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May 12, 2022

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Santa Fe, NM 87508

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Submitted electronically via objections-southwestern-regional-office@usda.gov

RE: OBJECTION TO THE SANTA FE MOUNTAINS LANDSCAPE RESILIENCY PROJECT DECISION NOTICE AND FINDING OF NO SIGNIFICANT IMPACT

Dear Ms. Cress and Ms. Imler-Jacquez:

Defenders of Wildlife ("Defenders") is filing an official objection to the **Draft Decision Notice and Finding of No Significant Impact ("FONSI")** for the Santa Fe Mountains Landscape Resiliency Project ("Project"), located in the Las Vegas and Espanola Ranger Districts in the Santa Fe National Forest. On October 29, 2021, Defenders submitted comments on the Project's Environmental Assessment ("EA"), and those comments support our objection points which are incorporated here in full.

The following objection is submitted on behalf of Defenders. Defenders is a national, nonprofit membership organization dedicated to the protection of all native animals and plants in their natural communities. Defenders is committed to protecting wild lands and wildlife in New Mexico and has 22,328 members and supporters in New Mexico and our Southwest Program headquarters office is in Santa Fe, NM.

We would like to thank the Forest Service for its dedication to improving ecosystem resilience in the Santa Fe National Forest. Defenders supports efforts to restore the natural ecosystem process if done in a manner that does not negatively affect sensitive and imperiled species, water quality, human health and other valuable resources. We recognize and appreciate the harm that uncharacteristic wildfire can cause to forest ecosystems, public safety, wildlife, and human infrastructure, economic interests, and support science-based management of forests to reduce undesirable hazards.

However, we object to the Draft Decision Notice and FONSI for the Project and the accompanying EA. First, given the size and scope of the Project and the significant impacts it will have on the forest, wildlife, and the quality of the human environment, the EA was not a legally adequate analysis of the impacts. Thus,

to comply with the National Environmental Policy Act ("NEPA") the Forest Service must prepare an Environmental Impact Statement ("EIS") before proceeding with the Project.

Second, a condition-based analysis is inappropriate for this project because it does not provide enough specificity for the Forest Service to determine the effects of the Project nor for the public to meaningfully participate.

Third, the Project fails to include proper protection for canopy-dependent songbirds including the Grace's Warbler (*Setophaga graciae*), Pinyon Jay (*Gymnorhinus cyanocephalus*), and Virginia's Warbler (*Leiothlypis virginiae*).

I. The Forest Service did not provide a full Environmental Impact Statement for the Project as require by NEPA.

NEPA requires all federal agencies to prepare a full EIS if a proposed project is a "major Federal action significantly affecting the human environment."[1] The Council on Environmental Quality interprets "major" to have the same meaning as significantly.[2] To determine if an action is significant "requires consideration of both context and intensity."[3] A context analysis considers the project's effects on "society as a whole (human, national), the affected region, the affected interests, and the locality."[4] An intensity analysis considers the "severity of impact" of the project.[5] The Council on Environmental Quality lists ten factors that inform an intensity analysis:

1. Impacts that may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial.
2. The degree to which the proposed action affects public health or safety.
3. Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.
4. The degree to which the effects on the quality of the human environment are likely to be highly controversial.
5. The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.
6. The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.
7. Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.
8. The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.
9. The degree to which the action may adversely affect an endangered or threatened

[1] 42 U.S.C. § 4332(C).
[2] *Id.* at § 1508.18.
[3] *Id.* at § 1508.27.
[4] *Id.*
[5] *Id.*

species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.

10. Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment. 40 C.F.R 1508.27(b).[6]

For the proposed Project, factors one, two, three, four and five all contribute to the conclusion that an EIS was required. The following describes how each of those factors are met and prove that a full EIS is warranted.

Factor 1 is met because the Project's beneficial and adverse effects are significant due to the extended duration of the project, the intrusiveness of the proposed treatments, and the extensive area of the project. The Project's long duration will be significant with lasting effects on the Project area. The long-term goal of the Project is to "reestablish historic low-intensity fire" to the landscape, which will take multiple treatments spread out over 10 up to 25 years.[7] Thinning treatments are expected to occur over the next 10 years, though the EA states that they could occur for up to 25 years.[8] For both thinned and unthinned areas, the EA predicts that maintenance burning will occur every 5 to 10 years, with no end date.[9] Given the long-term nature of the Project and its purpose to "improve the ecosystem resilience . . . to future disturbances"[10] the impacts will intentionally be significant.

The extensive thinning and prescribed burning proposed will produce significant impacts to the landscape, species, and recreational values of the Project area. Whether the impacts are beneficial or detrimental, the fact that large swaths of forest will be burned, sometimes in fire intolerant communities, will significantly affect the ecological integrity of treatment areas. The Project area covers 50,566 acres, or 5.5% of the combined acreage of the Española and Pecos/Las Vegas Ranger Districts. While there is no size threshold that automatically makes a federal action significant,[11] in this case, the Project's size contributes to a conclusion that it is significant.

Factor 2 is met because the Project's potential to affect public health and safety is significant because the extensive prescribed burning will create smoke that will likely affect air quality in the area and the potential for wildfire in the region. Due to its proximity to Santa Fe and surrounding communities, prescribed burns in the Project area will create smokey conditions in highly populated areas, negatively affecting the health of those subjected to the smoke.

Factor 3 is met because the Project's potential to affect ecologically critical areas for canopy dependent bird species, including the Grace's Warbler, Pinyon Jay, and Virginia's Warbler, is significant as the proposed Project does not provide adequate mitigation measures for the species and habitat, they depend on to thrive. For example, the Pinyon Jay is a rapidly declining species that is sensitive to habitat disturbances.[12] Nesting colonies, which are utilized year after year, are vitally important to the breeding success on Pinyon Jays.

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[6] 40 C.F.R. § 1508.27(b).
[7] UNITED STATES DEP'T OF AGRICULTURE, UNITED STATES FOREST SERV., SANTA FE MOUNTAINS LANDSCAPE RESILIENCY PROJECT: ENVIRONMENTAL ASSESSMENT 1-1 (2022).
[8] *Id.*
[9] *Id.*
[10] *Id.*
[11] *WildEarth Guardians v. Conner*, 920 F.3d 1245, 1261 (10th Cir. 2019).
[12] SCOTT SOMERSHOE ET AL., PARTNERS IN FLIGHT WESTERN WORKING GROUP AND U.S. FISH & WILDLIFE SERV., CONSERVATION STRATEGY FOR THE PINYON JAY (*GYMNORHINUS CYANOCEPHALUS*) (2020).

Pinyon Jay have been shown to abandon nesting colonies due to habitat disturbances.[13] Thus, without adequate mitigation measures, the Project will likely result in disturbance of nesting areas, altered flock behavior, and diminished reproductive success.

Factor 4 is met because the Project's potential effects are likely to be highly controversial. There is scientific evidence that directly contradicts the findings of the EA and the public strongly opposes some of the treatment plans. Even with public support, an action may be "highly controversial" if there is "substantial dispute as to the size, nature, or effect of the action."[14]

Factor 5 is met because the degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks. The Project proposes extensive thinning and prescribed burning in ponderosa pine and xeric mixed conifer forests, with no design features or mitigation measures for Grace's Warbler and other canopy-dependent songbirds. Species experts predict that thinning at the level proposed will detrimentally affect Grace's Warbler populations on the Santa Fe National Forest.[15] Further, even treatments that may have been effective in the past may have unforeseen consequences as climate change alters how ecosystems respond to disturbances.[16]

II. The condition-based approach to land management for the Project does not comply with NEPA because it does not include specificity "to ensure informed decision making and meaningful public participation."

Condition-based management is "a system of management practices based on implementation of specific design elements from a broader Proposed Action, where the design elements vary according to a range of on-the-ground conditions in order to meet intended outcomes."[17] While condition-based management aims to adapt to dynamic ecosystem conditions,[18] in this case, it prevents the public from being able "to identify where th[e] activities will take place in relation to" important resource values in the Project area.[19] Within the Project area, there are a number of bird species that rely on higher canopy cover or are sensitive to thinning including sensitive or threatened bird species—the Mexican Spotted Owl, Northern Goshawk, Pinyon Jay, and Grace's Warbler—for which neither the Forest Service nor the public can adequately determine the potential impacts of the Project because individual treatment locations are undetermined. While the Project includes design features and mitigation measures that address impacts to Mexican spotted owl and Northern Goshawk, there is no such tool for Grace's Warbler or other canopy-dependent songbirds. There is only one design feature for the Pinyon Jay, a management indicator species and at-risk species.

Further, there is no way of determining where treatments may occur within the Project area because the EA only includes "potential vegetation thinning and prescribed fire treatment units."[20] Thus, while the maps presented in the EA *may* represent treatment units, their boundaries are subject to change. By failing to definitively delimit treatment units, the EA fails to provide the public with a meaningful opportunity to

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[13] *Id.*
[14] *Middle Rio Grande Conservancy Dist. v. Norton*, 294 F.3d 1220, 1229 (10th Cir. 2002).
[15] Margaret Darr, Santa Fe County (Oct. 2021, personal communication).
[16] *Id.*
[17] U.S. DEP'T OF AGRICULTURE, *supra* note 7, at 2-1.
[18] *Id.* at 2-2.
[19] *See Southeast Alaska Conservation Council v. United States Forest Serv.*, 443 F. Supp. 3d 995, 1010 (D. Alaska 2020) (holding the Forest Service's EIS inadequate because it did not include site-specific impacts analysis for timber sales on the Tongass National Forest).
[20] U.S. DEP'T OF AGRICULTURE, *supra* note 7, at 2-5.

participate in the NEPA process. Without knowing where within the Project area treatments will occur, neither the public nor the Forest Service can determine if and how treatments will affect sensitive species such as the Grace's Warbler, Pinyon Jay, and Virginia's Warbler. If the treatment units were more specific and definitive, the public could identify where treatments will occur in relation to sensitive species' occupied or essential habitats.

III. The Project does not include design features and mitigation measures for preserving adequate canopy cover for canopy-dependent songbird species including the Grace's Warbler, Pinyon Jay, Virginia's Warbler, and other bird species.

Scientific studies on forest and woodland bird species show bird numbers decline with heavy thinning projects, like the proposed Project. The cause of the decline is significant canopy removal or canopy cover reduction because of heavy thinning. We request that the Final Decision Notice and FONSI include design criteria that would leave canopy cover in all forest treatment closer to 50% to protect forest songbirds and no less than 15% in piñon-juniper woodlands to protect Pinyon Jay.

Responses to heavy thinning vary among bird species. In fact, research conducted in ponderosa pine and dry mixed-conifer forests confirm that forest bird species richness is highest when canopy cover levels remain at the high end of the historical levels as is shown in the figure at the right.[21] Species that respond positively to heavy thinning are brush and open-country species.[22] Species that respond negatively are forest birds.[23] Forests should be managed for forest birds not open shrub and grassland birds.

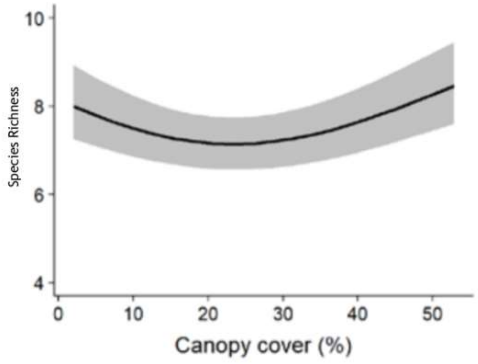

Figure 1. Canopy cover effects on species richness.

Other bird research demonstrates tree removal that does not significantly reduce canopy cover, e.g., small-diameter tree removal can be beneficial to forest and woodland bird species.[24] Similarly, a phased thinning approach where canopy removal is limited can still reduce fuel loads adequately to meet objectives. Grace's Warbler, Pinyon Jay, and Virginia's Warbler are all sensitive to thinning and canopy cover reduction.[25] The figures below illustrate the negative affects overstory removal has on forest and woodland bird species.[26]

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[21] QURESH S. LATIF & DAVID C. PAVLACKY JR., BIRD CONSERVANCY OF THE ROCKIES, AVIAN MULTI-SCALE HABITAT RELATIONSHIPS FOR THE FOUR-FOREST RESTORATION INITIATIVE: FINAL REPORT 20 (2020).
[22] Elizabeth L. Kalies, Carol L. Chambers & W. Wallace Covington, *Wildlife Responses to Thinning and Burning Treatments in Southwestern Conifer Forests: A Meta-Analysis*, 259 ECOLOGY & MGMT. 333 (2010).
[23] *Id.*
[24] *Id.* at 336.
[25] *Id.* at 337; Kris Johnson et al., *Piñon-juniper fuels reduction treatment impacts pinyon jay nesting habitat*, 16 GLOBAL ECOLOGY & CONSERVATION 1, 4–6 (2018).
[26] Kalies et al., *supra* note 22, at 336.

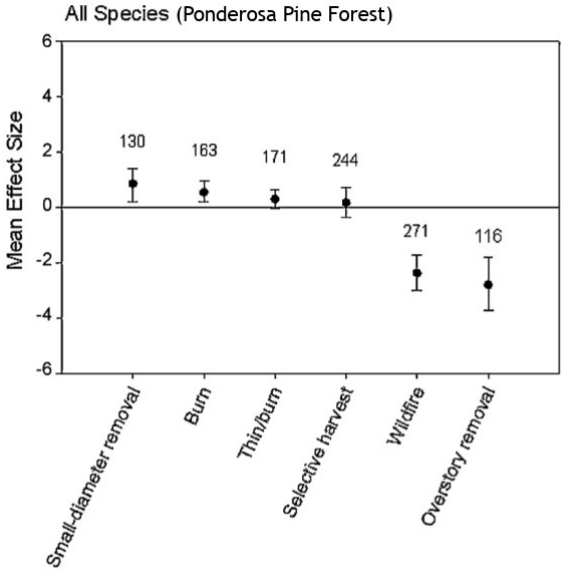

Figure 2. Forest thinning effects on all bird species. Kalies et al., supra *note 22, at 336.*

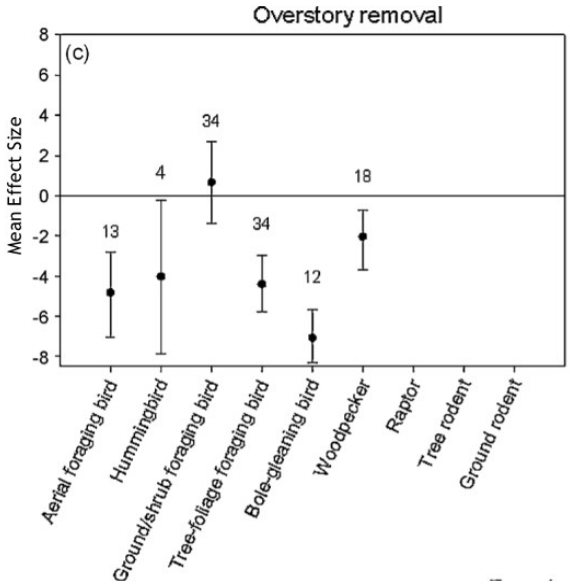

Figure 3. Overstory removal effects on types of bird species. Kalies et al., supra *note 22, at 336.*

Also, diminished forest canopy cover allows for invasion by brown-headed cowbird, a nest parasite that can negatively affect songbird reproduction.[27] The figure on the right demonstrates the parasite's ability to thrive in areas with low canopy cover.[28]

For example, the Grace's Warbler is a ponderosa pine specialist that inhabits ponderosa pine forests in the southwestern United States. In New Mexico, Grace's Warbler arrives in April and begins nesting in May.[29] Breeding territories range from 2-6.5 ha, depending on habitat quality.[30] Individuals build their nests high in ponderosa pine trees (approximately 8-18 m) and hide them in the foliage.[31]

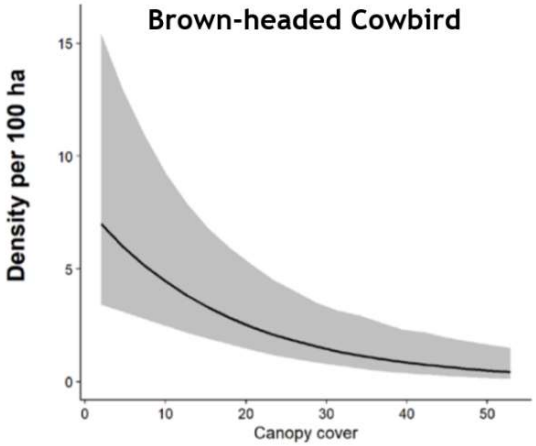

Figure 4. Diminished canopy cover favors brown-headed cowbird. QURESH & PAVLACKY, supra note 21, at 107.

> "Grace's Warbler is primarily a foliage gleaner, feeding on insects and other invertebrates. It mostly forages in the middle and upper portions of conifer canopies, on small branches and needles away from the trunk (Balda 1969, Szaro and Balda 1979, Stacier and Guzy 2002). This foraging ecology suggests canopy cover is important for Grace's Warbler. Two studies support this assumption. Flesch (2014) found that Grace's Warbler density

[27] QURESH & PAVLACKY, *supra* note 21, at 14, 36, 75, 107.
[28] QURESH & PAVLACKY, *supra* note 21**Error! Bookmark not defined.**, at 107.
[29] MARGARET DARR & CHRISTOPHER RUSTAY, GRACE'S WARBLER (*SETOPHAGA GRACIAE*) SPECIES ACCOUNT *in* NEW MEXICO BIRD CONSERVATION PLAN 5 (2021).
[30] *Id.*
[31] *Id.*

> increased with increasing conifer canopy cover, as well as with increasing densities of canopy trees. Kalies and Rosenstock (2013) documented a weak positive Grace's Warbler occupancy response to increasing canopy cover; in this study, canopy cover ranged from 14.9% to 72.5%, with a median of 47.5%, and an average of 47.2%. While canopy cover appears to be important for Grace's Warbler, conifer tree size also appears to be important. One study documented a strong positive Grace's Warbler occupancy response to large ponderosa pine with a diameter at breast height (DBH) greater than 45.7 cm (approximately 18 in; Kalies and Rosenstock (2013). This same study documented a weak positive Grace's Warbler occupancy response to medium-sized ponderosa pine with a DBH of 40.6-45.7 cm (approximately 16-18 in; Kalies and Rosenstock 2013). Another study found Grace's Warbler occurrence was negatively associated with small-diameter ponderosa pine with a DBH of 2.5-8 cm (approximately 1-3 in; Jentsch et al. 2008). Finally, a literature review of silvicultural treatments in the Rocky Mountains (Hejl et al. 1995) suggests Grace's Warbler is associated with old-growth forests (presumably composed primarily of large trees). In addition to trees with a larger DBH, tall trees also appear to be important. Balda (1969) found that Grace's Warblers foraged extensively in ponderosa pine heights between 12 m (39 ft) and 21 m (69ft)."[32]

Studies on the effects of thinning show that Grace's Warbler is negatively affected by moderate to heavy thinning of ponderosa pine forests.[33] While light thinning treatments that aim to restore ponderosa pine forests to their historical range of variability may benefit the species in the short term, the long-term effects are unknown.[34] Prior to European settlement, "ponderosa pine forests in the Southwest historically had approximately 12 to 124 trees per acre, and 10-50% canopy cover."[35] Heavy thinning projects assume remaining trees will grow larger; but it cannot be guaranteed under future climate change conditions. Over the last century, active fire suppression has allowed ponderosa pine forests to grow denser than they were historically.[36] Mild thinning in these stands to return them to their historic range of variability may help improve the overall habitat for Grace's Warbler.

Santa Fe National Forest is home to a core population of Grace's Warbler. Conducting moderate to heavy thinning in ponderosa pine forests within areas inhabited by Grace's Warbler could significantly affect the species as whole. Implementing a phased thinning approach that maintains canopy cover level at the high end of the historical range (~50%) is recommended.[37] This practice can achieve reduced fuel loads in the forest. And to prevent further detrimental effects to Grace's Warbler, project managers should consult with forest bird experts during this process can ensure critical habitat needs are met. Along with continuous monitoring of bird responses to thinning by researchers on the ground.

Another example of a species negatively affected by canopy cover removal and thinning treatments is the Pinyon Jay. An obligate and keystone species of piñon-juniper woodlands and a major piñon pine seed disperser, over 85% of its population has been lost since the 1960's.[38] Threats include loss of significant

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[32] *Id.*
[33] *Id.* at 2, 7.
[34] *Id.* at 2.
[35] *Id.* at 6.
[36] *Id.* at 4.
[37] *Id.* at 10.
[38] John R. Sauer, William A Link & James E. Hines, *The North American Breeding Bird Survey, Results and Analysis 1966 – 2015*, USGS (2015), https://www.mbr-pwrc.usgs.gov/bbs/ (last visited May 12, 2022).

amounts of piñon-juniper habitat due to drought and removal/thinning/chemical treatments of woodlands.[39] Studies show that moderate to heavy piñon-juniper woodland thinning may have negative effects on Pinyon Jay habitat. In its Pinyon Jay Species Account, New Mexico Avian Conservation Partners summarized the scientific literature investigating the effects of thinning on piñon juniper birds.[40]

> "Magee et al. (2019) found that Pinyon Jay occupancy decreased locally in piñon-juniper woodland treated to reduce canopy cover from 36% to 5%. Another study found that Pinyon Jays avoided nesting within parts of a known colony site in persistent piñon-juniper woodland after the colony site was significantly thinned (87% reduction of trees per acre)."[41]

Given the Pinyon Jay's precarious state, we again request the Forest Service proceed with caution in Pinyon Jay nesting habitat. The Project should include species-specific treatment standards and guidelines that protect Pinyon Jay habitat and provide adequate resources for Pinyon Jay colonies. Despite our previous comments, the final EA does not include additional species-specific design features for the Pinyon Jay.

The only design feature for the Project that considers Pinyon Jay, IDF-Wild-13 was not changed between the draft and final EA. This design feature, which states that in piñon-juniper woodlands "treatments would be implemented to promote Pinyon Jay habitat . . . and connectivity," does not provide enough specificity to protect Pinyon Jay nor its nesting and foraging habitat. Further, retaining "[a]t least 15% of mature and over-mature mast-producing stands of pinon-juniper" fails to protect Pinyon Jay nesting sites. Therefore, we again recommend amending the Project to include no treatment buffers around nesting colonies and smaller diameter limits in areas surrounding no-treatment buffers, and retention of minimum of 15-35% canopy cover in thinned patches. Reducing canopy cover below this threshold "may render a site unsuitable for Pinyon Jays for nesting habitat" although Pinyon Jay may still use the area for foraging and caching.[42]

Furthermore, we request that the Forest Service confer with the U.S. Fish and Wildlife Service ("FWS") before finalizing the record of decision. Since the public comment period, which closed in October 2021, Defenders petitioned FWS to list the Pinyon Jay as an endangered species.[43] Conferring with FWS at this early stage would ensure the Project will not jeopardize the continued existence of the Pinyon Jay or any potential critical habitat within the Project boundaries.

Habitat treatments such as thinning and prescribed burning affect Pinyon Jay nesting behavior. One study of a site in New Mexico found that Pinyon Jays abandoned a traditional colony site after habitat treatment was implemented within the boundaries of the site.[44] Although the treatment left "trees of suitable size for nesting," the Pinyon Jays "appeared to avoid placing nests within treated areas."[45] The Project's EA did not analyze whether habitat treatments in existing Pinyon Jay nesting habitat will affect Pinyon Jay survival and

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[39] Defenders of Wildlife, Petition to List the Pinyon Jay (*Gymnorhinus cyanocephalus*) as Endangered or Threatened Under the Endangered Species Act, at i–ii (Apr. 25, 2022).
[40] KRISTINE JOHNSON, MARGARET (PEGGY) DARR, & CHRISTOPHER RUSTAY, NEW MEXICO AVIAN CONSERVATION PARTNERS, PINYON JAY (*GYMNORHINUS CYANOCEPHALUS*) SPECIES ACCOUNT *in* NEW MEXICO BIRD CONSERVATION PLAN (2020).
[41] *Id.*
[42] SOMERSHOE ET AL., *supra* note 12, at 44.
[43] Defenders, *supra* note 39.
[44] Johnson et al., *supra* note 25.
[45] *Id.* at 5.

reproduction. The Project's EA mixed the effects on nesting habitat with effects on individual Pinyon Jays. While the EA claimed treatments would not affect individual Pinyon Jays, the scientific literature does not support this conclusion. In fact, "[v]ery little is known about how sensitive Pinyon Jays are to physical disturbances associated with management."[46] Additionally, very little is known about what influences colony and nest site locations. While the active disturbance associated with habitat treatments may be "temporary and minor" from a human perspective, it may have lasting effects on the area's suitability for Pinyon Jays. Thus, the EA's conclusion that vegetation treatments in Pinyon Jay nesting habitat will not affect individual Pinyon Jays nor their nesting habitat is not supported by the scientific literature.

Other birds negatively affected by removal of mature piñon-juniper include piñon-juniper obligates like Juniper Titmouse (*Baeolophus ridgwayi*) and Gray Vireo (*Vireo vicinior*), which are among the more than 70 bird species that breed in this habitat.[47]

IV. Conclusion

In conclusion, Defenders objects to the final EA and draft Record of Decision because the Forest Service should have prepared a full EIS. Furthermore, Defenders objects to the final EA and draft Record of Decision because the condition-based management approach does not provide sufficient site specificity allow the Forest Service and the public to adequately analyze the Project's effects, in violation of NEPA. Finally, Defenders objects to the final EA and draft Record of Decision because the Project, as proposed lacks species-specific design features and mitigation measures for sensitive forest and woodland bird species. Therefore, Defenders makes the following suggested remedies that would resolve the objection:

1. The Forest Service must prepare an EIS;
2. The final analysis must include site-specific prescriptions and analysis of effects; and
3. The Project must include species-specific design features and mitigation that protect nesting and foraging habitat and adequate canopy cover and tree size for forest and woodland bird species, namely Grace's Warbler, Pinyon Jay, and Virginia's Warbler.
    a. Grace's Warbler and Virginia's Warbler: Maintain canopy cover at the high end of the historical range (~50%).
    b. Pinyon Jay: Maintain a minimum of 15-35% canopy cover in thinned patches; incorporate primary no disturbance buffers and secondary buffers with retention of medium and high productivity trees.

Thank you for considering our objection to the Santa Fe Mountains Landscape Resiliency Project.

Sincerely,

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[46] SOMERSHOE ET AL., *supra* note 12, at 31.
[47] *See* Defenders of Wildlife, *supra* note 39, at 29.

Appendix A. Ponderosa Pine – Mixed Conifer and Thinning Effects Draft. Darr, M. Santa Fe County, 2022.

	Flammulated Owl (19; Level 1)	Virginia's Warbler (19; Level 1)	Grace's Warbler (18; level 1)
Response to Heavy Thinning		Negative (Latif et al. 2020)	Negative (Kalies et al. 2010); **≥ 80% of basal area removed**
			Negative (Franzreb and Ohmart 1978); **70% of trees removed**
			Negative (Villasenor et al. 2005)
			Negative (Battin and Sisk 2011); **80% of pine-stems removed**
			Negative (Szaro and Balda 1979)
Relationship to Overstory Canopy Cover			
		Positive response to canopy cover, so presumed **negative** response to heavy thinning (Latif and Pavlacky 2020)	Positive response to canopy cover, so presumed **negative** response to heavy thinning (Latif and Pavlacky 2020)
			Positive response to canopy cover, so presumed **negative** response to heavy thinning (Flesch 2014)
Optimum Canopy Cover%			
21 Total Species			
Positive = (>80% of studies) 1 species			
Negative (>80% of studies)= 6 species			
Mixed/Unclear = 8 species			
No Information = 6 species			
Species most sensitive to thinning:			
Grace's Warbler* 7/7 studies; 100%			
Red-faced Warbler* 4/4 studies; 100%			
Virginia's Warbler* 2/2 studies; 100%			
Greater Pewee 2/2 studies; 100%			
Steller's Jay 6/7 studies; 86%			
Mountain Chickadee 5/6 studies; 83%			
***=NMDGF Species of Greatest Conservation Need and USFWS Bird of Conservation Concern**			

	Lewis's Woodpecker (18; level 1)	Spotted Owl (18; level 1)	Mexican Whip-poor-will (17; level 1)
Response to Heavy Thinning			
Relationship to Overstory Canopy Cover			
Optimum Canopy Cover%			
21 Total Species			
Positive = (>80% of studies) 1 species			
Negative (>80% of studies)= 6 species			
Mixed/Unclear = 8 species			
No Information = 6 species			
Species most sensitive to thinning:			
Grace's Warbler* 7/7 studies; 100%			
Red-faced Warbler* 4/4 studies; 100%			
Virginia's Warbler* 2/2 studies; 100%			
Greater Pewee 2/2 studies; 100%			
Steller's Jay 6/7 studies; 86%			
Mountain Chickadee 5/6 studies; 83%			
***=NMDGF Species of Greatest Conservation Need**			
and USFWS Bird of Conservation Concern			

	Red-faced Warbler (17; level 1)	Band-tailed Pigeon (16; level 2)	Broad-tailed Hummingbird (16; level 2)
Response to Heavy Thinning	Negative (Kalies et al. 2010); **≥ 80% basal area removed**		Positive (Hejl et al. 1995)
	Negative (Franzreb and Ohmart 1978); **70% of trees removed**		Positive (Bagne and Finch 2009); **70% of trees removed**
	Negative (Szaro and Balda 1979)		Positive (Szaro and Balda 1979)
			Negative (Kalies et al. 2010); ≥ **80 of basal area removed**
			Positive (Villasenor et al. 2005)
Relationship to Overstory Canopy Cover			
	Positive response to canopy cover, so presumed **negative** response to heavy thinning (Latif and Pavlacky 2020)		Positive response to canopy cover, so presumed **negative** response to heavy thinning (Latif and Pavlacky 2020)
Optimum Canopy Cover%			
21 Total Species			
Positive = (>80% of studies) 1 species			
Negative (>80% of studies)= 6 species			
Mixed/Unclear = 8 species			
No Information = 6 species			
Species most sensitive to thinning:			
Grace's Warbler* 7/7 studies; 100%			
Red-faced Warbler* 4/4 studies; 100%			
Virginia's Warbler* 2/2 studies; 100%			
Greater Pewee 2/2 studies; 100%			
Steller's Jay 6/7 studies; 86%			
Mountain Chickadee 5/6 studies; 83%			
***=NMDGF Species of Greatest Conservation Need**			
and USFWS Bird of Conservation Concern			

	Cassin's Finch (16; level 2)	**Clark's Nutcracker (16; level 2)**	**Pygmy Nuthatch (16; level 2)**
Response to Heavy Thinning	Positive (Latif et al. 2020)	Positive (Bagne and Finch 2009); **70% of trees removed**	Negative (Kalies et al. 2010); **≥ 80% basal area removed**
		Mixed (Hejl et al. 1995)	Neutral (Hurteau et al. 2008); **60-70% of trees removed**
			Negative (Franzreb and Ohmart 1978); **70% of trees removed**
			Negative (Hejl et al. 1995)
			Positive (Bagne and Finch 2009)
			Negative (Szaro and Balda 1979)
Relationship to Overstory Canopy Cover			
		Positive response to canopy cover, so presumed **negative** response to heavy thinning (Latif and Pavlacky 2020)	Mixed (Latif and Pavlacky 2020)
			Negative response to canopy cover, so presumed **positive** response to heavy thinning (Kalies and Rosenstock 2013)
Optimum Canopy Cover%			
			50% (Latif and Pavlacky 2020)
21 Total Species			
Positive = (>80% of studies) 1 species			
Negative (>80% of studies)= 6 species			
Mixed/Unclear = 8 species			
No Information = 6 species			
Species most sensitive to thinning:			
Grace's Warbler* 7/7 studies; 100%			
Red-faced Warbler* 4/4 studies; 100%			
Virginia's Warbler* 2/2 studies; 100%			
Greater Pewee 2/2 studies; 100%			
Steller's Jay 6/7 studies; 86%			
Mountain Chickadee 5/6 studies; 83%			
***=NMDGF Species of Greatest Conservation Need**			
and USFWS Bird of Conservation Concern			

	Steller's Jay (16; level 2)	**Evening Grosbeak (15; level 2)**	**Greater Pewee (15; level 2)**
Response to Heavy Thinning	Negative (Kalies et al. 2010); ≥ 80% basal area removed	Positive (Latif et al. 2020)	Negative (Villasenor et al. 2005)
	Negative (Hejl et al. 1995)	Negative (Hejl et al. 1995)	
	Negative (Bagne and Finch 2009); 70% of trees removed		
	Positive (Latif et al. 2020)		
Relationship to Overstory Canopy Cover			
	Positive response to canopy cover, so presumed **negative** response to heavy thinning (Latif and Pavlacky 2020)		Positive response to canopy cover, so presumed **negative** response to heavy thinning (Flesch 2014)
	Positive response to canopy cover, so presumed **negative** response to heavy thinning (Kalies and Rosenstock 2013)		
	Positive response to canopy cover, so presumed **negative** response to heavy thinning (Flesch 2014)		
Optimum Canopy Cover%			
	50% (Latif and Pavlacky 2020)		
21 Total Species			
Positive = (>80% of studies) 1 species			
Negative (>80% of studies)= 6 species			
Mixed/Unclear = 8 species			
No Information = 6 species			
Species most sensitive to thinning:			
Grace's Warbler* 7/7 studies; 100%			
Red-faced Warbler* 4/4 studies; 100%			
Virginia's Warbler* 2/2 studies; 100%			
Greater Pewee 2/2 studies; 100%			
Steller's Jay 6/7 studies; 86%			
Mountain Chickadee 5/6 studies; 83%			
***=NMDGF Species of Greatest Conservation Need**			
and USFWS Bird of Conservation Concern			

	Olive Warbler (15; level 2)	Painted Redstart (15; level 2)	Williamson's Sapsucker (15; level 2)
Response to Heavy Thinning			Neutral (Kalies et al. 2010); **≥ 80% basal area removed**
			Neutral (Hejl et al. 1995)
Relationship to Overstory Canopy Cover			
	Positive response to canopy cover, so presumed **negative** response to heavy thinning (Latif and Pavlacky 2020)		Positive response to canopy cover, so presumed **negative** response to heavy thinning (Latif and Pavlacky 2020)
Optimum Canopy Cover%			
21 Total Species			
Positive = (>80% of studies) 1 species			
Negative (>80% of studies)= 6 species			
Mixed/Unclear = 8 species			
No Information = 6 species			
Species most sensitive to thinning:			
Grace's Warbler* 7/7 studies; 100%			
Red-faced Warbler* 4/4 studies; 100%			
Virginia's Warbler* 2/2 studies; 100%			
Greater Pewee 2/2 studies; 100%			
Steller's Jay 6/7 studies; 86%			
Mountain Chickadee 5/6 studies; 83%			
***=NMDGF Species of Greatest Conservation Need and USFWS Bird of Conservation Concern**			

	Mountain Chickadee (14; level 2)	**Townsend's Solitaire (14; level 2)**	**Violet-Green Swallow (14; level 2)**
Response to Heavy Thinning	Negative (Kalies et al. 2010); **≥ 80% basal area removed**	Positive (Hejl et al. 1995)	Negative (Kalies et al. 2010); **≥ 80% basal area removed**
	Negative (Hurteau et al. 2008); **60-70% of trees removed**	Negative (Bagne and Finch 2009); **85% of trees removed**	Positive (Franzreb and Ohmart 1978); **70% of trees removed**
	Negative (Franzreb and Ohmart 1978); **70% of trees removed**		Negative (Hejl et al. 1995)
	Negative (Hejl et al. 1995)		Positive (Bagne and Finch 2009); **85% of trees removed**
			Negative (Szaro and Balda 1979)
			Negative (Latif et al. 2020)
Relationship to Overstory Canopy Cover			
	Positive response to canopy cover, so presumed **negative** response to heavy thinning (Latif and Pavlacky 2020)	Positive response to canopy cover, so presumed **negative** response to heavy thinning (Latif and Pavlacky 2020)	Negative response to canopy cover, so presumed **positive** response to heavy thinning (Kalies and Rosenstock 2013)
	Negative response to canopy cover, so presumed **positive** response to thinning (Kalies and Rosenstock 2013)		Mixed (Latif and Pavlacky 2020)
Optimum Canopy Cover%			
	50% (Latif and Pavlacky 2020)		
21 Total Species			
Positive = (>80% of studies) 1 species			
Negative (>80% of studies)= 6 species			
Mixed/Unclear = 8 species			
No Information = 6 species			
Species most sensitive to thinning:			
Grace's Warbler* 7/7 studies; 100%			
Red-faced Warbler* 4/4 studies; 100%			
Virginia's Warbler* 2/2 studies; 100%			
Greater Pewee 2/2 studies; 100%			
Steller's Jay 6/7 studies; 86%			
Mountain Chickadee 5/6 studies; 83%			
***=NMDGF Species of Greatest Conservation Need**			
and USFWS Bird of Conservation Concern			

Appendix B. Cited Sources

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