bond (2015), Lee et al. (2012) cannot reasonably be cited in support of such a claim.[693] According to the Conservation Strategy, owl selectivity for essential habitat characteristics

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[687] *See generally* DELLASALA & HANSON, *supra* note 29; Bond, *supra* note 262; DellaSala et al., *supra* note 236; Lee, *supra* note 328.

[688] *See, e.g.*, CONSERVATION STRATEGY, *supra* note 213, at 11–12.

[689] *Id.* It should be mentioned that Lee and Bond (2015) is briefly discussed within Ganey et al. (2017) and Peery et al. (2019), yet these discussions, especially in Peery et al. (2019), do not provide adequate details of the Lee and Bond study. See Ganey et al., *supra* note 310, at 151; Peery et al., *supra* note 252, at S1–S2. Moreover, Ganey et al. (2017) and Peery et al. (2019) are not accurately represented within agency documents, and there is no indication that the results and conclusions of Lee and Bond (2015) have been considered in plan revision. *See* CONSERVATION STRATEGY, *supra* note 213, at 10; REVISED DRAFT EIS, *supra* note 4, at 172–73, 470. This is true, as well, for Bond (2016), which is briefly discussed in Ganey et al. (2017), but there is no indication this Bond article has been considered in plan revision. *See* REVISED DRAFT EIS, *supra* note 4, at 470; Ganey et al., *supra* note 310, at 153–54. Presumably, Lee (2018) is one of the studies dismissed from consideration, citing Peery et al. (2019). *See* REVISED DRAFT EIS, *supra* note 4, at 172–73. Yet Bond et al. (2019), which provides a plausible response, is not considered or cited within agency documents. REVISED DRAFT EIS, *supra* note 4, at 172–73; Bond et al., *supra* note 252, at 9–12.

[690] *See* CONSERVATION STRATEGY, *supra* note 213, at 10; *see also* CONSERVATION ASSESSMENT, *supra* note 17, at 60. *See generally* Roberts et al., *supra* note 265.

[691] *See* Roberts et al., *supra* note 265, at 610, 616–17.

[692] CONSERVATION STRATEGY, *supra* note 213, at 18. *See generally* Lee et al., *supra* note 209.

[693] Lee et al., *supra* note 209, at 800; Lee & Bond, *supra* note 13, at 228, 233–34.

(tall trees, high canopy cover) is greatest within approximately ten acres of the nest.[694] Yet the cited study, North et al. (2017), suggests, rather, that habitat selectivity for these features extends to approximately PAC boundaries, and perhaps beyond.[695] As in these examples, numerous citations throughout agency documents are ineffective for reasons of misrepresentation, unacknowledged flaws or limitations, questionable relevance, or simply lack of support.

Major difficulties within the draft EIS, revised draft EIS, final EIS, and other documents involved in plan revision include, then, failure to consider or cite relevant studies, failure to acknowledge flaws and limitations in studies cited in support of agency claims, failure to adequately support claims concerning the impacts of high-severity fire on spotted owls, failure to adequately consider Lee and Bond (2015) and other cited studies, and use of numerous citations that are (for various reasons) ineffective. With respect to the standard of judicial review articulated in *Lands Council* and other Ninth Circuit decisions, it is fair to state that within the draft EIS, final EIS, and other documents involved in plan revision, relevant factors have been overlooked in descriptions of the affected environment and in the analyses of impacts, and, generally, there are clear errors of judgment in the use of scientific information.[696]

Finally, within the final EIS for Inyo forest plan revision, and the revised draft EIS for Sequoia and Sierra forests plan revision, the Forest Service has attempted to set up a "battle of the experts," with studies by Baker, Odion, Hanson, and others explicitly set against those by Levine, Fulé, Stevens, Safford, and others.[697] The agency will claim discretion to choose those studies authored by its own scientists and favored experts. As discussed, in a "battle of the experts" the courts are not to take sides, attempting to second-guess the agency's position with respect to conflicting published studies.[698] Yet the courts will insist that the agency provide a thorough and well-reasoned explanation for why it sides with its own experts and discounts opposing studies.[699] As stated in a previous Ninth Circuit opinion, "Nor will we 'take sides in a battle of the experts,' as the

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[694] *See* CONSERVATION STRATEGY, *supra* note 213, at 6, 9.
[695] *See* North et al., *supra* note 413, at 171–75. North and others write, for example, "selection for tall trees may continue beyond the bounds of the PAC." *Id.* at 171.
[696] *See* Lands Council v. McNair, 537 F.3d 981, 987 (9th Cir. 2008).
[697] *See* INYO FINAL EIS, *supra* note 3, at 168; *see also* REVISED DRAFT EIS, *supra* note 4, at 172–73.
[698] Ctr. for Biological Diversity v. Skalski, 61 F. Supp. 3d at 956, 958 (E.D. Ca. 2014).
[699] *See id.* at 958.

Forest Service . . . provided a thorough and reasoned explanation for its rejection of [the opposing] position."[700]

The final EIS and revised draft EIS do not provide "a thorough and reasoned explanation" for dismissing the opposing position.[701] One problem is that the listed reasons for dismissal are vague and superficial.[702] The agency should explain in adequate detail, for example, the "serious analytical and methodological issues" facing Baker (2014) and the other rejected studies.[703] Why claim that these studies suffer from "unreasonable inferences and inappropriate conclusions drawn"?[704] A list of vague reasons, with cited studies, does not constitute a "thorough and reasoned explanation" for dismissing the opposing science.[705]

Another problem is that the final EIS, revised draft EIS, and other documents involved in plan revision fail to consider or cite the published responses to the criticisms of Baker (2014) and Odion et al. (2014) presented in Levine et al. (2017), Stevens et al. (2016), Fulé et al. (2014), and Miller and Safford (2017).[706] Within the final EIS, and other documents involved in plan revision, there is no discussion of the plausible responses provided in Baker and Williams (2018), Odion et al. (2016), and Williams and Baker (2014); indeed, these studies are not cited.[707] And although Collins (2011, 2015), Stephens et al. (2015), and other timber-inventory studies are cited in criticism of Baker, Odion, Hanson, and others, there is no consideration of the alleged problems in the methodology of such studies, as discussed in Baker (2015), and Hanson and Odion (2016).[708] This constitutes failure to provide a "thorough and reasoned explanation" for dismissing the opposing science.[709] The final EIS, and

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[700] *Id.* (quoting Native Ecosystems Council v. U.S. Forest Serv., 428 F.3d 1233, 1244 (9th Cir. 2005)).
[701] *See* INYO FINAL EIS, *supra* note 3, at 168.
[702] *See id.*
[703] *See id.*
[704] *Id.*
[705] *Id.*
[706] *See id.* at 168; REVISED DRAFT EIS, *supra* note 4, at 172–73; NRV TECHNICAL REPORT, *supra* note 38, at 48–50; Miller & Safford, *supra* note 150, at 77–80. *See also* Fulé et al., *supra* note 82. *See generally* Levine et al., *supra* note 90; Stevens et al., *supra* note 125.
[707] *See* INYO FINAL EIS, *supra* note 3, at 168; NRV TECHNICAL REPORT, *supra* note 38, at 48–50; REVISED DRAFT EIS, *supra* note 4, at 172–73; Miller & Safford, *supra* note 150, at 77–80. *See generally* Baker & Williams, *supra* note 96; Odion et al., *supra* note 132; Williams & Baker, *supra* note 87.
[708] *See* INYO FINAL EIS, *supra* note 3, at 168; NRV TECHNICAL REPORT, *supra* note 38, at 48–50; REVISED DRAFT EIS, *supra* note 4, at 172–73; Miller & Safford, *supra* note 150, at 77–80. *See generally* Baker, *supra* note 67; Hanson & Odion, *supra* note 10.
[709] Ctr. for Biological Diversity v. Skalksi, 61 F. Supp. 3d 945, 958 (E.D. Ca. 2014).

revised draft EIS, do not present a "battle of the experts" that meets the standard articulated in *Center for Biological Diversity* and other Ninth Circuit opinions, and the courts are under no obligation to defer to agency judgment concerning which studies are to be considered and which are to be rejected.[710] On the contrary, the courts are required to conduct a "searching and careful" review of the agency's use of scientific information.[711]

CONCLUSION

Philosopher Paul Feyerabend defends pluralism in science, arguing that scientists make more efficient progress by investigating and developing theories that are alternative to currently accepted theories.[712] Feyerabend points out, for example, that an accepted theory may be shown false by data uncovered as scientists develop and test an alternative theory.[713] Scientists should investigate and develop a proliferation of genuinely alternative theories, he claims.[714] "It often happens," he writes, "that parts of science become hardened and intolerant . . . ," dogmatically accepting certain theories without a fair consideration of alternatives.[715] According to Feyerabend, "[K]nowledge is obtained from a multiplicity of views rather than from the determined application of a preferred ideology."[716]

Applying Feyerabend's thought to the context of management plan revision in the Sierra Nevada, the proper course of action to take with respect to forest treatments is best determined "from a multiplicity of views rather than from the determined application of a preferred ideology."[717] The agency's NRV Technical Report briefly discusses and dismisses the "alternative viewpoint" of historic forest structure and fire proposed by "a small school of researchers and environmentalists," failing to consider published responses to the criticisms offered of Baker (2014) and Odion et al. (2014).[718] According to the Conservation Assessment, "[a] few recent studies . . . challenge the prevailing understanding . . . ," and Baker

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[710] *See, e.g.*, *id.* at 956, 958.
[711] *See* Lands Council v. McNair, 537 F.3d 981, 987 (9th Cir. 2008); Earth Island Inst. v. U.S. Forest Serv., 442 F.3d 1147, 1160 (9th Cir. 2006); *see also* Weldon & Patterson, *supra* note 510, at 84.
[712] *See* PAUL FEYERABEND, AGAINST METHOD 24–25 (4th ed. 2010).
[713] *See id.* at 13–25.
[714] *See id.* at 25, 31–32.
[715] *Id.* at 31.
[716] *Id.* at 32. "Variety of opinion is necessary for objective knowledge," he also writes. *Id.* at 25.
[717] FEYERABEND, *supra* note 712, at 32.
[718] NRV TECHNICAL REPORT, *supra* note 38, at 48–50.

(2014) and Odion et al. (2014) are dismissed without considering the published responses to criticisms and the evident strength of these studies.[719]

At stake, of course, is maintaining viable populations of California spotted owls and other native species. Experts express concern over the "biodiversity crisis" we face in the world today.[720] We should expect that the problems of conserving native species in the context of human population growth, economic development, worsening pollution, climate change, etc. are intractable enough that no one ideology will be sufficient to address them successfully. Consistent with Feyerabend's philosophy, the proper course of action in the Sierra Nevada is best determined by a fair and balanced consideration of alternative points of view, even those that have been labeled "environmentalist" or "radical preservationist."[721] As Feyerabend claims, within society each ideology needs other ideologies.[722]

It may be true, as Baker, Odion, Hanson, and others argue, that historic Sierra Nevada forests were highly heterogeneous, consisting in some areas of relatively open, park-like forests, and in other areas of dense forests with much undergrowth, numerically dominated by smaller trees.[723] As reported by Baker (2014), observers of historic Sierra Nevada forests recorded such highly diverse forest structures.[724] It may be true, as shown in reconstruction studies, that high-severity fire made up a substantial proportion of historic fire, which would explain the high coarse-grained heterogeneity observed in these forests.[725] It may also be true, as argued by Lee, Bond, and others, that spotted owls are adapted to the occurrence of high-severity fire, and are generally unaffected by large patches of such fire as long as pre- and post-fire habitat remain of high quality.[726]

NEPA regulations provide the means to ensure that the Forest Service considers relevant studies and alternative points of view within an EIS, and it is up to citizen organizations and the courts to compel the agency to meet its information obligations under NEPA.[727] Legal scholars have emphasized that, under the standard of judicial review required under APA, the courts must adopt a highly deferential approach; according

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[719] CONSERVATION ASSESSMENT, *supra* note 17, at 127–29.
[720] *See, e.g.*, MICHAEL J. NOVACEK, THE BIODIVERSITY CRISIS: LOSING WHAT COUNTS (2001).
[721] NRV TECHNICAL REPORT, *supra* note 38, at 48.
[722] *See* Paul Feyerabend, *How to Defend Society Against Science*, 11 RADICAL PHIL. 3, 7 (1975).
[723] *See, e.g.*, Baker, *supra* note 46, at 1, 22–24; Odion et al., *supra* note 27, at 10–11.
[724] Baker, *supra* note 46, at 2–3.
[725] *See, e.g.*, *id.* at 25–26.
[726] *See* Bond, *supra* note 262, at 10; Lee et al., *supra* note 280, at 1335–37, 1339; Lee & Bond, *supra* note 13, at 228, 233–34.
[727] *See* 40 C.F.R. §§ 1500–1508 (1987), especially § 1500.1(b), § 1502.1, § 1502.15, § 1502.24.

to some scholars, the agency is effectively free from constraints in its use of scientific information.[728] Yet agency discretion is limited. Courts are to conduct a "searching and careful" review of the Forest Service's use of science to ensure that relevant factors have not been overlooked and that, in general, there have been no clear errors of judgment.[729] The agency must consider relevant studies, explain why its evidence is reliable, explain why it favors its own experts, etc.[730] In accordance with NEPA regulations, and the standard of judicial review required under APA, the agency must bring to bear the best available scientific information in plan revision, regardless of how well this fits with traditional agency beliefs and proposed actions.[731]

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[728] *See* Weldon & Patterson, *supra* note 510, at 55, 83–84; *see also* Clark, *supra* note 494, at 342–43.
[729] *See* Lands Council v. McNair, 537 F.3d 981,992 (9th Cir. 2008); *see also* Weldon & Patterson, *supra* note 510, at 84.
[730] *See, e.g.*, 537 F.3d at 994–99, 1000; Earth Island Inst. v. U.S. Forest Serv., 442 F.3d 1147, 1173 (9th Cir. 2006); Ctr. for Biological Diversity v. Skalski, 61 F. Supp. 3d 945, 958 (E.D. Ca. 2014).
[731] *See* 40 C.F.R. §§ 1500.1(b), 1502.1, 1502.15, 1502.24 (1987); *see also, e.g.*, 61 F. Supp. 3d at 958; 537 F.3d at 994–99, 1000; 442 F.3d at 1173.