July 8, 2017

Regional Forester, Objection Review Officer
USDA Forest Service, Southwest Region
333 Broadway Blvd., SE
Albuquerque, NM 87102
Via Email: objections-southwestern-regional-office@fs.fed.us

Re: OBJECTIONS Pursuant to 36 C.F.R. § 218.8 on Luna Restoration Project, Quemado Ranger District, Gila National Forest

Dear Reviewing Office:

The Center for Biological Diversity ("the Center") hereby submits these objections to the Gila National Forest's draft Record of Decision (ROD) and final environmental impact statement (FEIS) for the Luna Restoration Project.

Project Objected To

Pursuant to 36 C.F.R. § 218.8(d)(4), the Center objects to the following project:

Project: Luna Restoration Project, Catron County, New Mexico, Gila National Forest

Responsible Official and Forest/Ranger District: Adam Mendonca, Forest Supervisor, Gila National Forest, Quemado Ranger District

Timeliness

These objections are timely filed. Notice of the draft ROD was published in the Silver City Daily Press on May 22, 2019.[1]

Lead Objector

As required by 36 C.F.R. § 218.8(d)(3), the Center designate the "Lead Objector" as follows:

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[1] *See* Legal Notice, Silver City Daily Press and Independent (May 22, 2019), reproduced at https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd632595.pdf (last viewed July 6, 2019). The 45th day after the date of the May 22 notice falls on Saturday, July 6, and so the objection period expires at 11:59 PM Mountain time on the next business day, Monday July 8. *See* 36 C.F.R. § 218.6(a).

<u>Interests and Participation of the Objectors</u>

The Center for Biological Diversity is a non-profit environmental organization with over 61,000 members, and 1.6 million activist-supporters nationwide who value wilderness, biodiversity, old growth forests, and the threatened and endangered species which occur on America's spectacular public lands and waters. Many of the Center's members and supporters frequently use and enjoy the spectacular landscapes of the Gila National Forest landscape for recreation, sustenance, nature study, and spiritual renewal.

At the Center for Biological Diversity, we believe that the welfare of human beings is deeply linked to nature — to the existence in our world of a vast diversity of wild animals and plants. Because diversity has intrinsic value, and because its loss impoverishes society, we work to secure a future for all species, great and small, hovering on the brink of extinction. We do so through science, law and creative media, with a focus on protecting the lands, forests, waters and climate that species need to survive. The Center has and continues to actively advocate for increased protections for species and their habitats in New Mexico and across the American Southwest.

INTRODUCTION

The Center considers the proposed Record of Decision (ROD) to contain some beneficial project elements insofar as restoration and fuels treatments in forests, grasslands, shrublands, woodlands, and riparian areas are informed by the best available science and are coordinated within a cohesive and unified strategic, process-oriented approach.

We are pleased that proposed decision includes the following action items:

- Thinning in MSO PACs is restricted to felling of trees under 9" DBH outside of breeding season (March 1 to August 31) (Draft ROD at 13)
- Prescribed fire is planned for use of mixed severities, and as the only treatment on 36,022 acres
- Prescribed fire is planned in conjunction with thinning on up to 100,000 acres (Draft ROD at 5)
- Vegetation and fire treatments will be restricted from willow flycatcher and gartersnake critical habitat
- Approximately 113 miles of road decommissioning with portions remaining open to non-motorized use
- New temporary roads are minimized at 3-5 miles
- Stream and riparian treatments to address a range of issues, as listed in table 18 of the FEIS (FEIS at 32; see also Draft ROD at 14-15)

These are all positive management actions that should lead towards improved habitat, watershed function, and forest visitor experience. The FEIS seems to imply that a major focus of the project is to allow the use of fire, both planned and unplanned ignitions, to achieve restoration objectives. We strongly support this approach and are eager to continue work with the Gila National Forest to develop a project that can harness the restorative benefits of fire in a way that compliments a variety of forest management goals and protects communities and other values at risk while not compromising habitats for threatened, endangered and sensitive wildlife species.

Despite these constructive components, the Final EIS fails to comply with NEPA, and fails to address a number of issues we raised in past comments. We are therefore objecting on the following grounds:

1) The Luna FEIS failed to consider a reasonable alternative proposed by the Center and instead analysis a very narrow range of nearly identical alternatives.

2) The Luna FEIS fails to take a hard look at the impacts of livestock-related water and fencing developments, restricting analysis to a narrow and identical range of alternatives, and precluding the installation of permanent livestock-excluding riparian fencing.

3) The Luna FEIS fails to sufficient protect old and large trees despite the documented dearth of such trees on the landscape, the numerous times the Center argued for adequate protections in line with broadly agreed-upon positions, and contrary to scientific information which calls for their protection.

4) The Luna FEIS approves the use of herbicides on nearly 30,000 acres without taking a hard look at the effects of herbicides on the environment, and without considering the scientific information we presented that disputed the underlying need for herbicide treatment of rabbitbrush.

I. NEPA Mandates That Agencies Analyze All Reasonable Alternatives.

When federal agencies prepare an EIS, NEPA requires that they must take a "*hard look*" at the project's environmental impacts and the information relevant to its decision.[2] In taking the required "*hard look*," an EIS must "*study, develop, and describe*" reasonable alternatives to the proposed action.[3] This alternatives analysis "*is the heart of the environmental impact statement*."[4]

As a result, agencies must "[r]*igorously explore and objectively evaluate all reasonable alternatives*."[5] "*To comply with the National Environmental Policy Act and its implementing*

[2] *Wyoming v. U.S. Dep't of Agriculture*, 661 F.3d 1209, 1237 (10th Cir. 2011).

[3] 42 U.S.C. §§ 4332(2)(E); 4332(2)(C)(iii).

[4] 40 C.F.R. § 1502.14; *see also All Indian Pueblo Council v. United States*, 975 F.2d 1437, 1444 (10th Cir. 1992).

[5] 40 C.F.R. § 1502.14.

regulations, [agencies] *are required to rigorously explore all reasonable alternatives ... and give each alternative substantial treatment in the environmental impact statement*."[6] "*Without substantive, comparative environmental impact information regarding other possible courses of action, the ability of an EIS to inform agency deliberation and facilitate public involvement would be greatly degraded*."[7]

When a federal agency prepares an EIS, it must consider "*all reasonable alternatives*" which are consistent with its stated purpose and need.[8] An agency may dismiss a reasonable alternative if it is not "'*significantly distinguishable from the alternatives already considered*.'"[9]

Federal courts have struck down Forest Service EISs where the agency evaluated several alternatives, but where those alternatives were all fairly similar. *See, e.g., California v. Block*, 690 F.2d 753, 767-69 (9th Cir. 1982) (setting aside Forest Service EIS that evaluated eight alternatives because all of the alternatives considered protecting less than 34% of eligible lands as potential wilderness).

In addition, NEPA "*does not permit the agency to eliminate from discussion or consideration a whole range of alternatives, merely because they would achieve only some of the purposes of a multipurpose project.*"[10] If a different action alternative "*would only partly meet the goals of the project, this may allow the decision maker to conclude that meeting part of the goal with less environmental impact may be worth the tradeoff with a preferred alternative that has greater environmental impact*."[11]

A. The Luna Project.

The Luna project's purpose is exceedingly broad. It is "to *create and maintain a healthy resilient landscape and watersheds capable of delivering benefits to the public including reduced threat*

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[6] *Custer County Action Ass'n v. Garvey*, 256 F.3d 1024, 1039 (10th Cir. 2001) (emphasis added). *See also New Mexico ex rel. Richardson v. Bureau of Land Management*, 565 F.3d 683, 703 (10th Cir. 2009) ("[A]n EIS must rigorously explore and objectively evaluate all reasonable alternatives to a proposed action, in order to compare the environmental impacts of all available courses of action."); *Colo. Envtl. Coalition v. Dombeck*, 185 F.3d 1162, 1174 (10th Cir. 1999) (explaining reasonable alternatives).

[7] *New Mexico ex rel. Richardson*, 565 F.3d at 708.

[8] 40 C.F.R. § 1502.14(a). *See also Colorado Environmental Coal. v. Salazar,* 875 F. Supp. 2d 1233, 1245 (D. Colo. 2012) (stating that the agency's objectives dictate the range of reasonable alternatives).

[9] *Colorado Environmental Coal. v. Salazar,* 875 F. Supp. 2d at 1245 (quoting *New Mexico ex rel. Richardson,* 565 F.3d 683, 708-09 (10th Cir. 2009).

[10] *Town of Matthews v. U.S. Dep't. of Transp*., 527 F. Supp. 1055, 1057 (W.D. N.C. 1981).

[11] *North Buckhead Civic Assoc v. Skinner*, 903 F.2d 1533, 1542 (11th Cir. 1990). *See also Natural Resources Defense Council v. Callaway*, 524 F.2d 79, 93 (2d Cir. 1975) ("the EIS must nevertheless consider such alternatives to the proposed action as may partially or completely meet the proposal's goal and it must evaluate their comparative merits"); *Natural Resources Defense Council v. Morton*, 458 F.2d 827, 836 (D.C. Cir. 1972) ("(it is not) appropriate, as Government counsel argues, to disregard alternatives merely because they do not offer a complete solution to the problem.").

of high-intensity fire, clean air and water, habitat for native fish and wildlife, forest products, and outdoor recreation opportunities."[12] The FEIS states that there "*is a need to*:

- *reduce the impacts of high-severity fire on natural and cultural resources, private inholdings, communities, infrastructure, and livelihoods within the planning area;*
- *implement vegetative treatments to restore departed landscapes that are, overstocked, encroached, and at risk to fire, disease, insects, and climate stressors;*
- *implement treatments in watersheds that are not properly functioning;*
- *improve water quality by hardening stream crossings and performing road maintenance;*
- *continue to provide the wide range of forest products that are important to the culture, tradition and livelihoods of local communities;*
- *protect and restore threatened and endangered species and habitats;*
- *provide opportunities for off-highway vehicle use, enjoyment, and access from the community of Luna;*
- *provide permanent water supplies to support wildlife and livestock; and*
- *improve rangeland, wildlife, aquatic and riparian habitat*."[13]

B. The FEIS considers only a very narrow range of alternatives.

The FEIS analyzes three action alternatives, all of which are nearly identical, and which have only minor differences a narrow range of action alternatives.

The meat of each of the action alternatives is the same. Alternatives B, C, and D all contain the following identical components and/or impacts:

- They each would undertake precisely the same acreage of vegetation treatments – 73,856 acres of mechanical and/or hand treatments in forested and woodlands areas, and 23,125 acres of grassland treatments – using identical treatments in each area.[14]
- They each would use prescribed fire on precisely the same area (36,022 acres) within precisely the same forest types, and would use prescribed fire together with mechanical treatments on precisely the same 70,000 – 100,000 acres.[15]

[12] Luna FEIS at 13.

[13] Luna FEIS at 13-14.

[14] Luna FEIS at 20, Table 11. *See also id.* at 19 ("[V] vegetation treatments are the same for alternatives B, C, and D").

• They each would construct precisely the same number and type of rangeland improvements – the same wells, storage tanks, drinkers, trick tanks, pipelines and miles of fence – at precisely the same locations in the same pastures.[16]

• They each would undertake precisely the same number and type of stream and riparian treatments – the same crossings, diversions, exclosures, barriers, erosion control structures, etc. – at precisely the same locations.[17]

• They would each have precisely the same impacts on "fire and fuels resources."[18]

• They would each have the same impacts on the federally listed Mexican gray wolf, Mexican spotted owl, southwestern willow flycatcher, narrow-headed gartersnake, New Mexico meadow jumping mouse, spikedace, loach minnow, as well as Region 3 sensitive species, and migratory bird species.[19]

• They would each have precisely the same impacts to "social and economic resources."[20]

There are only two appreciable differences between the alternatives. First, Alternative C differs from Alternatives B and D in how it would treat rabbitbrush and alligator juniper, although an identical acreage would be treated under all three alternatives.[21] Second, while the bulk of transportation management decisions are the same under each of the three alternatives, Alternative D would decommission 130 miles of road, while Alternatives B and C would identically decommission 116 miles of road.[22]

1. The Center Proposed a Reasonable Alternative.

We proposed a reasonable alternative that would meet the purpose and need and is distinguishable from the other alternatives. In a scoping letter on the Luna project the Center requested that the analysis "*includes detailed study and development of action alternatives that*

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[15] Luna FEIS at 25, Table 13. *See also id.* at 25 ("There are no differences in the location, amount or types of [prescribed fire] treatments between alternatives.").

[16] Luna FEIS at 28, Tables 14 and 15. *See also id*. at 27 ("There are no differences in the location, amount or types of [livestock grazing] improvements between alternatives.").

[17] Luna FEIS at 32, Table 18. *See also id.* at 32 ("There are no differences in the type, number or location of [stream and riparian] treatments between alternatives.").

[18] Luna FEIS at 43-44, Table 20.

[19] Luna FEIS at 45-51, Table 21.

[20] Luna FEIS at 59-60, Table 29.

[21] *See* Luna FEIS at 22-24. Alternative B and D would use mowing in an attempt to reduce rabbitbrush across 20,283 acres; Alternative C would use herbicides on up to the same acreage. Alternative C would also use herbicides to eliminate alligator juniper on up to 8,000 acres.

[22] *See* Luna FEIS at 30-31.

propose different treatment locations and intensities to compare project effects on potential fire behavior."[23]

That letter also requested that the Forest Service "*study, develop and describe action alternatives in detail that generally retain existing large trees*" and "*study, develop and describe in detail a stand-alone action alternative based on the entire* [4FRI Old and Large Tree Retention] *Strategy*."

Finally, that letter stated that the Luna EIS "*should study, develop and describe an action alternative that:*

- *Implements existing forest plan standards and guidelines without amendment.*
- *Avoids road construction in Protected Activity Centers.*
- *Incorporates fuel treatment concepts outlined above, including large tree retention, management of surface fuels and sub-canopy forest structure, and spatial orientation.*
- *Applies fuel treatment modeling in spotted owl habitat, as proposed by Northern Arizona University Forest Ecosystem Restoration Analysis (Prather et al. 2008)*."

In our comments on the Draft EIS[24], we further requested that contained a "*detailed study of an action alternative that foregoes road building on steep slopes and sensitive, erodible soils where it may increase erosion or impair ecosystem productivity*."

2. The Forest Service's failure to analyze in detail our proposed alternative violates NEPA.

In scoping comments the Center identified old and large tree retention as an issue for analysis. We commend the Forest Service for crafting prescriptions that *emphasize* retention of old and large trees, but the FEIS provides language results in broad flexibility and room for interpretation. We have asked that the Forest Service include an unambiguous restriction on any form of cutting of any old growth tree (150 years or older) of any species for any reason. This is the basis of our proposed alternative which meets the project purpose stated in section I.A of this objection and pages 13-14 of the FEIS.

Retention of large trees is fundamentally important to fire resistance of treated stands. [25] Mature conifers have a high capacity to survive and recover from crown scorch.[26] Large tree structure enhances forest resilience to severe fire effects[27,28,29] whereas removing them may undermine fire

[23] *See* Letter from Joe Trudeau (Center for Biological Diversity) to Emily Irwin, October 17, 2017, referencing letter from Jay Lininger (Center for Biological Diversity) to Emily Irwin, July 1, 2016.

[24] Letter from Joe Trudeau (Center for Biological Diversity) to Adam Mendonca, June 22, 2018.

[25] DellaSala, D.A., J.E. Williams, C.D. Williams and J.F. Franklin. 2004. Beyond smoke and mirrors: a synthesis of fire policy and science. *Conservation Biology* 18: 976-86.

[26] McCune, Bruce. "Ecological diversity in North American pines." American Journal of Botany (1988): 353-368.

[27] Arno, S.F. 2000. Fire in western ecosystems. Pp. 97-120 in: J.K. Brown and J.K. Smith (eds.). *Wildland Fire in Ecosystems, Vol. 2: Effects of Fire on Flora*. USDA For. Serv. Gen. Tech. Rep. RMRS-42-vol.2. Ogden, UT.

resilience.[30,31] Research demonstrates no advantage in fire hazard mitigation resulting from mechanical forest treatments that remove large trees compared to treatments that retain them. Modeled treatments that removed only trees smaller than 16-inches diameter were marginally more effective at reducing long-term fire hazard than so-called "comprehensive" treatments that removed trees in all size classes.[32]

Thinning small trees and pruning branches of large trees to increase canopy base height significantly decreases the likelihood of crown fire initiation,[33,34,35,36] which is a precondition to active crown fire behavior.[37,38] Therefore, low thinning and underburning to reduce surface fuels and increase canopy base height at strategic locations effectively reduces fire hazard at a landscape scale and meets the purpose and need.

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[28] Omi, P.N., and E.J. Martinson. 2002. *Effect of Fuels Treatment on Wildfire Severity*. Unpubl. report to Joint Fire Science Program. Fort Collins: Colorado State Univ. Western Forest Fire Research Ctr. March 25. 36 pp.

[29] Pollett, J. and P.N. Omi. 2002. Effect of thinning and prescribed burning on crown fire severity in ponderosa pine forests. *International Journal of Wildland Fire* 11: 1-10.

[30] Brown, R.T., J.K. Agee, and J.F. Franklin. 2004. Forest restoration and fire: principles in the context of place. *Conservation Biology* 18: 903-12.

[31] Naficy, C., A. Sala, E.G. Keeling, J. Graham and T.H. DeLuca. 2010. Interactive effects of historical logging and fire exclusion on ponderosa pine forest structure in the northern Rockies. *Ecological Applications* 20: 1851-64.

[32] Fiedler, C.E., and C.E. Keegan. 2003. Reducing crown fire hazard in fire-adapted forests of New Mexico. Pp. 29-38 in: P.N. Omi and L.A. Joyce (tech. eds.). *Fire, Fuel Treatments, and Ecological Restoration: Conference Proceedings*. 2002 April 16-18: Fort Collins, CO. USDA For. Serv. Rocky Mtn. Res. Sta. Proc. RMRS-P-29. Fort Collins, CO.

[33] Graham, R.T., S. McCaffrey, and T.B. Jain (Tech. Eds.). 2004. *Science Basis for Changing Forest Structure to Modify Wildfire Behavior and Severity*. USDA For. Serv. Rocky Mtn. Res. Sta. Gen. Tech. Rep. RMRS-120. Ft. Collins, CO.

[34] Keyes, C.R. and K.L. O'Hara. 2002. Quantifying stand targets for silvicultural prevention of crown fires. *Western Journal of Applied Forestry* 17: 101-09.

[35] Perry, D.A., H. Jing, A. Youngblood, and D.R. Oetter. 2004. Forest structure and fire susceptibility in volcanic landscapes of the eastern high Cascades, Oregon. *Conservation Biology* 18: 913-26.

[36] Omi and Martinson 2002, Pollett and Omi 2002

[37] Agee, J.K. 1996. The influence of forest structure on fire behavior. Pp. 52-68 in: J.W. Sherlock (chair). *Proc. 17th Forest Vegetation Management Conference.* 1996 Jan. 16-18: Redding, CA. Calif. Dept. Forestry and Fire Protection: Sacramento.

[38] Van Wagner, C.E. 1977. Conditions for the start and spread of crown fire. *Canadian Journal of Forest Research* 7: 23-24.

Large trees are not abundant at any scale in Southwestern forests and they are the most difficult of all elements of forest structure to replace once removed.[39] The ecological significance of old growth forest habitat and large trees comprising it is widely recognized.[40,41] There is no agreed-upon scientific basis for removing large trees to promote fire resistance in southwestern forests.[42,43] In addition to their rarity, a variety of factors other than logging threatens the persistence of the remaining large trees in Southwestern conifer forests. Recruitment of large trees, snags and large woody debris will become more limiting over time as climate change imposes chronic drought, reduced tree growth rates, and more widespread tree mortality.[44,45,46,47,48] A large tree retention alternative would maintain trees that are most likely to survive fire injury and supply recruitment structure that will support the recovery of old growth forest habitat in the future.

In forests with a variety of species and disturbance regimes, large tree removal reduces forest canopy and diminishes recruitment of large snags and downed logs, which in turn affects long-

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[39] Agee, J.K. and C.N. Skinner. 2005. Basic principles of forest fuel reduction treatments. *Forest Ecology and Management* 211: 83-96.

[40] Friederici, P. (Ed.). 2003. *Ecological Restoration of Southwestern Ponderosa Pine Forests*. Island Press: Washington, DC.

[41] Kaufmann, M.R., W.H. Moir, and W.W. Covington. 1992. Old-growth forests: what do we know about their ecology and management in the Southwest and Rocky Mountain regions? Pp. 1-10 in: M.R. Kaufmann, W.H. Moir, and R.L. Bassett (eds.). *Old-Growth Forests in the Southwest and Rocky Mountain Regions: Proceedings from a Workshop* (1992). Portal, AZ. USDA For. Serv. Gen. Tech. Rep. RM-213. Fort Collins, CO.

[42] Allen, C.D. M.A. Savage, D.A. Falk, K.F. Suckling, T.W. Swetnam, T. Schulke, P.B. Stacey, P. Morgan, M. Hoffman, and J.T. Klingle. 2002. Ecological restoration of southwestern ponderosa pine ecosystems: A broad perspective. *Ecological Applications* 12: 1418-33.

[43] Brown et al. 2004, Dellasala et al. 2004

[44] Diggins, C., P.Z. Fulé, J.P. Kaye and W.W. Covington. 2010. Future climate affects management strategies for maintaining forest restoration treatments. *International Journal of Wildland Fire* 19: 903-13.

[45] Savage, M. P.M. Brown, and J. Feddema. 1996. The role of climate in a pine forest regeneration pulse in the southwestern United States. *Ecoscience* 3: 310-18.

[46] Seager, R., M. Ting, Y. Kushnir, J. Lu, G. Vecchi, H. Huang, N. Harnik, A. Leetmaa, N. Lau, C. Li, J. Velez and N. Naik. 2007. Model projections of an imminent transition to a more arid climate in southwestern North America. *Science* 316: 1181-84.

[47] van Mantgem, P.J., N.L. Stephenson, J.C. Byrne, L.D. Daniels, J.F. Franklin, P.Z. Fulé, M.E. Harmon, A.J. Larson, J.M. Smith, A.H. Taylor and T.T. Veblen. 2009. Widespread increase of tree mortality rates in the western United States. *Science* 323: 521-24.

[48] Williams, A.P., C.D. Allen, C.I Millar, T.W. Swetnam, J. Michaelsen, C.J. Still and S.W. Leavitt. 2010. Forest responses to increasing aridity and warmth in the southwestern United States. *PNAS* 107: 21289-94.

term forest dynamics, stand development and wildlife habitat suitability.[49,50,51] If significant reductions of crown bulk density are deemed necessary to meet the purpose and need then it is highly unlikely that the project will maintain habitat for threatened and sensitive wildlife species associated with closed-canopy forest.[52,53] An unambiguous commitment to old and large tree retention would maintain wildlife habitat in the short-term and mitigate adverse effects of the proposed treatments.

The key elements of our alternative that distinguish it from the other action alternatives, which are all almost identical anyway, are that it would:

• Retain all old trees over 150 years old, except in cases of imminent personal safety.

• Avoids road construction in Protected Activity Centers.

• Incorporates fuel treatment concepts including large tree retention, management of surface fuels and sub-canopy forest structure, and spatial orientation.

• Treat a different amount of the landscape with mechanical thinning as a comparison of effects to the other alternatives which are all identical in thinning acres.

The FEIS appears to dismiss our alternative without explanation. The only alternative Considered but Eliminated from Detailed Study in the FEIS is the "Use of Mechanical Treatments only within Defined Wildland-Urban Interfaces in the Planning Area."[54] The Center did not suggest this as an alternative. Our comments on the Draft EIS stated:

"*Mechanical thinning treatments should be prioritized for protection of the WUI and critical infrastructure, and otherwise utilized in a strategic and optimized manner in order to facilitate restoration of landscape scale wildland fire for resource benefit. Such an approach is consistent with the National Cohesive Wildfire Management Strategy and the best available science*."

This statement in our comments did not propose using mechanical treatments only in the WUI; instead, it said that mechanical treatments should be *prioritized* for the WUI and used elsewhere

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[49] Quigley, T.M., R.W. Haynes and R.T. Graham. 1996. *Disturbance and Forest Health in Oregon and Washington*. USDA For. Serv. Pac. Nor. Res. Sta. Gen. Tech. Rep. PNW-GTR-382. Portland, OR.

[50] Spies, T.A. 2004. Ecological concepts and diversity of old-growth forests. *Journal of Forestry* 102: 14-20.

[51] van Mantgem, P.J., N.L. Stephenson, J.C. Byrne, L.D. Daniels, J.F. Franklin, P.Z. Fulé, M.E. Harmon, A.J. Larson, J.M. Smith, A.H. Taylor and T.T. Veblen. 2009. Widespread increase of tree mortality rates in the western United States. *Science* 323: 521-24.

[52] Beier, P., and J. Maschinski. 2003. Threatened, endangered, and sensitive species. Pp. 206-327 in: P. Friederici (ed.). *Ecological Restoration of Southwestern Ponderosa Pine Forests*. Island Press: Washington, D.C.

[53] Keyes, C.R. and K.L. O'Hara. 2002. Quantifying stand targets for silvicultural prevention of crown fires. *Western Journal of Applied Forestry* 17: 101-09.

[54] Luna FEIS at 39.

outside of the WUI in a strategic and optimized manner. The FEIS fails to address our proposed alternative described above, constituting a violation of NEPA.

II. The Final EIS Fails To Take A Hard Look At The Impacts Of Livestock-Related Water And Fencing Developments.

"An examination of Table 7 in the proposed action compared to Table 15 in the DEIS yields a shocking increase in proposed range improvements that directly benefit the ranching industry. Comparing these tables shows there is a doubling of the number of trick tanks and a near-doubling of the number of drinkers, a 50% increase in drilling of new wells and storage tanks, and a near-doubling in the miles of new pipeline in the DEIS." (DEIS comments at 11).

The Forest Service states that the purpose and need for the project includes "*provid*[ing] *permanent water to support wildlife and livestock*," and "*improv*[ing] *rangeland, wildlife, aquatic and riparian habitat*."[55] The purpose of "[d]*eveloping waters*" is not simply to construct new developments, but "*to improve livestock and water distribution*."[56]

To achieve these ends, the Forest Service proposes to significantly alter the landscape by building and putting in place 50 new water developments, including 11 new wells, 14 new storage tanks (each with a10,000 gallon capacity), 24 new drinkers, and 2 new trick tanks.[57] The Forest Service also proposes to approve 16 miles of new pipeline, and 2.25 miles of new fence).[58] Each action alternative "*propose*[s] *the same range improvements*."[59] While proposing this significant level of development, the Forest Service asserts that "[t]*his proposal would not alter the management (livestock kind, class, number or season of use) or desired conditions outlined in each allotment's corresponding grazing analysis*."[60] The proposal identifies the specific location and allotment for each structure.[61]

As discussed below, the Forest Service violated NEPA by failing to disclose the impacts of, or reasonable alternatives to, the proposal to construct these livestock management developments.

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[55] FEIS at 14.

[56] FEIS at 15. *See also* FEIS at 27 (proposed action would add new improvements "*to increase livestock and wildlife distribution to benefit rangeland conditions, including watershed, soils, and stream resources*."); Draft ROD at 14 ("*to increase livestock and wildlife distribution that would benefit rangeland conditions, including watershed, soils, and stream resources…. The improvements would enhance livestock distribution, forage utilization and management flexibility*.").

[57] FEIS at 28, 29.

[58] FEIS at 28.

[59] FEIS at 27.

[60] FEIS at 27. *See also* Draft ROD at 14 (same).

[61] FEIS at 28; FEIS Map 7.

A. The Forest Service Must Disclose Baseline Conditions, by Allotment, that Individual Water Developments and Fences Are Meant to Address.

The Center's comments on the DEIS urged the Forest Service to disclose baseline conditions related to livestock grazing and the project area's ecological condition.[62]

"*In analyzing the affected environment, NEPA requires the agency to set forth the baseline conditions.*"[63] Specifically, NEPA requires agencies to "*succinctly describe the environment of the area(s) to be affected or created by the alternatives under consideration*."[64] The Council on Environmental Quality, the agency charged with interpreting NEPA, has explained that "*[t]he concept of a baseline against which to compare predictions of the effects of the proposed action and reasonable alternatives is critical to the NEPA process*."[65] Federal courts hold that "*[w]ithout establishing ... baseline conditions ... there is simply no way to determine what effect [an action] will have on the environment and, consequently, no way to comply with NEPA*."[66]

Because the Forest Service designed the proposed range developments "*to improve livestock and water distribution*,"[67] this presupposes that livestock and water distribution currently require improvement, meaning that each of the identified allotments has areas where livestock are, presumably, causing damage to soil, water quality, water quantity, native vegetation, etc., or, at a minimum, that livestock impacts to those and other values could be reduced or mitigated. However, the Forest Service failed to disclose, on an allotment by allotment basis, the conditions that require or would benefit from these developments, including, for example, the "*rangeland conditions, including watershed, soils, and stream resources*" that the Forest Service intends that the range developments will benefit.[68] This failure violates NEPA. Without such information, neither the public nor the decisionmaker can understand why the Forest Service proposes the particular number of developments at the identified locations on any particular allotment.

Without baseline information on an allotment by allotment basis, the public also cannot understand what the difference between the proposed action and the no action alternative might be. Which riparian areas, if any, will allegedly be more lightly grazed because new development will "lure" livestock away from those areas? What values of those riparian areas may benefit?

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[62] *See* Center Comment Letter (June 22, 2018) at 9-10.

[63] *Western Watersheds Project v. BLM*, 552 F.Supp.2d 1113, 1126 (D. Nev. 2008)

[64] 40 C.F.R. § 1502.15.

[65] Council on Environmental Quality, Considering Cumulative Effects Under the National Environmental Policy Act 41 (1997), https://ceq.doe.gov/publications/cumulative_effects.html (last visited July 5, 2019).

[66] *Half Moon Bay Fishermans' Mktg. Ass'n v. Carlucci*, 857 F.2d 505, 510 (9th Cir. 1988); *see also N. Plains Res. Council, Inc. v. Surface Transp. Bd.*, 668 F.3d 1067, 1084–85 (9th Cir. 2011) (holding that agency did not take a sufficiently "hard look" at environmental impacts because it did not collect baseline data).

[67] Luna FEIS at 15 (emphasis added).

[68] Luna FEIS at 27.

Further, the Forest Service states that one of the purposes of the range developments is to "*increase ... wildlife distribution*."[69] But the EIS fails to disclose the current distribution of wildlife, and where and why that distribution needs to be "improved."

Because the Forest Service fails to supply the required baseline information, the FEIS cannot make the required comparison, in violation of NEPA.

> Suggested Remedy: The Forest Service must either: (1) prepare new or supplemental NEPA analysis that discloses the baseline conditions of each allotment, by allotment; or (2) remove the fence, pipeline, and water development proposals from the final Record of Decision.

B. The Forest Service Must Disclose the Impacts of Water Developments for Livestock.

The Center's comments on the DEIS urged the Forest Service to disclose the impacts of each and every proposed range development.[70] The FEIS fails to do so.

NEPA requires federal agencies to take a "*hard look*" at the environmental impacts of proposed actions.[71] To do so, federal agencies must prepare an environmental impact statement (EIS) for all "*major Federal actions significantly affecting the quality of the human environment*."[72] An EIS must "*provide [a] full and fair discussion of significant environmental impacts*" associated with a federal decision and "*inform decisionmakers and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment*."[73] Taking the required "*hard look*" requires agencies to "*utiliz[e] ... the best available scientific information*."[74]

The FEIS contains only vague and contradictory language concerning the impacts of the proposed range developments, and the Forest Service fails to respond to scientific and expert literature contradicting the Forest Service's assumptions.

The FEIS asserts, without support or site-specific analysis, that the proposed range developments will have beneficial impacts. For example, the FEIS alleges that other project components combined with new range waters and fences will result in more resilient rangeland vegetation.[75]

[69] Luna FEIS at 27 (emphasis added).

[70] *See* Center Comment Letter (June 22, 2018) at 9-10.

[71] *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350 (1989).

[72] 42 U.S.C. § 4332(2)(C); *see also* 40 C.F.R. § 1501.4.

[73] 40 C.F.R. § 1502.1.

[74] *Colo. Envtl. Coal. v. Dombeck*, 185 F.3d 1162, 1171 (10th Cir. 1999).

[75] Luna FEIS at 146 ("*This, along with the proposed water developments and pasture division, would lead to the improvement of livestock distribution and use across the landscape, allowing for improved livestock management and resilience of the rangeland vegetation during times of drought and unforeseen climate conditions*").

The agency asserts that "*several areas*" will benefit because water development will "*provid[e] relief from grazing pressure … and decrease dependence on riparian habitat as a water source*."[76] The FEIS fails to disclose the location or extent of these "*several areas*," and the degree of benefit is nowhere described.

We find it concerning that the Draft ROD asserts that "*range improvements [among other things] will improve the watershed conditions and move streams toward meeting New Mexico State water quality standards*"[77] But the FEIS does not itself make such an assertion concerning range improvements, nor does the FEIS disclose how range improvements will improve the conditions in which watershed.

On the other hand, the FEIS appears to admit that water developments are likely to have negligible or harmful impacts to the environment, but again without the site-specific detail NEPA requires. For example, the Forest Service describes the potentially significant impacts from ground disturbance, trenching, and the use of motorized vehicles involved in range development construction.[78] The FEIS further admits that livestock grazing in upland areas, where developments will be built, can cause sedimentation and impair water quality.[79] The FEIS also appears to state that the potential benefits of rangeland improvements to soil conditions are "*minimal*." In analyzing the "no action" alternative, the Forest Service states:

> *Currently, <u>isolated</u> areas around existing water points receive heavier use from livestock and wildlife, resulting in less herbaceous vegetation and soil compaction. These areas would remain the same, as there would be no improvement in distribution of livestock and wildlife. However, <u>the acres associated with these areas are minimal</u> across the project area.*[80]

Again, the FEIS does not appear to reveal the location of these "*isolated*" areas. The analysis of the proposed action alternatives also predicts little improvement in soil conditions at existing sites, and environmental damage at construction sites:

> *Additional watering sites in selected grazing allotments within the project area are anticipated to improve livestock and wildlife distribution. Improvements <u>would not completely eliminate concentrated use</u> at existing watering locations.*

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[76]Luna FEIS at 199.

[77] Luna Draft ROD at 5.

[78] Luna FEIS at 29.

[79] Luna FEIS at 115 ("*Water quality impairments have been identified by the State as a result of rangeland grazing with some of the probable causes of impairment notes as sedimentation or siltation and temperature. These causes can be both a direct and indirect result of inadequate woody and herbaceous vegetation, both in <u>uplands</u> and on streambanks*.") (emphasis added).

[80] Luna FEIS at 118 (emphasis added).

> *At new sites, some soil compaction and loss of herbaceous vegetation is likely to occur.*[81]

Similarly, the FEIS also downplays the benefit, if any, to water quality and quantity from the range developments:

> *In watering locations where the water source is spring fed, less [livestock grazing] pressure on these springs may occur. The proposed treatments, however, do not provide fencing any of these areas, but rather provide alternate water sources to reduce pressure. This may relieve some water quality and quantity impacts; however, they may not be measurable. Effects to water quality and quantity are expected to improve slightly or not at all under all action alternatives.*[82]

The FEIS thus concludes that the new water developments may provide little or no benefit to existing springs, at least in part because the Forest Service has declined to protect those springs with permanent fencing.

As a whole, the FEIS contains vague, unsubstantiated claims concerning the alleged benefits of livestock distribution that the developments may or may not promote, and does so without any site-specific, or allotment specific, analysis. This violates NEPA, particularly when the record before the agency rebuts claims of environmental benefit.

The FEIS's claims concerning the alleged benefits are also contradicted by the best available science, which shows little benefit, and some harm, is likely to occur from additional range developments. Riparian areas do more than provide water. They also provide food, shade, and cooler temperatures to livestock. A number of studies conclude that providing artificial water in uplands does little to lure livestock away from riparian areas.[83] To comply with NEPA, the

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[81] Luna FEIS at 120 (emphasis added).

[82] Luna FEIS at 135 (emphasis added).

[83] *See* L.D. Bryant, *Response of Livestock to Riparian Zone Exclusion*, Journal of Range Management, Vol. 35, No. 6 (Nov. 1982), pp. 780-785 (concluding that "Neither salt placement nor alternate water location away from the riparian zone influenced livestock distribution appreciably."). *See also* J. Carter et al. *Upland Water and Deferred Rotation Effects on Cattle Use in Riparian and Upland Areas*, Rangelands, Vol. 39 (2017), 112, 117 (concluding, based on a four year study of an allotment in Utah that "Upland water developments and supplements do not overcome the propensity of cattle to linger in riparian areas, resulting in overgrazing and stream damage, and therefore do not lead to recovery of these damaged systems."); R.L. Gillen, Cattle Distribution on Mountain Rangeland in Northeastern Oregon, Journal Of Range Management 37(6), November 1964, pp. 549-53 ("Water distribution was not correlated with grazing patterns in uplan[d] plant communities.").

Failure to address this scientific literature would constitute a separate NEPA violation. *See* 40 C.F.R. § 1502.9(b) (requiring that each final EIS respond to "any responsible opposing view which was not adequately discussed in the draft statement."); *Ctr. for Biological Diversity v. U.S. Forest Serv*., 349 F.3d 1157, 1168 (9th Cir. 2003) (finding Forest Service's failure to disclose and respond to evidence and opinions challenging EIS's scientific assumptions violated NEPA); *Seattle Audubon Soc'y v. Moseley*, 798 F. Supp. 1473, 1482 (W.D. Wash. 1992) ("The agency's explanation is insufficient under NEPA – not because experts disagree, but because the FEIS lacks reasoned discussion of major scientific objections."), aff'd sub nom. *Seattle Audubon Soc'y v. Espy*, 998 F.2d 699, 704 (9th

Forest Service must address this science, and disclose what science the agency relies on to conclude that water developments will actually impact livestock utilization of currently un-grazed areas.

But even if the proposed action will achieve the purpose and need of increasing the distribution of livestock, because cattle will leave currently grazed areas to move onto now-lightly grazed lands with new water developments, that action will have environmental consequences that the FEIS fails to disclose. A wealth of scientific literature confirms that livestock grazing (and the roads, fences, water developments, and predator eradication that come with it) harms riparian areas, consumes vegetation used by native wildlife, fouls water, causes erosion, and significantly damages natural resource values in a plethora of ways.[84] All of these impacts are likely to occur on the lands adjacent to new water developments should those developments result in attracting more livestock presence there.[85] In a landscape where livestock are nearly ubiquitous, upland sites where grazing is currently precluded or limited by water scarcity are often the only places where relatively undisturbed, native vegetation can be found. Historically, the provision of livestock water to such sites has caused livestock to degrade upland soils, vegetation, wildlife habitat, scenery, and aesthetic qualities.[86] These impacts have led many to call the lands near water developments "sacrifice areas."

Many the of water developments may require altering hydrology, and water flow and volume on some parts of the forest by either requiring water to be piped from areas where it may already be providing habitat to wildlife and plants, or altering the hydrology by creating structures that will limit the down-gradient flow of water. The 11 new wells will lower the water table, which may impact springs that are recharged via groundwater. For the other structures – storage tanks, drinkers, trick tanks, and pipelines, we could locate no information in the FEIS disclosing the source of the water serving those facilities. Removing water from its natural source will have impacts.

While the FEIS states that each water structure will require application to the State of New Mexico for a water right that fails to address in any way environmental damage. In response to a comment submitted by the Center, the FEIS states:

Cir. 1993) ("[i]t would not further NEPA's aims for environmental protection to allow the Forest Service to ignore reputable scientific criticisms that have surfaced").

[84] *See, e.g.*, Lynn B. Jacobs, *Waste of the West: Public Lands Ranching* (1991); Thomas Fleischner, *Ecological Costs of Livestock Grazing in Western North America*, Conservation Biology, Volume 8, No. 3 (Sep. 1994), pp. 629-644; Joseph M. Feller, *What Is Wrong with the BLM's Management of Livestock Grazing on the Public Lands?*, 30 Idaho L. Rev. 556, 560-563 (1993).

[85] The U.S. Fish & Wildlife Service has identified the development of livestock waters in previously ungrazed areas as a major factor contributing to the decline to the decline of the desert tortoise, which is now listed as a threatened species. *See* 55 Fed. Reg, 12,178, 12,181, 12,185 (1990).

[86] *See, e.g.*, Laurence A. Stoddart, et al., *Range Management*, Third Edition (1975) (concentration of livestock at water sources on arid rangelands causes severely denuded areas); Joan E. Scott, *Do Livestock Waters Help Wildlife?*, in Environmental, Economic, and Legal Issues Related to Rangeland Water Developments, Proceedings of a Symposium (1997), pp. 493-507.

> *All water developments within the Gila/San Francisco River and Little Colorado River basins must be approved by the New Mexico Office of the State Engineer who ensures the development is without detriment to existing surface water rights or impairment to existing ground water rights*.[87]

But ensuring a senior water right is about protecting a more senior, down-stream water right holder's access to water. It says nothing about whether reducing flows in the watershed will damage other values besides water rights. Removing water from riparian areas to pipe to new water developments, drilling for groundwater that may feed seeps elsewhere, or altering hydrology upstream clearly has the potential to alter local hydrological processes, and thus harm the flora and fauna that rely on them. The FEIS fails to take the hard look at these impacts, violating NEPA.

The FEIS contains no analysis of impacts to recreation or scenic values (caused by copious feces and urine and flies caused by congregating livestock; creation of de facto sacrifice zones; creation of obviously altered landscapes with fences, pipelines, etc.).

The FEIS also fails to address the financial or other costs to taxpayers (if any) of constructing the range developments. Because the developments are likely to have little if any ecological value, the added potential cost to the taxpayer may demonstrate to the public and/or the decisionmaker that the costs of these developments far outweighs the benefit. The Forest Service's failure to include the potential financial costs of the more than 50 developments violates NEPA's hard look mandate. Further, the Forest Service does not state whether the Forest Service or the livestock permit-holder will hold water rights to the water provided by the new facilities.

> *Suggested Remedy*: The Forest Service must either: (1) prepare new or supplemental NEPA analysis that takes the required hard look at the environmental, recreational, and financial impacts of range developments; or (2) remove the fence, pipeline, and water development proposals from the final Record of Decision.

C. The Forest Service Must Analyze a Range of Reasonable Alternatives re: Range Developments.

The Center's comments on the DEIS urged the Forest Service to analyze reasonable alternatives to building each and every one of the 50+ proposed livestock developments.[88] The FEIS fails to do so.

As noted elsewhere, NEPA requires the Forest Service to analyze a range of reasonable alternatives in every EIS.[89]

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[87] Luna FEIS at 199.

[88] *See* Letter from Joe Trudeau (Center for Biological Diversity) to Emily Irwin, October 17, 2017 at 11-12.

As noted above, the purpose of "[d]*eveloping waters*" is not simply to construct new developments, but "*to improve livestock and water distribution*."[90] Therefore, an alternative that improves livestock distribution and protects existing waters would meet this part of the project's purpose and need.

The FEIS itself suggests alternative means to limit the degradation caused by livestock on riparian areas and to ensure broader livestock distribution. In analyzing the potential for synergistic impacts of logging and livestock grazing on wildlife habitat, the FEIS states: "*Adaptive management actions that may occur to mitigate [such] effects include adjustments in pasture rotation schedules, herding, salting and reduced numbers*."[91] If pasture rotation, herding, and salting can be used to mitigate the impacts of logging treatments on range resources, surely these techniques can be used to improve livestock distribution and better protect areas around existing waters. There are many other ways to improve livestock distribution and to limit the damage to riparian areas, including:

- Reducing the number of livestock.
- Permanently fencing livestock out of riparian areas.
- Closing allotments.
- Resting allotments.

The FEIS fails to address any of these alternatives. Nor does the FEIS explain why it could not limit the damage of these developments by constructing half as many developments, or building them only on the allotments with the most severe impacts from poor livestock distribution but not on other allotments. These would be reasonable alternatives as well. However, here the Forest Service took an "all or nothing" approach, with all three actions alternatives proposing to construct all 50+ developments, while the no action alternative looked at building none. Federal courts routinely find that agency that fail to consider reasonable middle-ground alternatives violate NEPA.[92] It would be odd indeed if the precise 50+ developments at the precise locations in the precise same allotments was *only* reasonable way for the Forest Service to improve livestock distribution.

The Forest Service may assert that it cannot consider such alternatives because the agency pledged not to engage in allotment management planning for this decision. The FEIS states that

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[90] Luna FEIS at 15. *See also* FEIS at 27 (proposed action would add new improvements "*to increase livestock and wildlife distribution to benefit rangeland conditions, including watershed, soils, and stream resources*."); Draft ROD at 14 ("*to increase livestock and wildlife distribution that would benefit rangeland conditions, including watershed, soils, and stream resources…. The improvements would enhance livestock distribution, forage utilization and management flexibility*.").

[91] Luna FEIS at 146 (emphasis added).

[92] See, e.g., *Wilderness Soc'y v. Wisely*, 524 F. Supp. 2d 1285, 1312 (D. Colo. 2007) (striking down BLM NEPA analysis where agency failed to analyze in detail "*a potentially appealing middle-ground compromise between the absolutism of the outright leasing and no action alternatives*.")

"[t]*his proposal would not alter the management (livestock kind, class, number or season of use) or desired conditions outlined in each allotment's corresponding grazing analysis*."[93] But the Forest Service cannot have it both ways. It cannot say that it will not "*alter the management*" of grazing allotments and then propose a series of actions designed to change the way grazing is managed. If it chooses to propose changing livestock grazing distribution by allowing a massive increase in range developments to improve grazing management, it must analyze alternatives that could provide similar results without such construction. The agency's failure to do so here violated NEPA.

> Suggested Remedy: The Forest Service must either: (1) prepare new or supplemental NEPA document analyzing a range of alternatives to address increased distribution of livestock; or (2) remove the fence, pipeline, and water development proposals from the final Record of Decision.

D. The Forest Service should expand and make permanent riparian exclosures.

In the Center's comments on the DEIS we reviewed the benefits of livestock removal to upland grassland, shrub and woodland vegetation, including

• An example of where cattle from rangelands for 35 years led to the disappearance of rabbitbrush from previously shrub-dominated communities - and native grasses regained dominance;[94]

• An example of where Forest Service scientists at the Intermountain Forest and Range Experiment Station found that protection of an Idaho range from grazing increased grass and forb production by 30% and decreased shrub production by 20%.[95]

• An example of where University of Idaho range scientists documented a 20-fold increase in perennial grass cover after 25 years of grazing exclusion while shrub cover only increased by 1.5-fold, attributing the grass response to "*the availability of seeds as formerly depleted populations increase in size*."[96]

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[93] Luna FEIS at 27.

[94] Austin, D.D., and P.J. Urness. 1998. Vegetal change on a northern Utah foothill range in the absence of livestock grazing between 1948 and 1982. *Great Basin Naturalist* 58(2): 188-191.

[95] Laycock, W.A. 1967. How heavy grazing and protection affect sagebrush-grass ranges. *Journal of Range Management* 20: 206-213.

[96] Anderson, J.E., and K.E. Holte. 1981. Vegetation development over 25 years without grazing on sagebrush-dominated rangeland in southeastern Idaho. *Journal of Range Management* 34:25-29.

• An example of where in a southeastern Arizona rangeland excluded from cattle grazing for 14 years, grass cover was 45% higher, the grass community was more heterogeneous, herb cover was higher, and rodent and bird numbers were higher than grazed comparison areas.[97]

In violation of NEPA, the FEIS does not address any of this scientific information.

As with upland habitats, the scientific literature documenting the impacts of livestock grazing on aquatic and riparian habitats in the Southwest is extensive and universally shows severe and lasting negative impacts such that near complete exclusion of cattle is widely accepted as the only means of preserving stream health.[98]

The FEIS concurs with this notion in the assertion that riparian exclosures will have benefits to water, wildlife, and vegetation. "*By alleviated grazing pressure within these areas, it will provide a needed period of rest and recovery for riparian woody and herbaceous vegetation to grow, upland vegetation to recover, and stream banks to stabilize. These restoration efforts, combined, will aid in reversing erosion, lack of ground cover, and destabilized channels. Riparian areas, wetlands, and wet meadows will benefit over the long term. It will likely take several years for these improvements to be realized*."[99]

Livestock grazing has both direct and indirect effects on streams. Livestock directly affect riparian habitats through removal of riparian vegetation[100] which in turn raises water temperatures, reduces bank stability and eliminates an important structural component of the stream environment that contributes to the formation of pools,[101] and by physically altering

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[97] Bock, C.E., J.H. Bock, W.R. Kenney, and V.M. Hawthorne. 1984. Responses of birds, rodents, and vegetation to livestock exclosure in a semidesert grassland site. *Journal of Range Management* 37(3): 239-242.

[98] See Fleischner, T. L. 1994. Ecological costs of livestock grazing in western North America.

Conservation Biology 8(3): 629-644; Ohmart, R. D. 1996. Historical and present impacts of livestock grazing on fish and wildlife resources in western riparian habitats. Rangeland Wildlife. P. R. Krausman. Denver, CO, Society for Range Management; and Belsky, A. J., A. Matzke, and S. Uselman. 1999. Survey of livestock influences on stream and riparian ecosystems in the western United States. *Journal of Soil and Water Conservation* 54(1):419-431.

[99] Luna FEIS at 126.

[100] See Clary, W. P., B. F. Webster. 1989. Managing grazing of riparian areas in the Intermountain Region. USDA Forest Service; Clary, W. P., D. E. Medin. 1990. Differences in vegetation biomass and structure due to cattle grazing in a northern Nevada riparian ecosystem. USDA Forest Service; Schulz, T. T., and W.C. Leininger. 1990. Differences in riparian vegetation structure between grazed areas and exclosures. *Journal of Range Management* 43(4): 295-299; and Armour, C. L., D. A. Duff, and W. Elmore. 1991. The effects of livestock grazing on riparian and stream ecosystems. *Fisheries* 16(1):7-11.

[101] See Meehan, W. R., F.J. Swanson, and J.R. Sedell. 1977. Influences of riparian vegetation on aquatic ecosystems with particular reference to salmonid fishes and their food supply. USDA Forest Service; Kauffman, J. B., W. C. Krueger. 1984. Livestock impacts on riparian plant communities and streamside management implications. A review. *Journal of Range Management* 37(5): 430-438; Minckley, W.L., and J.N. Rinne. 1985. Large woody debris in hot-desert streams: an historical review. *Desert Plants* 7(3):142-153; and Platts, W. S. 1990. Managing fisheries and wildlife on rangelands grazed by livestock: A guidance and reference document for biologists, unpublished document, Nevada Department of Wildlife.

streambanks through trampling and shearing, leading to bank erosion.[102] Livestock also indirectly impact aquatic and riparian habitats by compacting soils, altering soil chemistry and reducing vegetation cover in upland areas, leading to increased severity of floods and sediment loading, lower water tables and altered channel morphology.[103] These processes are all on full display in the riparian areas on the Luna landscape that are currently grazed by livestock.

Clearly, livestock negatively impact riparian and aquatic ecosystems. The projects inclusion of riparian exclosure fence could in effect accomplish the purpose "*to create and maintain a healthy resilient landscape and watersheds capable of delivering benefits to the public, including clean air and water, habitat for native fish and wildlife, forest products, and outdoor recreation opportunities*,"[104] however, the Forest Service does not intend for the exclosure fencing to be permanent,[105] stating frankly that "[T]*hese are temporary exclosures and are not meant to permanently exclude livestock and wildlife from riparian areas*"[106] calling into question the ability of the project to "*protect and restore threatened and endangered species and habitats*" and "*improve rangeland, wildlife, aquatic and riparian habitat*"[107] in the long term.

Does the Forest Service have any evidence to prove that temporary exclosures are effective at restoring aquatic and riparian ecosystems for the life of the project, at a minimum?

The FEIS provides no evidence or studies, and we are aware of none, that riparian areas will somehow be protected from livestock grazing impacts once exclosures are removed. When cattle

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[102] See Armour, C.L. 1977. Effects of deteriorated range streams on trout. U.S. Bureau of Land Management, Boise, ID. 7 pp; Platts, W.S., and R.L. Nelson. 1985. Stream habitat and fisheries response to livestock grazing and instream improvement structures, Big Creek, Utah. *Journal of Soil and Water Conservation* 40(4):374-379; and Trimble, S.W., and A.C. Mendel. 1995. The cow as a geomorphic agent - a critical review. *Geomorphology* 13(1995):233-253.

[103] See Cooperrider, C. K. and B. A. Hendricks. 1937. Soil erosion and streamflow on range and forest lands of the upper Rio Grande watershed in relation to land resources and human welfare, USDA Technical Bulletin 567; Sartz, R. S., and D.N. Tolsted. 1974. Effect of grazing on runoff from two small watersheds in southwestern Wisconsin. *Water Resources Research* 10(2): 354-356; Gifford, G. F., R. H. Hawkins. 1978. Hydrologic impact of grazing on infiltration: a critical review. *Water Resources Research* 14: 305-313; Blackburn, W. H., R. W. Knight, M.K. Wood. 1982. Impacts of grazing on watersheds: a state of knowledge. College Station, Texas, Texas Agricultural Experiment Station, Texas A&M University; Orodho, A.B., M.J. Trlica, and C.D. Bonham. 1990. Long-term heavy-grazing effects on soil and vegetation in the four corners region. *The Southwestern Naturalist* 35(1):9-15; Schlesinger, W.H., J.R. Reynolds, G.L. Cunningham, L.F. Huenneke, W.M. Jarrell, R.A. Virginia, and W.G. Whitford. 1990. Biological feedbacks in global desertification. Science 246:1043-1048; and Elmore, W., and B. Kauffman. 1994. Riparian and watershed systems: degradation and restoration. Pp 212-231 in M. Vavra, W. A. Laycock, and R. D. Pieper, editors. Ecological implications of livestock herbivory in the west. Society for Range Management, Denver, CO.

[104] Luna FEIS at i.

[105] See Luna FEIS at 33 ("exclosure[s] could be relocated"); Luna FEIS at 38 (exclosure "[m]odifications include such things as expanding, moving, reducing, or removal");

[106] FEIS at 200 and 201.

[107] Luna FEIS at 14.

can again access riparian areas, they will again consume, trample, and defecate and urinate, and cause erosion and sedimentation in that habitat. The FEIS's conclusions are thus arbitrary and capricious and violate NEPA because they are not supported by, and in fact contradict, the best available science.

Because of the severity and broad array of these impacts, livestock grazing is one of the most prevalent causes of species being federally listed in this region, and has documented negative impacts on the species discussed in this section, all of which are specifically dependent on aquatic and riparian habitat:

> *Southwestern willow flycatcher*: Listed as endangered February 27, 1995 (60 Fed. Reg. 10695); final critical habitat January 3, 2013 (78 Fed. Reg. 343);[108]
>
> *Loach minnow and spikedace*: Uplisted to endangered February 23, 2012 (77 Fed. Reg. 10810); final critical habitat February 23, 2012 (77 Fed. Reg. 10810);[109]
>
> *Northern Mexican garter snake and narrow-headed garter snake*: Listed as threatened July 8, 2014 (79 Fed. Reg. 38677); proposed critical habitat July 10, 2013 (78 Fed. Reg. 41549).[110]

The Forest Service has already proven that it struggles with ensuring livestock remain excluded from sensitive riparian areas, especially those which contain habitat for federally listed species. In a past settlement, the Forest Service was tasked with excluding livestock from 99% of riparian areas on 57 allotments in Arizona and New Mexico, including the Luna Allotment, yet a recent survey concluded that there are still livestock damaging the riparian areas therein at severe levels.[111] Comments on the Luna DEIS submitted by the New Mexico Department of Game and Fish stated that "*during the field visit, Department and Quemado Ranger District staff observed multiple impaired riparian and aquatic habitats across the planning area*," and specifically identified the need to exclude livestock from sensitive riparian areas such as Adair Springs.[112]

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[108] *See* 60 Fed. Reg. at 10707 ("Overuse by livestock has been a major factor in the degradation and modification of riparian habitats in the United States … Livestock grazing in riparian habitats typically results in reduction of plant species diversity and density, especially of palatable plants like willow and cottonwood saplings.")

[109] *See* 77 Fed. Reg. at 10,818)("Impacts associated with roads and bridges, changes in water quality, improper livestock grazing, and recreation have altered or destroyed many of the rivers, streams, and watershed functions in the ranges of the spikedace and loach minnow.").

[110] *See* 79 Fed. Reg. at 38718 ("We found numerous effects of livestock grazing that have resulted in the historical degradation of riparian and aquatic communities that have likely affected northern Mexican and narrow-headed gartersnakes.")

[111] See "Rapid Assessment of Cattle Impacts in Riparian Exclosures on the Gila National Forest" submitted to the Gila National Forest, March 2018.

[112] Luna FEIS at 216.

Of much concern is that the FEIS incorrectly addresses our comments on exclosure fencing. In the Response to Comments section of the FEIS, the Forest Service claims that the Center was "*Concern*[ed] *that riparian exclosures may affect southwestern willow flycatcher, loach minnow, narrow-headed garter snake, northern Mexican gartersnake (CBD-27), and beaver. (WEG-14).*[113]

The Forest Service response states that the Center was concerned with how exclosures would affect the species listed. This misrepresents our concern. Our full comments on the DEIS, specific to this issue, were:

"*Bank full width is a primary indicator of channel function, and directly related to fish habitat quality, water quality, and channel stability.*[114] *Livestock grazing degrades water quality in several ways, including by widening channels due to bank damage from trampling and sedimentation, leading to elevated water temperature via the loss and suppression of riparian vegetation that provides stream shade.*[115/116] *Trampling impacts are often substantial even in the absence of shade loss.*[117] *This is a serious impact because elevated water temperature adversely affects numerous aquatic species, including those which occur in this project area such as southwestern willow flycatcher, loach minnow, narrow-headed garter snake, and northern Mexican gartersnake. Stream restoration actions taken under the Luna project will not be successful if these issues are not comprehensively addressed in the EIS. How do the proposed exclosures address these issues*?"[118]

We specifically asked the FS how proposed *temporary* exclosures addressed the impacts of grazing on riparian and aquatic systems, including bank full width, water quality, channel stability, trampling, sedimentation, and water temperature. We did not express any concern that exclosures would negatively affect native, imperiled species.

To reiterate, we specifically stated that "... *elevated water temperature adversely affects numerous aquatic species, including those which occur in this project area such as southwestern*

[113] Luna FEIS at 201.

[114] Dalldorf, K.N., S.R. Swanson, D.F. Kozlowski, K.M. Schmidt, R.S. Shane, and G. Fernandez. 2013. Influence of livestock grazing strategies on riparian response to wildfire in northern Nevada. *Rangeland Ecology and Management* 66: 34-42.

[115] Kondolf, G. Mathias, Richard Kattelmann, Michael Embury, and Don C. Erman. 1996. Status of riparian habitat. Sierra Nevada Ecosystem Project: Final report to Congress, Volume 2

[116] Beschta, R.L., D.L. Donahue, D.A. DellaSala, J.J. Rhodes, J.R. Karr, M.H. O'Brien, T.L. Fleischner and C.D. Williams. 2013. Adapting to climate change on western public lands: addressing the ecological effects of domestic, wild, and feral ungulates. *Environmental Management* 51: 474-91.

[117] Rhodes, J.J., D.A. McCullough, and F.A Espinosa, Jr. 1994. A coarse screening process of the effects of land management on salmon spawning and rearing habitat in ESA consultations. Technical Report 94-4. Columbia River Inter-Tribal Fish Commission. Portland, Oregon. Report prepared for National Marine Fisheries Service.

[118] Center Comments on the DEIS at 23.

willow flycatcher, loach minnow, narrow-headed garter snake, and northern Mexican gartersnake." That the Forest Service response was that "[e]*xclosures are not proposed in loach minnow, narrow-headed gartersnake, nor northern Mexican gartersnake habitat*"[119] proves that the project design will have little benefit to these species which are impacted by livestock grazing in their critical habitats. Further, the Forest Service's failure to respond to the comment actually submitted violates NEPA.[120]

> Suggested Remedy: The Forest Service must either: (1) prepare new or supplemental NEPA analysis that takes the required hard look at the effectiveness of temporary riparian exclosures on restoring riparian habitats used by listed species occurring in the project area, including but not limited to southwestern willow flycatcher, loach minnow, spikedace, narrow-headed garter snake, and northern Mexican gartersnake; or (2) increase the extent of exclosures such that they encompass habitats for all listed species occurring in the project area, and make the exclosures permanent in their exclusion of domestic livestock.

III. The Draft EIS Fails to Take a Hard Look at the Impacts of Herbicides

We oppose the use of herbicides in this project in all areas except for the treating of juniper stumps within a ¼ mile buffer around private property as part of Wildland Urban Interface treatments. In our comments on the Draft EIS we extensively reviewed the literature on herbicides, rabbitbrush, and the effects of livestock grazing on rabbitbrush persistence in rangelands. The FEIS fails to address the numerous questions we asked about this issue, and it fails to address the vast scientific evidence that without reducing grazing, rabbitbrush will continue to proliferate. Despite the Center providing a compelling critique of the Forest Service's proposal in the Draft EIS, the FEIS has not reduced the extent of the herbicide use area by a single acre.

In the Luna FEIS, the Forest Service provides no real answer to our concern that "*there is no evidence linking chemical treatment of rabbitbrush & juniper to improve biodiversity, grassland health, or improvement in watershed condition*."[121] The Forest Service response fails to address the scientific literature demonstrating that livestock overgrazing is directly responsible for the rabbitbrush density on the landscape. As we note elsewhere in this Objection, the failure to address this scientific literature is an independent NEPA violation.[122]

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[119] Luna FEIS at 201.

[120] *See* 40 C.F.R. 1503.4(a) ("An agency preparing a final environmental impact statement shall assess and consider comments both individually and collectively, and shall respond ... stating its response in the final statement.").

[121] See FEIS at 205.

[122] *See* 40 C.F.R. § 1502.9(b) (requiring that each final EIS respond to "any responsible opposing view which was not adequately discussed in the draft statement."); *Ctr. for Biological Diversity v. U.S. Forest Serv*., 349 F.3d 1157, 1168 (9th Cir. 2003) (finding Forest Service's failure to disclose and respond to evidence and opinions challenging EIS's scientific assumptions violated NEPA); *Seattle Audubon Soc'y v. Moseley*, 798 F. Supp. 1473, 1482 (W.D. Wash. 1992) ("The agency's explanation is insufficient under NEPA – not because experts disagree, but because the

The benefits of the herbicide use described by the EIS are greatly outweighed by the harms. As a threshold matter, the Draft EIS fails to take a hard look at the actual impacts of herbicide use in the Luna project. The FEIS fails to take a hard look at the impacts of herbicide use on ESA listed animals, relying on statements that herbicide use will not take places on sites where these species are present. While the Forest Service may have staff that can identify the habitats which are to be buffered and avoided, it is entirely possible, and perhaps even likely, that the third parties who actually do the herbicide application would not be able to identify these habitats, despite being licensed applicators.

An example of a key issue area that was overlooked is the impact of herbicide use on non-target species. Starting with pollinators, the FEIS fails to give any consideration to the impacts of herbicide use on pollinators. New Mexico boasts over 500 native bee species, yet this FEIS fails to consider the impacts of herbicide use on native bees or even mention them at all. The vast majority of native bee species are cavity or ground nesting, thus the preferred alternative would result in these remarkable, and in many cases imperiled species, creating nests and leaving their eggs to hatch in sites where herbicides have been used. Herbicide use in these sites could lead to the failure of brooding sites for years to come. In addition, many native bees and pollinators are incredibly specialized and do not travel more than a couple hundred yards, thus the killing or even disturbance of a small patch of plants via herbicide could have significant impacts on an important population.[123] Herbicide use is a leading cause of the decline of butterflies, and other pollinator species, because of its impacts to the floral resources they rely on.[124] Many species of native bees and pollinators remain understudied and rely on federal public lands, but the use of herbicides proposed in the selected alternative could have significant impacts on these populations.

In addition to native pollinators, the FEIS fails to consider impacts to honeybees, which are of vital importance to agriculture. Recent peer reviewed and scientific studies have shown that herbicides interfere with the microbiomes, and subsequently the survival, of honeybees,[125] and presumably native bees, although this is not yet confirmed. However, this new and emerging body of research clearly indicates that herbicide use, once considered relatively benign for honey bees outside of the impacts to floral resources, has a more significant impact than previously considered.

The FEIS also fails to adequately consider the impacts of herbicide use on avian species, especially cavity nesting species that may use sites where herbicides would be used under the

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FEIS lacks reasoned discussion of major scientific objections.”), aff’d sub nom. *Seattle Audubon Soc’y v. Espy*, 998 F.2d 699, 704 (9th Cir. 1993) (“[i]t would not further NEPA’s aims for environmental protection to allow the Forest Service to ignore reputable scientific criticisms that have surfaced”).

[123] Kearns, C.A., D.W. Inouye, and N.M. Waser. 1998. Endangered mutualisms: The Conservation of Plant-Pollinator Interactions,. *Annual Review of Ecology and Systematics* 29(1): 83-112.

[124] *See e.g.,* Petition to List Monarch Butterfly, Center for Biological Diversity et al, 2014. https://www.biologicaldiversity.org/species/invertebrates/pdfs/Monarch_ESA_Petition.pdf

[125] Dai, P., Z. Yan, S. Ma, Y.Y. Qiang Wang, C. Hou, Y. Wu, Y. Liu, and Q. Diao. 2018. The Herbicide Glyphosate Negatively Affects Midgut Bacterial Communities and Survival of Honey Bee during Larvae Reared in Vitro. *Journal of Agricultural and Food Chemistry* 66(29):7786-7793. DOI: 10.1021/acs.jafc.8b02212

Draft Record of Decision. The analysis of impacts to the Mexican spotted owl relies on a series of expected future conditions to justify the impact that are uncertain and do not adequately justify the anticipated impacts. The same goes with the New Mexico meadow jumping mouse and other listed species.

The FEIS fails to take the required hard look at the impacts of herbicide use within municipal watersheds or near areas of human habitation. While the draft mentions that herbicide use will occur adjacent to private property, it summarily dismisses any potential impacts without addressing threshold issues such as the current USGS survey data on herbicide residues in area waterways and considering whether and how adding an additional herbicide burden to these waterways will affect plants, animals or human health.

The FEIS fails to take a hard look at the specific impacts of specific herbicides. One herbicide, aminocyclopyrachlor, was essentially banned in the state of Oregon because of its astoundingly severe impacts on native trees, specifically ponderosa pines on May 9, 2019.[126] This herbicide traveled further than anyone anticipated it could to kill 2000 ponderosa pines on Forest Service land in Central Oregon, including old growth trees.[127] The FEIS does not identify the herbicides which would be used, so we cannot be sure if the Forest Service is considering using a herbicide in restoration that has such severe environmental impacts the state of Oregon has had to ban it. This alone is the strongest possible indication that this FEIS fails to adequately consider the impacts of herbicide use.

All herbicides have a significant risk of non-target impacts, all of them behave differently and create different risks, they have different half-lives and modes of action and drift risks, and yet the FEIS just lists them without taking a hard look at any of them. An EIS simply cannot consider the impacts of herbicide use when it does not even include all the herbicides by name. Referring to a nearly 20 year old analysis of noxious weed herbicides does not satisfy this requirement to take a "*hard look,*" as abundant new information has been published since the environmental assessment for noxious weed management on the Gila National Forest (USDA Forest Service 2000a). Furthermore, it must be noted that the EPA has never completed ESA consultation on any of these herbicides and thus their impacts to non-target listed species cannot be described with any certainty. The EPA's systematic failure to engage in ESA consultation on herbicides is the subject matter of numerous lawsuits by the Center and others.

Herbicides can be ineffective and have substantial adverse effects. For example, herbicides often do not kill whole plants but do cause leaves to whither, giving the appearance of an invasive species treatment being effective for a couple weeks, until the crew has left the area, the plant recovers and starts putting on leaves once more.

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[126] Oregon Rule 603-057-0392, available at https://www.oregon.gov/ODA/programs/Herbicides/RegulatoryIssues/Documents/Documents/2019/ACPPermanentRule.pdf (last viewed May 13, 2019).

[127] Emily Cureton, Oregon Becomes 1st State To Sharply Restrict Herbicide Linked To Tree Deaths, Oregon Public Broadcasting (May 10, 2019), available at https://www.opb.org/news/article/oregon-herbicide-restriction-aminocyclopyrachlor-perspective-acp-sisters/ (last viewed May 13, 2019).

Of extreme concern is the apparent discretionary nature of the Design Features Specific to Herbicide Treatments wherein the FEIS states that "*The following design features and best management practices would be considered,*" and then lists nearly twenty design features. [128]

Does that mean the FS will "*consider*" providing adequate notification and posting appropriate signage when applying near private lands?

Does that mean the FS will "*consider*" avoiding applying chemicals before forecasted severe storm events to limit runoff and ensure the chemical reaches intended targets?

Does that mean the FS will "*consider*" identifying resource concerns and mitigations specific to the individual treatment area prior to herbicide application?

Sadly, the FEIS fails to ensure that <u>any</u> of the Design Features Specific to Herbicide Treatments are mandatory. The Forest Service, therefore, cannot conclude that any of these measures will mitigate the impacts of herbicide use.

Interestingly, the FEIS indicates that at least some of the monitoring plans would be created at the site-specific level after the NEPA process is complete, during project implementation, stating that:

"*Prior to implementation, an interdisciplinary team will develop a forestwide Vegetation Management Plan for herbicide treatments on rabbitbrush and alligator juniper. The plan would include such things as objectives, techniques, and monitoring elements as well as the design features identified in the environmental impact statement and appropriate best management practices, permitting, and handling of materials*."[129]

Does that mean the Forest Service will "*consider*" preparing a forest-wide plan? Or that the Forest Service will "*consider*" what the forest-wide plan has to say in implementing the project? And how can the Forest Service rely on a design feature to mitigate impacts when that feature hasn't been adopted yet in the forest-wide plan? Under the law, it cannot. A forest-wide plan for herbicide use on alligator juniper and rabbitbrush will require its own NEPA analysis, and any approval of herbicides for these uses prior to the creation of such a plan is not a valid approval.

> <u>*Suggested Remedy:*</u> The Forest Service should (1) issue a revised or supplemental EIS for public comment that (a) includes a thorough analysis of herbicides proposed for use, fully answering the questions raised by the Center in this section; and (b) analyzes an alternative for comparison that reduces livestock stocking in order to achieve the desired restoration of plant communities; or (2) issue a final record of decision that eliminates the use of all herbicides in the Luna project except for treating juniper stumps within ¼ mile of private property.

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[128] Luna FEIS at 23.

[129] Luna FEIS at 23.

IV. The Luna Project Fails to Sufficiently Protect Old Growth and Large Young Trees.

In 2006, a team of dedicated professionals representing industry, conservation organizations, land management agencies, and independent scientists collaboratively developed a framework document called the New Mexico Forest Restoration Principles[130]. Among those authors was staff from the Center for Biological Diversity. We stand by the agreements established in this document when we signed our names alongside those in the US Forest Service, Bureau of Land Management, and other partners in restoration.

These principles for restoration should be used as guidelines for project development and they represent the "zone of agreement" where controversy, delays, appeals, and litigation are significantly reduced. They are appropriate for application to specific restoration projects in the southwestern United States, and especially the Gila National Forest. Projects using these principles should be driven primarily by ecological objectives while promoting economic and social benefits.

Slowly, forest restoration treatments have shifted from an almost exclusive focus on hand thinning of small diameter ladder fuels to what we see now in the Luna Restoration Project: a return of widespread commercial logging of trees of nearly any size to move towards agency-established desired conditions.

Some of the eighteen Principles are being adhered to in the Luna Restoration Project. Notably, some significant Principles are not, especially regarding retention of old and large trees. The New Mexico Forest Restoration Principles clearly state that restoration projects should "*preserve old or large trees while maintaining structural diversity and resilience*."

We believe that forest restoration projects in the southwest are now generally moving in the wrong direction, with excessive emphasis on structural manipulation and insufficient attention to fire-driven ecological processes. So-called "restoration projects" such as Luna even cunningly devise ways to justify cutting old growth and trees up to 24" (and even larger).

Until the Forest Service created GTR-310, large and old tree retention has been a fundamental of Southwestern forest restoration. Past timber management destroyed nearly all ponderosa pine and mixed conifer old growth forest in Arizona and New Mexico, including on much of the Gila National Forest. Even-aged or simplified forest has replaced the complex forests of the pre-settlement southwestern landscape.[131,132]

As described in detail below, the FEIS has not committed to preserve old or large trees. Vague and ambiguous statements leave too much room for abuse and backsliding on good intentions.

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[130] Attached via email.

[131] Covington, W.W., and M.M. Moore. 1994. Southwestern ponderosa forest structure: Changes since Euro-American settlement. *Journal of Forestry* 92: 39-47.

[132] Sesnie, S. and J. Bailey. 2003. Using history to plan the future of old-growth ponderosa pine. *Journal of Forestry* 99(7) (Oct/Nov): 40-47.

An absolute restriction on old and large tree removal is consistent with decades of forest restoration literature, and is a simple way to avoid delays and litigation.

A. The Center Requested That the Luna Project Protect Old and Large Trees.

In a letter to the Forest Service, the Center asked that the Luna Project adopt "*agreements developed in the 4FRI stakeholders group that govern the protection of old and large trees, mature and old growth structure, treatments in stands infected with mistletoe, and monitoring of treatments in MSO habitats*."[133]

In a later letter providing comments on the Draft EIS, the Center "*again request[ed] that those project design features are incorporated into the Luna Restoration Project from the onset [including] management direction for "SPLYT" stands, mistletoe treatments, treatments within Mexican spotted owl goshawk habitat, the old and large tree retention strategy, and other 4FRI elements which we have submitted.*"[134]

Elsewhere in that same letter the Center states that it was "*discouraging to not see any protections for old and large trees or a clearly listed section on best management practices for logging operations, because as we established in our scoping letter, the retention of large trees will best meet the project purpose and need as it pertains to old growth, goshawk and MSO habitat, fire resiliency, and other aspects of forest restoration.*"[135]

The FEIS acknowledges that the Center did request that the Luna project "*incorporate the collaboratively developed products and design features from 4FRI,*" and responds by pointing to a "*Vegetation (Silviculture) Report … appendix 3 Luna Restoration Project Old and Large Tree Implementation Strategy*."[136] This report is not attached to FEIS, nor does it appear available online. Only nine hours before the objection deadline did the Forest Service provide to us this document, making it difficult to determine if and how the Luna Project will protect old and large trees. Thank you for getting these requested documents to us for review, albeit very late in the process.

The Forest Service's Old Tree Implementation Plan and FEIS show that the agency violated NEPA by:

- Failing to consider an alternative that fully protected old and large trees;
- Failing to provide a rational basis for not protecting old and large trees consistent with 4FRI and West Escudilla Restoration Project design criteria;

[133] Letter from Joe Trudeau (Center for Biological Diversity) to Emily Irwin, October 17, 2017.

[134] Letter from Joe Trudeau (Center for Biological Diversity) to Adam Mendonca, June 22, 2018.

[135] Ibid.

[136] FEIS at 201.

• Failing to make available to the public and the decisionmaker data required to understand the impacts of the project; and

• Failing to respond to expert reports provided in comments.

B. The FEIS Indicates That Old and Large Trees Will Not Be Protected

The Luna FEIS does not provide sufficient protections for old and large trees and old growth stands. The FEIS states that

"*treatments would be designed to retain old and young large trees whenever possible unless they must be cut for threats to human health, safety, and property, and where the removal of an old tree is necessary for forest health concerns (high populations of insect or severe disease), or where removal is needed to reduce tree density to achieve project desired conditions*."[137]

Allow us to interpret this statement into more clear realities:

This guidance makes it clear that old and large young trees will be retained "*whenever possible unless*"…

• They need to be removed to protect human property, which in the case of the Luna Project may mean any priority private lands covered under the Community Wildfire Protection Plan and considered as Wildland Urban Interface areas. This could also mean protection of powerlines which cross the project area;

• If they have high populations of insect or severe disease which likely includes bark beetles or mistletoe, both of which are naturally occurring disturbance agents. The neighboring West Escudilla Restoration Project has made the news[138] for intensive cutting of old growth trees because they had dwarf mistletoe.[139] The Luna FEIS does not provide any assurances that this approach to mistletoe sanitation will not occur on the Luna landscape.

• They stand in the way of achieving desired conditions like regeneration openings[140], interspaces, and other density reductions. Essentially, this flexibility means that no old or large young tree is safe from being removed if it is determined to prevent the silviculturalists from achieving desired density or spatial arrangement.

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137 FEIS at 9, emphasis added.

138 https://azdailysun.com/news/old-growth-trees-cut-in-violation-of-fri-mission/article_2628fe18-672d-5cf3-bbbf-8d1a1134fa36.html#tracking-source=home-top-story

139 See exhibit titled "Field Report - Little Timber Sale Old Growth Logging - CBD - 10.15.2018"

140 For example see FEIS at 20.

The FEIS does again affirm that old and large trees will be logged in the statement that "*Additional old and large trees* ***may*** *be retained when not in conflict with meeting the desired conditions for this project*."[141]

The FEIS directs the public to some form of old and large tree implementation plan which "*is located in the appendix 3 Luna Restoration Project Old and Large Tree Implementation Strategy of the vegetation report.*"[142] When we discovered that the project website did not contain this appendix, we attempted to acquire it, and other appendices, via emails to Lisa Mizuno, Environmental Coordinator and Emily Irwin, District Ranger[143]. Both individuals replied that the request had been forwarded to the FOIA Coordinator for processing.

As stated by the Center in one of those emails, "*The FEIS and Decision refer the reader to specialist reports numerous times, and these are not posted on the project website which many forests often do. This makes it difficult if not impossible for the public to understand the project and decision*." Only nine hours before the objection deadline did the Forest Service provide to us this document, making it difficult to determine if and how the Luna Project will protect old and large trees.

The FEIS directs the public to specialists' reports approximately twenty times, but these are not easily made available to the public for review. Of key interest to the Center is the vegetation (silviculture) report and appendices, as those contain important project elements such as the Luna Restoration Project Old and Large Tree Implementation Strategy. Requests for these essential documents have only been fulfilled nine hours prior to the deadline for this objection.

The Forest Service's reliance upon material omitted from the EIS to support the agency's failure to protect all large and old trees violates NEPA, its "*hard look*" standard, and the law's requirement that agencies provide for meaningful public participation. Federal courts have ruled that key data to support the agency's conclusion cannot be concealed from the public by placing it in the administrative record.[144]

> Suggested Remedy: The Forest Service should issue a revised EIS for public comment that includes at least a summary of the information contained in the silvicultural reports, and should post the appendices online for public review, rather than requiring the public to submit a FOIA request.

C. Best Science Recommends against Mistletoe-Infected Old Tree Removal

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141 FEIS at 20, emphasis added.

142 FEIS at 9.

143 Email correspondence from Ted Zukoski (Center for Biological Diversity) to Emily Irwin and Lisa Mizuno, July 2, 2019, and email correspondence from Joe Trudeau (Center for Biological Diversity) to Emily Irwin, July 3, 2019.

144 *See Blue Mountains Biodiversity Project v. Blackwood*, 161 F.3d 1208, 1214 (9th Cir. 1998) ("We do not find adequate support for the Forest Service's decision in its argument that the 3,000 page administrative record contains supporting data. The EA contains virtually no references to any material in support of or in opposition to its conclusions. That is where the Forest Service's defense of its position must be found.").

The FEIS states that even aged management will be used in areas of high insect or disease infestation.[145] This is the only place where "mistletoe" is mentioned in the entire FEIS. As stated above, the FEIS also states that old trees will be cut when necessary for forest health concerns such as high populations of insect or severe disease.[146] The FEIS states that "*Group selection of excess size classes and diseased patches would be used to regenerate 20 percent of the area*."[147]

In our scoping comments of October 16, 2017, we requested that Luna Project adopt "*agreements developed in the 4FRI stakeholders group that govern the protection of old and large trees, mature and old growth structure, treatments in stands infected with mistletoe, and monitoring of treatments in MSO habitats*."[148]

We included as an attachment the Centers objection letter to the West Escudilla Restoration Project wherein we requested that the project incorporate 4FRI stakeholder-developed treatment approaches for stands with occurrence of southwestern dwarf mistletoe. We also attached a 4FRI stakeholder's letter addressing the unanimous rejection of the Forest Service's proposals to utilize aggressive overstory removal and even-aged management approaches in treating stands infected with mistletoe. We then included these same attachments in our comments on the DEIS, submitted on June 20, 2018.[149]

The aforementioned 4FRI Stakeholders (SHG) letter of April 27, 2017, rejecting the Forest Service's dwarf mistletoe proposal for 4FRI stated:

• "*Dwarf mistletoe is a natural disturbance agent and component of coniferous forests within the planning area. The plant provides food and cover for wildlife; large-tree mortality caused by mistletoe is an important factor in recruiting snags that provide habitat for cavity-nesting birds and other species*."

• "*The historical and recent data presented by USFS did not make a compelling case that mistletoe infections within the planning area are significantly outside the natural range of variability and pose a meaningful obstacle to meeting restoration objectives*."

• "*The SHG feels that restoration treatments consisting of mechanical or hand thinning, followed by application of prescribed/managed fire at regular intervals, meet the intent of the Forest Plans and are the preferred approach for stands with high levels of mistletoe infection. Where needed, those stands could also be buffered to reduce mistletoe spread*."

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145 FEIS at 5.

146 FEIS at 9.

147 FEIS at 20.

148 Letter from Joe Trudeau (Center for Biological Diversity) to Emily Irwin, October 17, 2017.

149 These attachments are again included as an exhibit.

• "*The SHG also feels that traditional silvicultural approaches to managing dwarf mistletoe (e.g. overstory removal, even-aged management) are inconsistent with an ecological restoration approach and are not supported by the best available science*."

These four points are particularly relevant to the Luna landscape given its geographic proximity to the 4FRI landscape; however the FEIS failed to address or respond to these comments. The agency's failure to respond to these comments violates NEPA.[150] The FEIS does not provide baseline conditions of existing mistletoe (ponderosa pine or Douglas-fir) infection levels, therefore cannot have identified where even-aged sanitation cutting would occur, and as such cannot have analyzed the effects of treatments on the environment.

The FEIS's failure to address mistletoe treatments also violates NEPA's mandate that the action agency to set an appropriate baseline detailing the nature and extent of the resources in the area. CEQ regulations implementing NEPA state that agencies must, in an EIS, "*succinctly describe the environment of the area(s) to be affected or created by the alternative under consideration*."[151] "*The concept of a baseline against which to compare predictions of the effects of the proposed action and reasonable alternatives is critical to the NEPA process*."[152] "*Without establishing ... baseline conditions ... there is simply no way to determine what effect* [an action] *will have on the environment and, consequently, no way to comply with NEPA*."[153]

The FEIS also does not provide an alternative which treats mistletoe using restoration prescriptions focused on small diameter thinning for comparison to the current direction of even aged sanitation style logging. Failure to consider a reasonable alternative also violates NEPA.

In addition to not meeting the requirements of NEPA, the current direction of logging old growth if it has disease infection is contrary to restoration principles and does not follow the best available science.

One of the most often cited scientific articles on southwestern ponderosa pine restoration stated that a core ecological restoration principle is:

"*Retain trees of significant size or age.—Large and old trees, especially those established before ecosystem disruption by Euro-American settlement, are rare, important, and difficult to replace. Their size and structural complexity provide critical wildlife habitat by contributing crown cover, influencing understory vegetation patterns, and providing future snags. Ecological restoration should protect the largest and oldest trees from cutting and crown fires, focusing treatments on excess numbers of small young trees. Given widespread agreement on this point, it is generally advisable to retain ponderosa trees larger than 41 cm (16 inches) dbh and all trees*

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[150] *See* 40 C.F.R. 1503.4(a) ("An agency preparing a final environmental impact statement shall assess and consider comments both individually and collectively, and shall respond ... stating its response in the final statement.").

[151] 40 C.F.R. § 1502.15.

[152] *See* Council on Environmental Quality, *Considering Cumulative Effects under the National Environmental Policy Act* at 41 (January 1997).

[153] *Half Moon Bay Fishermans' Mktg. Ass'n v. Carlucci*, 857 F.2d 505, 510 (9th Cir. 1988).

with old-growth morphology regardless of size (i.e., yellow bark, large drooping limbs, twisted trunks, flattened tops)."[154]

A recent scientific review paper[155] stated that

"*Today's forests are deficient in large, old trees, which have unique structural characteristics and represent centuries of genetic diversity*" … and that "*Some old presettlement trees with mistletoe infestation are often targeted in traditional silvicultural techniques for the management of mistletoe. However, some of these trees should be retained for ecological value and because infection growth is slower in these larger old trees*."[156]

This ERI working paper provides a table (below) of recommended silvicultural prescriptions for three levels of dwarf mistletoe infection. It recommends that old trees are retained, and if the infection is severe, to defer mechanical thinning and use fire only. The Luna FEIS does not make clear that this best available science has been used in developing the projects approach to dwarf mistletoe.

Compatible Silvicultural Prescription

Light to Moderate DM infestation:

- Uneven-aged prescriptions that are relatively open, maintaining groups of presettlement trees (old trees) with interspaces and openings (40-80 ft between groups).
- Group selection with thinning in the matrix; Retain all presettlement trees and use interspaces and openings with intergroup spacing of 40-80 ft.
- Be flexible and take advantage of opportunities to leave size/age class diversity.
- Repeated entries with prescribed fire are necessary to maintain openings.

Moderate to Severe DM infestation:

- Even-aged management maintaining groups of presettlement trees and openings (40-80 ft between groups).
- Group selection with thinning between groups. Retain all presettlement trees and remove all blackjacks. Maintain openings and interspaces (40-80 ft between groups).
- Be flexible. If DM infestation is patchy, may need to divide up stand at treat accordingly. Take advantage of opportunities to leave size/age class diversity.
- Repeated entries with prescribed fire are necessary to maintain openings.

Severe DM infestation:

- Use of fire only. Severely infested stands may be deferred and allowed to burn or left as wildfire habitat.

<u>Suggested Remedy</u>: The Forest Service should prepare a revised EIS for public comment that: (1) includes data concerning the baseline condition of mistletoe in the forest in the project area; (2) responds to and incorporates the best available science concerning mistletoe as described in the 4FRI stakeholders letter and the ERI working paper; and (3) analyze in detail an alternative that treats mistletoe using restoration prescriptions

[154] Page 1425 in Allen, C.D. M.A. Savage, D.A. Falk, K.F. Suckling, T.W. Swetnam, T. Schulke, P.B. Stacey, P. Morgan, M. Hoffman, and J.T. Klingle. 2002. Ecological restoration of southwestern ponderosa pine ecosystems: A broad perspective. *Ecological Applications* 12(5): 1418-1433.

[155] Wasserman, T., and A.E.M. Waltz. 2018. Restoration as a Mechanism to Manage Southwestern Dwarf Mistletoe in Ponderosa Pine Forests. ERI Working Paper No. 39. Ecological Restoration Institute, Northern Arizona University. 11 pp.

[156] Ibid at 4.

focused on small diameter thinning for comparison to the proposed action of even aged sanitation style logging.

D. The FEIS Shows That Existing Conditions are Deficient in Old and Large Trees

The FEIS provides several forms of data which indicate that old and large trees are deficient on the Luna landscape, including tables containing data showing Stand Density Index, Vegetation Structural Stage, and Old Growth Management Areas. These data all confirm that there is a lack of old and large trees on the landscape within the project area and that current amounts are below desired conditions.

1. Stand Density Index Indicates Relative Deficiency of Mature Stands

Table 2[157] in the FEIS shows existing and desired stand density index for the Luna project area. While the FEIS is correct in stating that forested stands in zones 1, 3, and 4 are within the desired range and forested stands in zone 2 are slightly above the desired range, it does not consider what existing landscape percentages are in relation to desired landscape percentages. Looking closer, the data indicate a relative overabundance of generally open, regenerating, and low density forest compared to denser, mature forest. Table 2 illustrates that:

• Comprising 19% of the existing landscape, Zone 1 areas (most open, least inter-tree competition, maximum growth, minimum stand volume) nearly exceed the desired percentage of the landscape of 10-20%.

• Comprising 33% of the existing landscape, Zone 2 areas (moderately open, some inter-tree competition, and intermediate tree growth and stand volume) actually exceed the desired percentage of the landscape of 20-30%.

• Comprising 38% of the existing landscape, Zone 3 areas (mature, dense, maximum stand volume, slowing growth, and active inter-tree competition) is in the lower half of the range of desired percentage of the landscape of 30-50%.

• Comprising 10% of the existing landscape, Zone 4 areas (very dense, stagnated growth, high inter-tree competition, and mortality-related volume decline) is barely meets the desired percentage of the landscape of 10-20%, with ample room for expansion on the landscape.

• Zones 1 and 2 can be considered generally open stands, and currently occupy 52% of the landscape. This percentage of the landscape currently exceeds the desired range of 30-50% of the landscape.

• Zones 3 and 4 can be considered generally dense stands, and currently occupy 48% of the landscape. This percentage of the landscape is in the lower third of the desired range of 40-70% of the landscape.

[157] FEIS at 7.

Based on desired conditions listed in Table 2, the relative deficiency of generally dense stands compared to the overabundance of generally open stands supports a need to manage more areas "*for wildlife requiring higher tree densities and canopy cover, and promote development of old growth characteristics in areas designated as old growth*."[158] This condition is substantiated in the data shown in Table 4[159] where the existing portion of the landscape that is in Canopy Density Class C ("Closed") is just 60% of what is the desired condition for the landscape. Additionally, according to Table 6[160] the proportion of the landscape that is managed for old growth features lacks desired canopy cover in 66% of ponderosa pine areas and 57% of mixed-species areas.

2. Vegetation Structural Stage Proportions Indicate Relative Deficiency of Mature Stands

Table 3[161] shows convincingly that there is a dramatic deficit of stands of large, old trees, and a surplus of stands of small, young trees. Below, we have copied Table 3 and added a basic "takeaway message"

Vegetation Structural Stage (VSS)	Existing Condition (percent acres)	Desired Condition (percent acres)	Takeaway Message
VSS 1 (0.0–0.9")	22%	10%	Vast excess of areas of regeneration and areas in openings
VSS 2 (1.0–4.9")	Less than 1%	10%	Deficiency of stands of young trees
VSS 3 (5.0–11.9")	30%	20%	Excess of stands of small to medium trees
VSS 4 (12.0–17.9")	25%	20%	Excess of stands of medium trees
VSS 5 (18.0–23.9")	16%	20%	Lack of stands of large trees
VSS 6 (24" +)	8%	20%	Dramatic lack of stands of very large trees.

The "takeaway message" from current VSS class distributions shown in Table 3 is that there are enough openings of regeneration to grow in to fill the void in young stands, and that there are far too many dense stands of small to medium trees and in turn a complete lack of stands of large, old trees. Mature and old growth features and ecological processes develop in stands in the upper half of VSS 4 and VSS 5 and 6 classes. These maturing and old growth stands are deficient on the landscape, even in areas currently managed for old growth features. To support this

[158] FEIS at 7.

[159] FEIS at 8.

[160] FEIS at 10.

[161] FEIS at 8.

conclusion, see to Table 6[162] which shows that the proportion of the landscape that is managed for old growth features is deficient in large trees in 32% of ponderosa pine areas and 55% of mixed-species areas.

3. Data in the FEIS Indicate Deficiency in Large, Old Trees and Old Growth Stands

Based on current data presented in the FEIS in several tables, and evaluated here, the Luna landscape has:

- A deficit of large trees and overabundance of small trees (Table 3).
- A deficit of dense, closed-canopy stands and relative overabundance of open stands (Tables 2, 4 and 6).
- A deficit of VSS 5 and VSS 6 stands (trees over 18" DBH) (Table 3).
- A deficit of large trees, large snags, and closed canopy conditions in areas managed for old growth features (Table 6).

All of this information demonstrates that large and old trees are below target levels for the project area. This demonstrates that an alternative that protects large and old trees is reasonable, and indeed may be necessary to achieve desired future conditions.

> Suggested Remedy: The Forest Service should prepare a revised EIS for public comment that includes an alternative (or mitigation measure) that contains an unambiguous restriction on cutting any and all old growth trees (per the 4FRI Stakeholders group Old and Large Tree Retention Strategy), regardless of species, except in cases of direct physical threat to human life. This restriction should apply to Wildland Urban Interface thinning, severe insect infestation and disease infection, MSO and northern goshawk habitat, and the general landscape. The alternative or mitigation measure should include prescriptive guidance for Stands with a Preponderance of Large Young Trees (SPLYT) as well as the large tree retention strategy components developed and vetted by 4FRI stakeholders, and adopted by the Forest Service as the 4FRI Old Tree and Large Tree Implementation Plans. This information should be should be included in the revised EIS and not be segregated into an appendix. The commitment to not cutting old trees should be reiterated throughout the revised EIS to ensure clarity and unambiguity. The phrase "*the removal of an old tree is necessary for forest health concerns (high populations of insect or severe disease), or where removal is needed to reduce tree density to achieve project desired conditions,*" and any related form of this language, should be removed from the revised EIS. Failure to accommodate this remedy, and to adopt an alternative that contains such measures, would ensure that the Center cannot support this project as it will not be a true "Restoration" project.

[162] FEIS at 10.

4. The Luna FEIS Considers Old Tree Age Inconsistent with Regional Age Delineations.

Appendix 3 to the Silvicultural Report to the FEIS states that old trees in the ponderosa pine vegetation cover type are those over 180 years old[163] and that old trees will be retained based on this age.[164] This is inconsistent with restoration practice in the southwest, where old trees are generally considered those 150 years or older, including 4FRI, which we requested the incorporation of the 4FRI old tree retention strategy. Elsewhere in the southwest, old trees are considered those 150 years and older, including in the neighboring West Escudilla Project, where "*Old pre-European settlement trees (>150 years old) will be retained, with few exceptions, regardless of their diameter, within the West Escudilla project area. Removal of old trees will be rare. Exceptions will be made for threats to human safety, and severe disease*."[165] In addition, the West Escudilla Old Tree Implementation Plan states that old trees will be determined by the following characteristics described in Figure 1 of Appendix C[166].

- Age –150 years and older.
- DBH. – Site dependent.
- Bark – ranging from reddish brown, shading to black in the top with moderately large plates between the fissures to reddish brown to yellow, with very wide, long, and smooth plates.
- Tops – ranging from pyramidal or rounded (occasionally pointed) to flat (making no further height growth).
- Branching – ranging from upturned in upper third of the crown, horizontal in the middle third, and drooping in the lower third of the crown to mostly large, drooping, gnarled, or crooked. Branch whorls range from incomplete and indistinct except at the top to completely indistinct and incomplete.

The FEIS neither acknowledges nor explains the conflict between the definition it chooses and other Forest Service definitions.

<u>Suggested Remedy</u>: The Forest Service should prepare a revised EIS for public comment that includes an amendment to the Forest Plan that would classify old trees as those over 150 years, as well as replace the current Luna Old Tree Implementation Plan with the

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[163] Appendix 3 to the Vegetation and Silviculture Report at 1.

[164] The Center did not comment on this issue because the definition of old growth as 180 years old was not included in either the DEIS or the FEIS. It was included in Appendix 3 to the Vegetation and Silviculture Report, which was only made available to the Center today for the first time. See 36 C.F.R. § 218.8(c) (Objector may raise issue for the first time in the objection if "the issue is based on new information that arose after the opportunities for comment.").

[165] Appendix C to the West Escudilla Environmental Assessment at 77.

[166] Appendix C is included as an attachment to this objection.

4FRI Old Tree Implementation Plan. Addressing this inconsistency with a plan amendment is in line with the numerous amendments already being sought by the Forest Service.

CONCLUSION.

We appreciate your consideration of the information and concerns addressed in this objection, as well as the information included in the attachments which have been emailed to the project email address. Pursuant to 36 C.F.R. § 218.11, we respectfully request to meet with the reviewing officer to discuss these concerns and suggested resolutions. Should you have any questions, please do not hesitate to contact Mr. Trudeau at the number provided below.

Respectfully,

Joe Trudeau, Southwest Advocate
Center for Biological Diversity
PO Box 1013, Prescott, Arizona 86302
603.562.6226
jtrudeau@biologicaldiversity.org

http://www.4fri.org/

April 27, 2017

USFS 4FRI Chief Executive Scott Russell
sarussell@fs.fed.us

Re: 4FRI Stakeholder Group Position on Dwarf Mistletoe Treatments in the Rim Country EIS.

Dear Scott,

On April 5, 2017, members of the U.S. Forest Service (USFS) 4FRI ID Team gave a presentation to the 4FRI Planning Workgroup (PWG) on dwarf mistletoe concerns in the Rim Country EIS planning area. It included a review of the role of dwarf mistletoe in forest ecosystems, an assessment of historical and current mistletoe infection levels, and a proposal for aggressive, targeted treatments (aka "mitigation") in moderately to severely infected stands (>20% of area infected; up to 265,000 acres of the planning area under current Forest Plan direction). This "mitigation" approach was included in the Proposed Action prepared by the USFS. It was asserted that a failure to implement dwarf mistletoe "mitigation" would be contrary to direction in the Forest Plans.

The PWG evaluated the information presented by USFS and developed this recommendation for consideration by the 4FRI Stakeholder Group (SHG), and with its approval, communication to USFS. The SHG decided unanimously to adopt this recommendation at its April 26, 2017 meeting.

The SHG appreciated the Forest Service's outreach to the PWG and concurs with the stated goal of maintaining mistletoe as a natural component of restored forests. Dwarf mistletoe is a natural disturbance agent and component of coniferous forests within the planning area. The plant provides food and cover for wildlife; large-tree mortality caused by mistletoe is an important factor in recruiting snags that provide habitat for cavity-nesting birds and other species.

The historical and recent data presented by USFS did not make a compelling case that mistletoe infections within the planning area are significantly outside the natural range of variability and pose a meaningful obstacle to meeting restoration objectives. The SHG welcomes additional data that USFS can bring to bear on this issue and the opportunity to see first-hand examples on the ground. We are also greatly interested in the larger discussion about using restoration treatments to address forest health concerns related to dwarf mistletoe.

The SHG feels that restoration treatments consisting of mechanical or hand thinning, followed by application of prescribed/managed fire at regular intervals, meet the intent of the Forest Plans and are the preferred approach for stands with high levels of mistletoe infection. Where needed, those stands could also be buffered to reduce mistletoe spread. The SHG also supports testing alternative restoration treatments for affected stands, if done at limited scale and in a learning/adaptive management framework.

The SHG also feels that traditional silvicultural approaches to managing dwarf mistletoe (e.g. overstory removal, even-aged management) are inconsistent with an ecological restoration approach and are not supported by the best available science. These may also be at odds with directions in 4FRI stakeholder foundational documents; the Collaborative Forest Landscape Restoration Program; and, the 2012 USFS Planning Rule. The SHG is particularly concerned that alternatives containing such aggressive treatments will be controversial and likely to impede timely completion of the Rim Country EIS and a Record of Decision.

Sincerely,

Jason Whiting, 4FRI co-chair

Jason Whiting
4FRI Stakeholder Group Co-chair

Travis Bruner, 4FRI co-chair

Travis Bruner
4FRI Stakeholder Group Co-chair

CC: Regional Forester Cal Joiner
Apache/Sitgreaves NF Supervisor Steve Best
Tonto NF Supervisor Neil Bosworth
Coconino NF Supervisor Laura Jo West
Kaibab NF Supervisor Heather Provencio

Center for Biological Diversity Post-Logging Rapid Survey

Unit 10, Little Timber Sale, Apache-Sitgreaves National Forests
Prepared by Joe Trudeau for 4FRI-SHG Little Timber Sale tour, 9/25/2018. Revised 10/15/2018.
Direct comments or questions to: jtrudeau@biologicaldiversity.org

Introduction

Between June 30 and July 2, 2018, a Facebook user posted a series of images of large diameter stumps, decks of large and old logs, and other photos and comments that called into question thinning activities underway at the Little Timber Sale on the Apache-Sitgreaves National Forest near Luna Lake, Arizona. In these posts, the author suggested that the public had been 'duped' by the Forest Service's claims that thinning under the Four Forest Restoration Initiative (4FRI) would be focused on small diameter trees. The revelation of these disturbing images of felled old growth and large diameter trees led to a series of visits to the site by a number of 4FRI stakeholders. This includes Center for Biological Diversity staff participating in a field trip to the timber sale with the Forest Service on August 28, 2018. Between August 27 and 31, 2018, Center for Biological Diversity conducted a rapid quantitative survey of a randomly selected unit where thinning had been completed (Unit 10). The purpose was to conclude if old growth was removed, and if so to estimate the amount cut. The methods and results of that survey are presented on the next two pages of this report, and discussed below.

Discussion

An additional field trip to the Little Timber Sale was requested by 4FRI Stakeholders and occurred on September 26, 2018. Approximately 45 Stakeholders and Forest Service employees attended. By request, the fifth stop of the itinerary was at Unit 10, where Center for Biological Diversity presented the results of this survey as well as an interpretation on how these observations fit into a broader - and concerning - narrative within 4FRI; that there appears to be a discernable shift away from core forest restoration principles and methodologies in southwestern ponderosa pine forest restoration, including pushing the boundaries of what has come to be known as the "social consensus" around cutting of large and old trees. The following results of our survey support this concern:

•The stand was thinned below the low end of the desired range. The desired basal are for this unit was 40-60 ft^2/acre, but our results found the units thinned to approximately 36 ft^2/acre. This supports our observation that the Forest Service tends to thin to the low end or below desired density ranges.

• Stump tallies and ring counts showed that more old growth trees (>150 years old) were cut than were retained. Removal of groups of old trees accounted for most of the reduction in this age class, with two 1-acre plots each having twenty probable old growth stumps. Despite Forest Service claims that these were predominantly large young trees, we found concrete evidence that trees well above 200 years old were cut, and that old trees may often be < 18" DBH (see photos on next page). Our sampling indicates that more than 1,300 old growth trees were cut in just this 200-acre unit. Even if our tree aging was 50% wrong, there would still be a very alarming result.

•Large trees were disproportionately targeted for removal, with nearly half of basal area reduction made in trees larger than 18" DBH, and the overall mean diameter of ponderosa pine at the stand level dropped by 2.3". Proportion of small to large trees, as measured by sampling frequency, was maintained pre- to post-logging. These results confirm that thinning was not focused on removal of small diameter trees.

•Stand exam data that we obtained showed that less than 6% of sampled ponderosa pine trees had mistletoe infections that would warrant removal under the stand thinning prescription. That prescription also stated plainly that "the stands have a low infection of dwarf mistletoe in the ponderosa pine." While is it difficult to determine the level of mistletoe infection of removed trees, our observations suggested that old tree removal was more focused on basal area reduction than severe disease infection. Based on our field survey results, target basal area of 40-60 ft^2/acre could have been met even without cutting any old trees at all.

Conclusion

Though the West Escudilla project was authorized under a separate NEPA analysis, it is part of 4FRI, being counted toward restoration targets within the 4FRI umbrella. The Center considers the observations reported here to be a troubling departure from Stakeholder-developed guidance for protection of large and old trees.

Center for Biological Diversity Post-Logging Rapid Survey (page 2)

Unit 10, Little Timber Sale, Apache-Sitgreaves National Forests

Prepared by Joe Trudeau for 4FRI-SHG Little Timber Sale tour, 9/25/2018. Revised 10/15/2018.

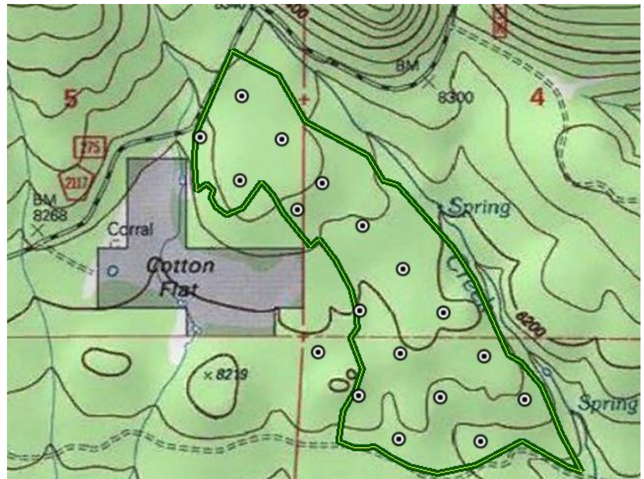
Inventory Specifications

18 plot centers located on August 27 and 31, 2018.
At each point, data from 3 plots were recorded:

Plot a) 10-factor prism
- in/out tally to determine basal area

Plot b) $1/10^{th}$ acre fixed radius (37.2′ radius)
- tree status (live, snag, stump), species, and DBH
- random sample first tree from North: determine age and record diameter at stump height

Plot c) 1 acre fixed radius (117.8′ radius)
- tallied live trees of all species over 4.5′ tall
- tallied live old growth (>150 years) and recent cut old growth stumps



Plots located on 10-chain grid (660′). One plot was moved due to fenceline and edge of unit.

Live Tree Results

Plot a) 10-factor prism (generous with "in" trees, no limiting distances checked)
- basal area: **37.8 ft^2/acre** (includes all species, any tree over 4.5′ tall)

Plot b) $1/10^{th}$ acre fixed radius (37.2′ radius)
- 139 sample trees measured: PIPO (n=71), QUGA (n=67); JUDE (n=1)
- PIPO basal area: **30.5 ft^2/acre**
- All species basal area: **33.7 ft^2/acre** (~10% of BA in QUGA)
- 16 of 18 plots had live PIPO trees (~10% in "regen openings")
- PIPO basal area excluding 2 plots with no live trees (exclude "regen openings"): **34.3 ft^2/acre**
- Trees/acre: **39.4 TPA** (PIPO), 77 TPA (all species >4.5′ tall)
- Average diameter of live trees (all species): 7.1″
- Average diameter of live trees (PIPO only): 10.3″
- Average age of sample tree: 117 years
- Tree taper ratio: 0.8227 (DBH/DSH on first sample tree)

mean BA=35.75 ft^2/acre

Plot c) 1 acre fixed radius (117.8′ radius)
- Average TPA Tally: 50.4 trees per acre (includes all species, any tree over 4.5′ tall)
- 103 likely live old growth trees tallied (3 top plots account for over 50% of total)
- 118 likely old growth stumps tallied (3 top plots account for nearly 50% of total)

Cut Tree Results (recent stumps on 1/10 acre plot, DBH estimated by applying site-specific taper ratio)

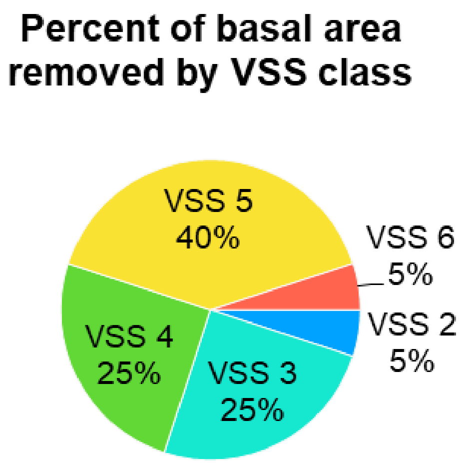
- 72 sample stumps measured (does not include stumps predating the Little sale)
- Average diameter at stump height (DSH) of recent cut trees 14.6″
- Estimated average DBH of recent cut trees 12.2″
- Estimated 37 ft^2/acre removed by recent thinning
- 18% of total trees and 45% of basal area removed was in VSS5 and VSS6 trees
- 1 snag recorded across all 18 plots (Forest Plan DC's aims for 2 snags/acre)

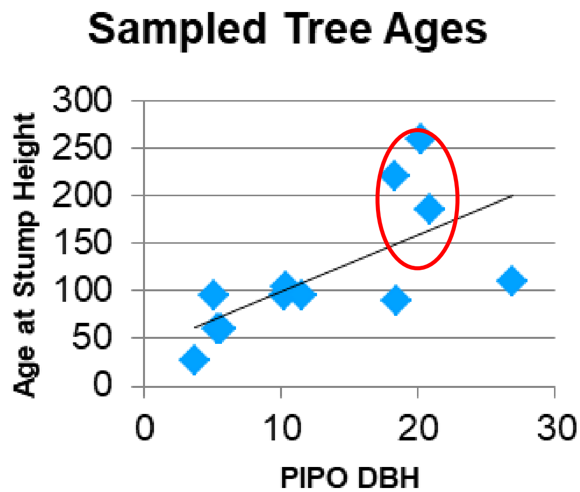
Center for Biological Diversity Post-Logging Rapid Survey (page 3)

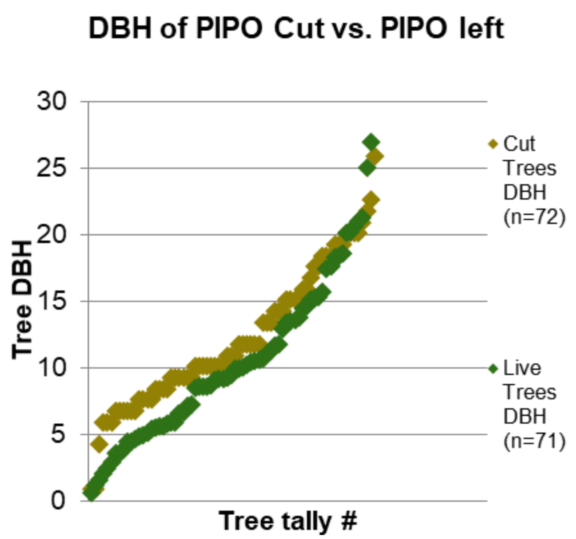
Unit 10, Little Timber Sale, Apache-Sitgreaves National Forests

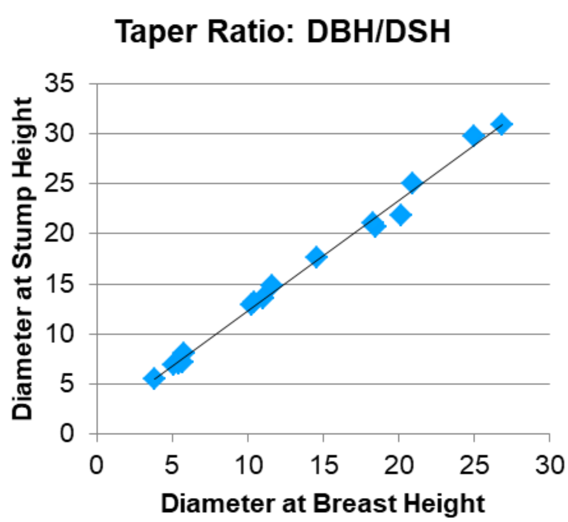
Prepared by Joe Trudeau for 4FRI-SHG Little Timber Sale tour, 9/25/2018. Revised 10/15/2018.

<u>Supplemental Information</u>









<u>16" DSH (13.2" DBH)</u>
230 years old at stump via ring count

<u>22" DSH (18" DBH)</u>
170 years old at stump via increment borer

<u>26" DSH (21.3" DBH)</u>
6" DBH leave tree has DMR score of 5

Supplemental Photos

Four 170-year old stumps (one not visible) surround a suppressed 6” DBH tree that is more than 60 years old. It is extremely unlikely that the old growth trees were severely infected with mistletoe while the small tree was uninfected.

Center for Biological Diversity Post-Logging Rapid Survey (page 5)

Unit 10, Little Timber Sale, Apache-Sitgreaves National Forests

Prepared by Joe Trudeau for 4FRI-SHG Little Timber Sale tour, 9/25/2018. Revised 10/15/2018.

Supplemental Photos

A 36"diameter ponderosa pine stump, approximately 160 years old. At the cusp of being a large young tree, this tree was presumably removed because of heart rot, likely visible in a broken top. Such trees are valued wildlife habitat.

Supplemental Photos

A tree that, based on bark character, was undeniably an old growth tree. As open as this area is, it's hard to reconcile that the tree had to be removed to meet restoration objectives. Nearby old trees showed no signs of mistletoe infection.

Supplemental Photos

A 32" diameter stump, aged at >160 years old, in the most aggressively thinned portion of Unit 10. The West Escudilla EA defined old trees as those >150 years, and claimed that removal would be rare except in cases of severe mistletoe. Inspection of slash piles failed to reveal troves of mistletoe infected branches.

New Mexico Forest Restoration Principles

Preamble

These principles were collaboratively developed by a team of dedicated professionals representing industry, conservation organizations, land management agencies, and independent scientists. These principles for restoration should be used as guidelines for project development and they represent the “zone of agreement” where controversy, delays, appeals, and litigation are significantly reduced. They may be appropriate for application to specific restoration projects in New Mexico. These principles were developed for use in designing and implementing projects with a primary objective of ecological restoration while promoting economic and social benefits.

Participants

The Nature Conservancy in New Mexico
Natural Resources Conservation Service
Bureau of Land Management
Sierra Club, Rio Grande Chapter
Forest Guardians
New Mexico State Forestry Office
U.S. Forest Service
Bureau of Indian Affairs
New Mexico State Land Office
Forest Guild
Center for Biological Diversity
Restoration Solutions
Public Service of New Mexico

Principles

1. **Collaborate**. Landscape scale assessment, and project design, analysis, implementation and monitoring should be carried out collaboratively by actively engaging a balanced and diverse group of stakeholders.

2. **Reduce the threat of unnatural crown fire.** A key restoration priority must be moving stands toward a more natural restored condition and the reduction of the risk of unnatural crown fires both within stands and across landscapes. Specific restoration strategies should vary based upon forest vegetation type, fire regime, local conditions, and local management objectives. Forests and woodlands characterized by infrequent and mixed-severity fire should be managed toward a stand structure consistent with their historical ranges of variation—including, in some cases, high-density, continuous stands. Discontinuous stand structure may be appropriate to meet community protection objectives in areas such as the wildland urban interface for these forest and woodland types.

3. **Prioritize and strategically target treatment areas**. Key considerations for prioritizing restoration treatment areas are: degree of unnatural crown fire risk, proximity to human developments and important watersheds, protection of old-growth forests and habitats of federally threatened, endangered, or listed sensitive species, and strategic positioning to break up landscape-scale continuity of hazardous fuels. Treatments should be done at a landscape scale to decrease forest vulnerability to unnatural stand-replacing fire. This priority-setting should take place during fire management planning, land management planning, and community wildfire protection planning.

4. **Develop site-specific reference conditions.** Site-specific historical ecological data can provide information on the natural range of variability for key forest attributes, such as tree age structure and fire regimes that furnish local "reference conditions" for restoration design. A variety of constraints, however, prevent the development of historical information on every hectare of land needing restoration. General goals should be to restore ecological integrity and function.

5. **Use low-impact techniques.** Restoration treatments should strive to use the least disruptive techniques, and balance intensity and extensiveness of treatments. In many areas, conservative initial treatments would be the minimum necessary to adequately reduce the threat of unnatural crown fire. Wildland fire use or management ignited fires may be sufficient to reestablish natural conditions in many locations. In the extensive areas where fire alone cannot safely reduce tree densities and hazardous ladder fuels, mechanical thinning of trees may be needed before the introduction of prescribed fire. Patient, effective treatments will provide more options for the future than aggressive attempts to restore 120 years of change at once. In certain areas, however, such as some urban-wildland interfaces, trade-offs with imminent crown fire risks require considerations of rapid, heavy thinning of mostly small diameter trees.

6. **Utilize existing forest structure.** Restoration efforts should incorporate and build upon valuable existing forest structures, such as large trees, and groups of trees of any size with interlocking crowns excluding aspen. These features are important for some wildlife species, such as Abert's squirrels and goshawks, and should not be removed completely just to recreate specific historical tree locations. Since evidence of long-term stability of precise tree locations is lacking, especially for piñon and juniper, the selection of "leave" trees and tree clusters in restoration treatments can be based on the contemporary spatial distribution of trees, rather than pre-1900 tree positions. Maximizing use of existing forest structure can restore historical forest structure conditions more quickly. Leaving some relatively dense within-stand patches of trees need not compromise efforts to reduce landscape-scale crown fire risk.

   The underlying successional processes of natural tree regeneration and mortality should be incorporated into restoration design. Southwestern conifer regeneration occurs in episodic, often region-wide pulses, linked to wet-warm climate conditions and reduced fire occurrence. Periods with major regeneration pulses in the Southwest occurred in the 1910s–1920 and in 1978–1998. Some of this regeneration would have survived under natural conditions. Restoration efforts should retain a proportion of these cohorts.

7. **Restore ecosystem composition.** Missing or diminished compositional elements, such as herbaceous understories, or extirpated species also require restoration attention. The forest understory, including shrubs, grasses, forbs, snags, and down logs, is an important ecosystem

component that directly affects tree regeneration patterns, fire behavior, watershed functioning, wildlife habitat, and overall patterns of biodiversity. Similarly, soil organisms, such as mycorrhizal fungi, are vital elements that can influence community composition and dynamics. A robust understory provides a restraint on tree regeneration and is essential for carrying surface fires. The establishment and maintenance of more natural patterns of understory vegetation diversity and abundance are integral to ecological restoration.

Restoration planning should include the conservation of habitats for diminished or extirpated wildlife species. Comprehensive forest ecosystem restoration requires balancing fire risk reduction with retention of forest structures necessary for canopy dependent species.

Recovery plans and conservation plans for threatened, endangered, and sensitive species should be incorporated to the fullest extent possible in planning for comprehensive forest restoration.

8. **Protect and maintain watershed and soil integrity.** Low impact treatments will minimize sedimentation, disruption of surface runoff, and other detrimental ecosystem effects. Equipment and techniques should be managed according to soil and water conservation "best management practices" applicable to site-specific soil types, physiography and hydrological functions.

   Reconstruction, maintenance, or decommissioning of existing roads to correct for poor hydrologic alignment and drainage condition can greatly reduce soil loss and sedimentation rates. Projects should strive for no net increase in road density.

   Managing forest density and fuels to avoid uncharacteristically intense wildfire events will reduce the likelihood of catastrophic post-fire soil erosion and nutrient depletion from forested landscapes. Soil productivity should be protected and maintained by avoiding soil loss and compaction, and managing for on-site nutrient retention. Avoid repeated whole tree biomass removal from the forest to maximize nutrient retention. Whenever feasible, green foliage should be recycled by scattering on site; followed by prescribed burning to release stored nutrients.

9. **Preserve old or large trees while maintaining structural diversity and resilience.** Large and old trees, especially those established before ecosystem disruption by Euro-American settlement, are important forest components and critical to functionality of ecosystem processes. Their size and structural complexity provide critical wildlife habitat by broadly contributing crown cover, influencing understory vegetation patterns, and providing future snags. Ecological restoration should manage to ensure the continuing presence of large and old trees, both at the stand and landscape levels. This includes preserving the largest and oldest trees from cutting and crown fires, focusing treatments on excess numbers of small young trees.

   Develop "desired" forest condition objectives that favor the presence of both abundant large diameter trees and an appropriate distribution of age classes on the landscape, with a wide distribution of older trees. It is generally advisable to maintain ponderosa pines larger than 41 cm (16 inches) diameter at breast height (dbh) and other trees with old-growth morphology regardless of size (e.g. yellow-barked ponderosa pine or any species with large drooping limbs, twisted trunks or flattened tops).

   Treatments should also focus on achievement of spatial forest diversity by managing for variable densities. Overall, forest densities should be managed to maintain tree vigor and stand resiliency to natural disturbances. Disease conditions are managed to retain some presence of native forest pathogens on the landscape, but constrained so that forest sustainability is not jeopardized. Guidelines must provide opportunities to apply differing site-specific management strategies to work towards attainment of these goals, and recognize that achievement may sometimes require more than one entry.

Stand level even-aged management may be appropriate for some objectives, including disease management, post wildfire tree regeneration, accelerating development of old growth characteristics, or for, forest types for which even-aged stands are characteristic, such as spruce or aspen. Treatments should be identified through collaboration with key stakeholders.

Some ponderosa pine forests contain extremely old trees and dead wood remnants that may be small but are important because they contain unique and rare scientific information in their growth rings. Such trees have become increasingly rare in the late 20^{th} century, and the initial reintroduction of fire often consumes these tree-ring resources. Restoration programs should preserve them where possible.

10. **Manage to restore historic tree species composition.** Forest density levels and the presence of fire in the ecosystem are key regulators of tree species composition. Where fire suppression has allowed fire-sensitive trees like junipers or shade-tolerant white fir or spruce to become abundant in historical ponderosa pine forests, treatments should restore dominance of more fire-resistant ponderosa pines. However, fire intolerant species sometimes make up the only remaining large tree component in a stand. Retention of these large trees is important to canopy dependent wildlife species. In mixed conifer forests, landscapes should be managed for composition and structure that approximates the natural range of variability.

11. **Integrate process and structure**. Ecological sustainability requires the restoration of process as well as structure. Natural disturbance processes, including fire, insect outbreaks, and droughts, are irreplaceable shapers of the forest. In particular, fire regimes and stand structures interact and must be restored in an integrated way; mechanical thinning alone will not reestablish necessary natural disturbance regimes. At the same time, fire alone may be too imprecise or unsafe in many settings, so a combination of treatments may often be the safest and most certain restoration approach.

    The single best indicator of whether a proposed approach should be considered as “ecological restoration” is to evaluate if the treatment would help successfully restore the fire regime that is natural for that forest type. Approaches that do not restore natural fire regimes will not achieve full ecological restoration.

12. **Control and avoid using exotic species.** Seeding of exotic grasses and forbs should be prohibited as ecologically incompatible with good restoration. Once established, exotic species can be extremely difficult or impossible to remove. Seeding should be conducted with certified or weed free seeds to reduce the risk of contamination by non-native species or varieties.

    In general, it is ecologically desirable to allow native herbaceous vegetation to recover incrementally unless there is potential for serious soil erosion or the potential for establishment of non-native invasive plants. If enhancement of herbaceous vegetation is needed, especially for road closures and recovery, using locally sourced native seeds or transplanting individuals from nearby areas into treatments is ecologically desirable.

Restoration treatments should also routinely incorporate early actions to control the establishment and spread of aggressive exotics that can be expected from restoration-related site disturbance.

13. **Foster regional heterogeneity**. Biological communities vary at local, landscape, and regional scales, and so should restoration efforts. Ecological restoration should also incorporate the natural variability of disturbance regimes across heterogeneous landscapes. Heterogeneity should be fostered in planning and implementing ecological restoration and all spatial scales, including within and between stands, and across landscape and regional scales.

14. **Protect sensitive communities**. Certain ecological communities embedded within ponderosa pine or other types of forests and some riparian areas, could be adversely affected by on-site prescribed burning or mechanical thinning. Restoration efforts should protect these and other rare or sensitive habitats, which are often hotspots of biological diversity, particularly those that are declining in abundance and quality in the region.

15. **Plan for restoration using a landscape perspective that recognizes cumulative effects**. Forest restoration projects should be linked to landscape assessments that identify historical range of variation (reference condition), current condition, restoration targets, and cumulative effects of management. Ecosystems are hierarchical; changing conditions at one level arise from processes occurring at lower levels, and are constrained, in turn, by higher levels. The landscape perspective captures these complex relationships by linking resources and processes to the larger forest ecosystem. Forest restoration projects should incorporate plans for long-term maintenance of ecological processes.

16. **Manage grazing**. Grass, forbs, and shrub understories are essential to plant and animal diversity and soil stability. Robust understories are also necessary to restore natural fire regimes and to limit excessive tree seedling establishment. Where possible, defer livestock grazing after treatment until the herbaceous layer has established its current potential structure, composition, and function.

17. **Establish monitoring and research programs and implement adaptive management**. Well-designed monitoring, research, and documentation are essential to evaluate and adapt ongoing restoration efforts. Monitoring programs must be in place prior to treatment, and must evaluate responses of key ecosystem components and processes at multiple scales. Use research and monitoring results from a variety of sources to adjust and develop future restoration treatments.

    When possible, restoration projects should be set up as experiments with replicates and controls to test alternative hypotheses. The locations and prescriptions for all restoration treatments should be archived in a geographic information system, so that land managers and researchers have access to site-specific records of restoration treatments.

18. **Exercise caution and use site-specific knowledge in restoring or managing piñon-juniper ecosystems and other woodlands and savannas**. These systems are diverse and complex. Knowledge of local reference structure, composition, processes and disturbance regimes is lacking or uncertain for many piñon–juniper ecosystem types. Given the diversity, variability, and complexity of piñon–juniper systems, identification of local reference conditions is critical to the development of restoration objectives. Exercise caution and use best available science and site-specific knowledge in planning and implementing ecological restoration projects. Use the Grassland and Woodland Restoration and Management

Framework for development and implementation of specific projects (The Framework is currently under development).

Active management may be appropriate to mitigate soil erosion, community wildland fire hazard, or degraded hydrologic function in cases where historical ecological dynamics are insufficiently understood to justify ecological restoration. Piñon–juniper sites may be particularly susceptible to ecological damage from treatments, for example, soil erosion and invasion by non-native plants.

July 10, 2019

James Melonas, Forest Supervisor
Hannah Bergemann, Fireshed Coordinator
Santa Fe National Forest Supervisor's Office
11 Forest Lane, Santa Fe, NM 87508

Re: Santa Fe Mountains Landscape Resiliency Project

Submitted via email to comments-southwestern-santafe@fs.fed.us and Hannah.Bergemann@usda.gov

Dear Supervisor Melonas and Fireshed Coordinator Bergemann,

This letter supplies the Center for Biological Diversity's ("the Center") comments on the Santa Fe Mountains Landscape Resiliency Project Scoping Document which was made available to the public on June 10, 2019. The scoping document specified that comments are due by Wednesday, July 10th 2019, making this letter timely.

The Center for Biological Diversity is a non-profit environmental organization with over 61,000 members, and 1.6 million activist-supporters nationwide who value wilderness, biodiversity, old growth forests, and the threatened and endangered species which occur on America's spectacular public lands and waters. Many of the Center's members and supporters frequently use and enjoy the spectacular landscapes of the Santa Fe National Forest landscape for recreation, sustenance, nature study, and spiritual renewal.

At the Center for Biological Diversity, we believe that the welfare of human beings is deeply linked to nature — to the existence in our world of a vast diversity of wild animals and plants. Because diversity has intrinsic value, and because its loss impoverishes society, we work to secure a future for all species, great and small, hovering on the brink of extinction. We do so through science, law and creative media, with a focus on protecting the lands, forests, waters and climate that species need to survive. The Center has and continues to actively advocate for increased protections for species and their habitats in New Mexico and across the American Southwest.

The Santa Fe Mountains Landscape Resiliency Project ("the Project") would encompass 50,566 acres in Española and Pecos/Las Vegas Ranger Districts of the Santa Fe National Forest in Santa Fe County and San Miguel County, New Mexico. The Center considers the proposed Project to contain some beneficial project elements insofar as restoration and fuels treatments in forests, shrublands, woodlands, and riparian areas are informed by the best available science and are coordinated within a cohesive and unified strategic, process-oriented approach.

These project elements have great potential to be positive management actions that should lead towards improved habitat, watershed function, and forest visitor experience. The scoping document seems to imply that a major focus of the project is to allow the use of fire, both planned and unplanned ignitions, to achieve restoration objectives. We strongly support this approach and are eager to continue work with the Santa Fe National Forest to develop a project that can harness the restorative benefits of fire in a way that compliments a variety of forest management goals and protects communities and other values at risk while not compromising habitats for threatened, endangered and sensitive wildlife species or the unique experience offered to the public in the beautiful forests of the Sangre de Cristo Mountains.

We are pleased that proposed Project includes the following components:

• Prescribed burning on up to 43,000 acres, exceeding the 21,557 acres of hand and mechanical tree removal (scoping document, p. 2).

• No mechanical equipment to be used on slopes greater than 40 percent (scoping document, p. 12).

• No new roads or temporary roads to be constructed (scoping document, pp.12, 13)

• Specification that mechanical and hand treatments will be "*noncommercial*" in nature (scoping document, pp. 2, 12, and 13).

• Thinning that would primarily target small diameter trees and medium diameter trees (up to 12 inches dbh) and no trees above 24 inches dbh would be cut (scoping document, p. 12); although in this letter we will address the need to implement a more refined approach to large tree retention.

• We support that "*noncommercial mechanical and hand-thinning treatments*" in the pinon-juniper type will be placed in "*strategic locations*" located "a*djacent to values at risk and in Wildland Urban Interface*." We appreciate that the overall objective to "*reduce the risk for large high-intensity wildfires*" (scoping document, p. 12; emphasis added) in the WUI, rather than to completely eliminate the risk of large high-intensity fires in the pinon juniper across the project area.

• "*Non-native species such as Siberian elm, Russian olive, salt cedar and Tree of Heaven would be cut and removed*" (scoping document, p. 14) as part of the 557 acres of riparian restoration; although in this letter we will address the need to implement diameter and age restrictions on conifer removal in riparian areas.

While the Center supports ecosystem-based management for resiliency outcomes, we must not forget that major landscape scale projects need to undergo a rigorous review under the National Environmental Policy Act (NEPA). NEPA is "*our basic national charter for protection of the environment*."[1] In enacting NEPA, Congress recognized the "*profound impact*" of human activities, including "*resource exploitation*," on the environment and declared a national policy

[1] *Center for Biological Diversity v. United States Forest Serv*., 349 F.3d 1157, 1166 (9th Cir. 2003) (quoting 40 C.F.R. § 1500.1).

"*to create and maintain conditions under which man and nature can exist in productive harmony.*"[2]

The statute has two fundamental two goals: *"(1) to ensure that the agency will have detailed information on significant environmental impacts when it makes decisions; and (2) to guarantee that this information will be available to a larger audience.*"[3] "*NEPA promotes its sweeping commitment to 'prevent or eliminate damage to the environment and biosphere' by focusing Government and public attention on the environmental effects of proposed agency action*."[4]

Stated more directly, NEPA's "'*action-forcing' procedures ... require the [Forest Service] to take a 'hard look' at environmental consequences*"[5] before the agency approves an action. "*By so focusing agency attention, NEPA ensures that the agency will not act on incomplete information, only to regret its decision after it is too late to correct*."[6] To ensure that the agency has taken the required "*hard look*," courts hold that the agency must utilize "*public comment and the best available scientific information.*"[7]

The Center will support the Project insofar as it meets the standards of NEPA, uses the best available scientific information, and provides for meaningful public participation from stakeholders of various perspectives, including the many local American citizens who are reluctant to support proposals that diminish the much beloved wild, wooded experience of the Sangre de Cristo Mountains remarkable forests.

These comments are divided into two sections. Section one presents Issues for Analysis. These are fundamental issues of concern that the Center asks are addressed and answered in detail in any subsequent NEPA document. We also would appreciate the opportunity to discuss these issues in person at a meeting or field trip.

Section two presents a reasonable alternative for analysis that will meet the project purpose of improving ecosystem resilience of a priority landscape to future disturbances including wildfire, climate change, and insect outbreaks. Section two provides extensive scientific citation to support our alternative which we request any subsequent NEPA document to address specifically and without cursory dismissal.

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[2] 42 U.S.C. § 4331(a).

[3] *Envtl. Prot. Info. Ctr. v. Blackwell*, 389 F. Supp. 2d 1174, 1184 (N.D. Cal. 2004) (quoting *Neighbors of Cuddy Mt. v. Alexander*, 303 F.3d 1059, 1063 (9th Cir. 2002)); *see also Earth Island v. United States Forest Serv.*, 351 F.3d 1291, 1300 (9th Cir. 2003) ("NEPA requires that a federal agency 'consider every significant aspect of the environmental impact of a proposed action ... [and] inform the public that it has indeed considered environmental concerns in its decision-making process.'").

[4] *Marsh v. Or. Natural Res. Council*, 490 U.S. 360, 371 (1989) (quoting 42 U.S.C. § 4321).

[5] *Metcalf v. Daley*, 214 F.3d 1135, 1141 (9th Cir. 2000) (quoting *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 348 (1989)).

[6] *Marsh*, 490 U.S. at 371 (citation omitted).

[7] *Biodiversity Cons. Alliance v. Jiron*, 762 F.3d 1036, 1086 (10th Cir. 2014) (internal citation omitted).

SECTION I. ISSUES FOR ANALYSIS

The scoping document is well prepared, well organized, and simple. It does lack detail on some very important issues however, although this is appropriate at this point in the Projects development. The Center has identified a number of issues for analysis in any subsequently prepared NEPA document. The agency's failure to respond to these comments violates NEPA.[8]

The center requests that the following issues are identified and analyzed in the EIS:

• ISSUE 1: Retention of existing old (>150 years) and large (>18" dbh) trees, and identification and retention of old growth patches and stands.

• ISSUE 2: Treatments in Mexican spotted owl habitat.

• ISSUE 3: Treatments for dwarf mistletoe.

• ISSUE 4: Effects of livestock grazing on meeting the Projects purpose and need.

• ISSUE 5: Conditions based management, monitoring, and adaptive management.

• ISSUE 6: Identification of and treatments in roadless and unroaded areas.

• ISSUE 7: Locally specific reference conditions are needed.

We will address each of these seven issues in detail below.

ISSUE 1: RETENTION OF EXISTING OLD (>150 YEARS) AND LARGE (>18" DBH) TREES, AND IDENTIFICATION AND RETENTION OF OLD GROWTH PATCHES AND STANDS.

In 2006, a team of dedicated professionals representing industry, conservation organizations, land management agencies, and independent scientists collaboratively developed a framework document called the New Mexico Forest Restoration Principles[9]. Among those authors was staff from the Center for Biological Diversity. We stand by the agreements established in this document when we signed our names alongside those in the US Forest Service, Bureau of Land Management, and other partners in restoration.

These principles for restoration should be used as guidelines for project development and they represent the "zone of agreement" where controversy, delays, appeals, and litigation are significantly reduced. They are appropriate for application to specific restoration projects in the southwestern United States, and especially the Santa Fe National Forest. Projects using these principles are driven primarily by ecological objectives while promoting economic and social

[8] *See* 40 C.F.R. 1503.4(a) ("An agency preparing a final environmental impact statement shall assess and consider comments both individually and collectively, and shall respond ... stating its response in the final statement.").

[9] Attached to this letter.

benefits. The Santa Fe Mountains Landscape Resiliency Project seems like a perfect fit for adopting these principles.

Slowly, forest restoration treatments have shifted from an almost exclusive focus on hand thinning of small diameter ladder fuels to what we see now in many so-called "restoration" projects: a return of widespread commercial logging of trees of nearly any size to move towards agency-established desired conditions. Thus far, the Santa Fe Mountains Landscape Resiliency Project does not appear to be one of those imposters.

Some of the eighteen Principles are especially important to the Center, especially those regarding retention of old and large trees. The New Mexico Forest Restoration Principles clearly state that restoration projects should "*preserve old or large trees while maintaining structural diversity and resilience*."

Large and old tree retention meets the project purpose and need

We believe that many forest restoration projects in the southwest are now generally moving in the wrong direction, with excessive emphasis on structural manipulation and insufficient attention to fire-driven ecological processes. Many so-called "restoration projects" such as the Luna Restoration Project on the Gila National Forest even cunningly devise ways to justify cutting old growth up to 180 years old and trees up to 24" (and even larger).

Until the Forest Service created GTR-310, large and old tree retention has been a fundamental principle of Southwestern forest restoration. Past timber management destroyed nearly all ponderosa pine and mixed conifer old growth forest in Arizona and New Mexico, including on much of the Santa Fe National Forest. Even-aged or simplified forest has replaced the complex forests of the pre-settlement southwestern landscape.[10,11]

Retention of large trees is fundamentally important to fire resistance of treated stands. [12] Mature conifers have a high capacity to survive and recover from crown scorch.[13] Large tree structure enhances forest resilience to severe fire effects[14,15,16] whereas removing them may undermine fire

[10] Covington, W.W., and M.M. Moore. 1994. Southwestern ponderosa forest structure: Changes since Euro-American settlement. *Journal of Forestry* 92: 39-47.

[11] Sesnie, S. and J. Bailey. 2003. Using history to plan the future of old-growth ponderosa pine. *Journal of Forestry* 99(7) (Oct/Nov): 40-47.

[12] DellaSala, D.A., J.E. Williams, C.D. Williams and J.F. Franklin. 2004. Beyond smoke and mirrors: a synthesis of fire policy and science. *Conservation Biology* 18: 976-86.

[13] McCune, Bruce. "Ecological diversity in North American pines." American Journal of Botany (1988): 353-368.

[14] Arno, S.F. 2000. Fire in western ecosystems. Pp. 97-120 in: J.K. Brown and J.K. Smith (eds.). *Wildland Fire in Ecosystems, Vol. 2: Effects of Fire on Flora*. USDA For. Serv. Gen. Tech. Rep. RMRS-42-vol.2. Ogden, UT.

[15] Omi, P.N., and E.J. Martinson. 2002. *Effect of Fuels Treatment on Wildfire Severity*. Unpubl. report to Joint Fire Science Program. Fort Collins: Colorado State Univ. Western Forest Fire Research Ctr. March 25. 36 pp.

resilience.[17,18] Research demonstrates no advantage in fire hazard mitigation resulting from mechanical forest treatments that remove large trees compared to treatments that retain them. Modeled treatments that removed only trees smaller than 16-inches diameter were marginally more effective at reducing long-term fire hazard than so-called "comprehensive" treatments that removed trees in all size classes.[19]

Thinning small trees and pruning branches of large trees to increase canopy base height significantly decreases the likelihood of crown fire initiation,[20,21,22,23] which is a precondition to active crown fire behavior.[24,25] Therefore, low thinning and underburning to reduce surface fuels and increase canopy base height at strategic locations effectively reduces fire hazard at a landscape scale and meets the purpose and need.

Large trees are not abundant at any scale in Southwestern forests and they are the most difficult of all elements of forest structure to replace once removed.[26] The ecological significance of old

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[16] Pollett, J. and P.N. Omi. 2002. Effect of thinning and prescribed burning on crown fire severity in ponderosa pine forests. *International Journal of Wildland Fire* 11: 1-10.

[17] Brown, R.T., J.K. Agee, and J.F. Franklin. 2004. Forest restoration and fire: principles in the context of place. *Conservation Biology* 18: 903-12.

[18] Naficy, C., A. Sala, E.G. Keeling, J. Graham and T.H. DeLuca. 2010. Interactive effects of historical logging and fire exclusion on ponderosa pine forest structure in the northern Rockies. *Ecological Applications* 20: 1851-64.

[19] Fiedler, C.E., and C.E. Keegan. 2003. Reducing crown fire hazard in fire-adapted forests of New Mexico. Pp. 29-38 in: P.N. Omi and L.A. Joyce (tech. eds.). *Fire, Fuel Treatments, and Ecological Restoration: Conference Proceedings*. 2002 April 16-18: Fort Collins, CO. USDA For. Serv. Rocky Mtn. Res. Sta. Proc. RMRS-P-29. Fort Collins, CO.

[20] Graham, R.T., S. McCaffrey, and T.B. Jain (Tech. Eds.). 2004. *Science Basis for Changing Forest Structure to Modify Wildfire Behavior and Severity*. USDA For. Serv. Rocky Mtn. Res. Sta. Gen. Tech. Rep. RMRS-120. Ft. Collins, CO.

[21] Keyes, C.R. and K.L. O'Hara. 2002. Quantifying stand targets for silvicultural prevention of crown fires. *Western Journal of Applied Forestry* 17: 101-09.

[22] Perry, D.A., H. Jing, A. Youngblood, and D.R. Oetter. 2004. Forest structure and fire susceptibility in volcanic landscapes of the eastern high Cascades, Oregon. *Conservation Biology* 18: 913-26.

[23] Omi and Martinson 2002, Pollett and Omi 2002

[24] Agee, J.K. 1996. The influence of forest structure on fire behavior. Pp. 52-68 in: J.W. Sherlock (chair). *Proc. 17th Forest Vegetation Management Conference.* 1996 Jan. 16-18: Redding, CA. Calif. Dept. Forestry and Fire Protection: Sacramento.

[25] Van Wagner, C.E. 1977. Conditions for the start and spread of crown fire. *Canadian Journal of Forest Research* 7: 23-24.

[26] Agee, J.K. and C.N. Skinner. 2005. Basic principles of forest fuel reduction treatments. *Forest Ecology and Management* 211: 83-96.

growth forest habitat and large trees comprising it is widely recognized.[27,28] There is no agreed-upon scientific basis for removing large trees to promote fire resistance in southwestern forests.[29,30] In addition to their rarity, a variety of factors other than logging threatens the persistence of the remaining large trees in Southwestern conifer forests. Recruitment of large trees, snags and large woody debris will become more limiting over time as climate change imposes chronic drought, reduced tree growth rates, and more widespread tree mortality.[31,32,33,34,35] A large tree retention alternative (which we propose) would maintain trees that are most likely to survive fire injury and supply recruitment structure that will support the recovery of old growth forest habitat in the future.

In forests with a variety of species and disturbance regimes, large tree removal reduces forest canopy and diminishes recruitment of large snags and downed logs, which in turn affects long-term forest dynamics, stand development and wildlife habitat suitability.[36,37,38] If significant

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[27] Friederici, P. (Ed.). 2003. *Ecological Restoration of Southwestern Ponderosa Pine Forests*. Island Press: Washington, DC.

[28] Kaufmann, M.R., W.H. Moir, and W.W. Covington. 1992. Old-growth forests: what do we know about their ecology and management in the Southwest and Rocky Mountain regions? Pp. 1-10 in: M.R. Kaufmann, W.H. Moir, and R.L. Bassett (eds.). *Old-Growth Forests in the Southwest and Rocky Mountain Regions: Proceedings from a Workshop* (1992). Portal, AZ. USDA For. Serv. Gen. Tech. Rep. RM-213. Fort Collins, CO.

[29] Allen, C.D. M.A. Savage, D.A. Falk, K.F. Suckling, T.W. Swetnam, T. Schulke, P.B. Stacey, P. Morgan, M. Hoffman, and J.T. Klingle. 2002. Ecological restoration of southwestern ponderosa pine ecosystems: A broad perspective. *Ecological Applications* 12: 1418-33.

[30] Brown et al. 2004, Dellasala et al. 2004

[31] Diggins, C., P.Z. Fulé, J.P. Kaye and W.W. Covington. 2010. Future climate affects management strategies for maintaining forest restoration treatments. *International Journal of Wildland Fire* 19: 903-13.

[32] Savage, M. P.M. Brown, and J. Feddema. 1996. The role of climate in a pine forest regeneration pulse in the southwestern United States. *Ecoscience* 3: 310-18.

[33] Seager, R., M. Ting, Y. Kushnir, J. Lu, G. Vecchi, H. Huang, N. Harnik, A. Leetmaa, N. Lau, C. Li, J. Velez and N. Naik. 2007. Model projections of an imminent transition to a more arid climate in southwestern North America. *Science* 316: 1181-84.

[34] van Mantgem, P.J., N.L. Stephenson, J.C. Byrne, L.D. Daniels, J.F. Franklin, P.Z. Fulé, M.E. Harmon, A.J. Larson, J.M. Smith, A.H. Taylor and T.T. Veblen. 2009. Widespread increase of tree mortality rates in the western United States. *Science* 323: 521-24.

[35] Williams, A.P., C.D. Allen, C.I Millar, T.W. Swetnam, J. Michaelsen, C.J. Still and S.W. Leavitt. 2010. Forest responses to increasing aridity and warmth in the southwestern United States. *PNAS* 107: 21289-94.

[36] Quigley, T.M., R.W. Haynes and R.T. Graham. 1996. *Disturbance and Forest Health in Oregon and Washington*. USDA For. Serv. Pac. Nor. Res. Sta. Gen. Tech. Rep. PNW-GTR-382. Portland, OR.

[37] Spies, T.A. 2004. Ecological concepts and diversity of old-growth forests. *Journal of Forestry* 102: 14-20.

reductions of crown bulk density are deemed necessary to meet the purpose and need then it is highly unlikely that the project will maintain habitat for threatened and sensitive wildlife species associated with closed-canopy forest.[39,40]

An unambiguous commitment to old and large tree retention would maintain wildlife habitat in the short-term and mitigate adverse effects of the proposed treatments. And it would avoid social disapproval, unnecessary delays, or litigation.

One of the most often cited scientific articles on southwestern ponderosa pine restoration stated that a core ecological restoration principle is:

"*Retain trees of significant size or age.—Large and old trees, especially those established before ecosystem disruption by Euro-American settlement, are rare, important, and difficult to replace. Their size and structural complexity provide critical wildlife habitat by contributing crown cover, influencing understory vegetation patterns, and providing future snags. Ecological restoration should protect the largest and oldest trees from cutting and crown fires, focusing treatments on excess numbers of small young trees. Given widespread agreement on this point, it is generally advisable to retain ponderosa trees larger than 41 cm (16 inches) dbh and all trees with old-growth morphology regardless of size (i.e., yellow bark, large drooping limbs, twisted trunks, flattened tops).*"[41]

By choosing to protect all old and large trees, how could you go wrong?

Recommendations for the issue of old and large tree retention and old growth protection:

The scoping document states that "*Large and mature trees are found throughout the project area*." We invite the Santa Fe National Forest to commit to protecting them. The history of forest restoration literature is replete with recommendations to retain old and large trees. Even though this Project is billed as a "resiliency" project it sits squarely on the shoulders of many "restoration" projects which paved the way. The Project should proudly recognize that old and large retention is the socially, ecologically, and scientifically right choice, and avoid making decisions that incite anger from the public.

► Implement an unambiguous prohibition of cutting any old tree in any situation except imminent danger to human life.

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[38] van Mantgem, P.J., N.L. Stephenson, J.C. Byrne, L.D. Daniels, J.F. Franklin, P.Z. Fulé, M.E. Harmon, A.J. Larson, J.M. Smith, A.H. Taylor and T.T. Veblen. 2009. Widespread increase of tree mortality rates in the western United States. *Science* 323: 521-24.

[39] Beier, P., and J. Maschinski. 2003. Threatened, endangered, and sensitive species. Pp. 206-327 in: P. Friederici (ed.). *Ecological Restoration of Southwestern Ponderosa Pine Forests*. Island Press: Washington, D.C.

[40] Keyes, C.R. and K.L. O'Hara. 2002. Quantifying stand targets for silvicultural prevention of crown fires. *Western Journal of Applied Forestry* 17: 101-09.

[41] Page 1425 in Allen, C.D. M.A. Savage, D.A. Falk, K.F. Suckling, T.W. Swetnam, T. Schulke, P.B. Stacey, P. Morgan, M. Hoffman, and J.T. Klingle. 2002. Ecological restoration of southwestern ponderosa pine ecosystems: A broad perspective. *Ecological Applications* 12(5): 1418-1433.

► Define "old trees" as those which are >150 years old at stump height or possess morphological characteristics of old age.[42] Don't cut any of them, not even poorly formed ones in old growth clumps or groups.

► Remove the 24" diameter cap and replace it with an 18" diameter cap in all vegetation types except when a tree poses an imminent danger to human life.

The scoping document states that "*In accordance with the Old Growth Standards outlined in the current Forest Plan, 20% of the forested areas in the Project Area would be identified, allocated and managed as old growth.*"

► Any subsequent NEPA document should provide a map that identifies these areas which are managed for old growth, including overlays of roads, trails, Mexican spotted owl and northern goshawk habitats, vegetation type, and topography.

► Any subsequent NEPA document should identify how management to achieve nebulous desired conditions as espoused in GTR-310 will maintain existing old growth and expand future old growth such that the full 20% of the Santa Fe National Forest is managed in old growth conditions.

► Any subsequent NEPA document should specify that areas managed for old growth will be treated with hand thinning and prescribed burning only and deferred from mechanical logging.

ISSUE 2: TREATMENTS IN MEXICAN SPOTTED OWL HABITAT.

The scoping document states that there are four Mexican spotted owl PACs in the Project area. That amounts to just 2,400 acres of the 50,566 acre Project area. The Center requests extreme caution - in fact, restrained conservatism - in thinning and burning in these PACs and all spotted owl habitats.

The 2012 Mexican spotted owl Recovery Plan states:

> "*Because it takes many years for trees to reach large size, we recommend that trees ≥46- cm (18 inches) dbh not be removed in stands designated as recovery nest/roost habitat unless there are compelling safety reasons to do so or if it can be demonstrated that removal of those trees will not be detrimental to owl habitat*."

The effects of mechanical thinning on the Mexican spotted owl have not been extensively studied and are not well understood. Prominent owl scientists have recently stated that "*Existing studies on the effects of fuels reduction treatments on spotted owls universally suggest negative*

[42] See attached 4FRI Old and Large Tree retention Strategy for reference to old tree morphological characteristics.

effects from these treatments"[43] and that "*forest restoration and thinning activities also may threaten owls and their existing habitat*."[44] Extreme caution must be taken in considering thinning within Mexican spotted owl habitat because "*No empirical studies have evaluated these management activities* [restoration thinning or logging] *on the Mexican spotted owl.*"[45]

Some relevant studies from dry, frequent fire adapted forests of southern California have published findings indicating deleterious effects of thinning of spotted owls. Stephens and colleagues[46] reported that in the Plumas National Forest of California, spotted owl territorial sites declined 43% within 3-4 years of landscape-scale thinning treatments, and following treatment owls redistributed across the landscape. A study by Lee and colleagues[47] reported that in the San Bernardino and San Jacinto of southern California, post-fire salvage logging further reduced California spotted owl occupancy rates beyond the initial impacts of wildfire, leading the authors to recommend that burned stands be monitored for occupancy prior to salvage logging. Elsewhere in the Sierra Nevada, Tempel and colleagues[48] found that, as expected, canopy cover and demographic rates were strongly positively related, and that medium intensity fuels reduction harvest were negatively related to owl reproduction. Other researchers have concluded that thinning effects would be less impactful than severe wildfire,[49] leading to uncertainty of the true impacts of thinning on spotted owls.

The Forest Service also has information—based on recent monitoring of Mexican spotted owls in the area of the Nuttall-Gibson Fire of 2004 in the Coronado National Forest—that Mexican spotted owls appear to survive and thrive in a post-fire environment.[50] This information directly

[43] Page 11 in Ganey, J.L., H.Yi Wan, S.A. Cushman, And C.D. Vojta. 2017. Conflicting Perspectives on Spotted Owls, Wildfire, and Forest Restoration. Fire Ecology 13(3) doi: 10.4996/fireecology.130318020.

[44] Page 8 in Yi Wan, H., J.L. Ganey, C.D. Vojta, and S.A. Cushman. 2018. Managing emerging threats to spotted owls. *The Journal of Wildlife Management.* DOI: 10.1002/jwmg.21423.

[45] Id at 8.

[46] Scott L. Stephens, Seth W. Bigelow, Ryan D. Burnett, Brandon M. Collins, Claire V. Gallagher, John Keane, Douglas A. Kelt, Malcolm P. North, Lance Jay Roberts, Peter A. Stine, Dirk H. Van Vuren. 2014. California Spotted Owl, Songbird, and Small Mammal Responses to Landscape Fuel Treatments. *BioScience* 64(10): 893-906.

[47] Lee, D.E., M.L. Bond, M. I. Borchert, and R. Turner. 2012. Influence of fire and salvage logging on site occupancy of spotted owls in the San Bernardino and San Jacinto Mountains of southern California. *The Journal of Wildlife Management* 77(7):1327-1341.

[48] Tempel, Douglas J., R.J. Gutierrez, Sheila A. Whitmore, Matthew J. Reetz, Ricka E. Stoelting, William J. Berigan, Mark E. Seamans, and Zachariah Peery. 2014. Effects of forest management on California spotted owls: implications for reducing wildfire in fire-probe forests. *Ecological Applications* 24(8):2089-2106.

[49] Lee, D.C., and L.L. Irwin. 2005. Assessing risks to spotted owls from forest thinning in fire-adapted forests of the western United States. *Forest Ecology and Management* 211:191-209.

[50] See "Occupancy and Reproductive Success of Mexican Spotted Owls in the Pinaleno Mountains, Safford Ranger District, Arizona: 2011" ("the owl population in the Pinaleno Mountains has demonstrated the capability of reproducing well, despite of or even with the aid of effects promulgated by the large, and in some areas, severely burning Nuttall-Gibson fire of 2004").

undercuts the 2012 Mexican spotted owl revised Recovery Plan's assumptions with respect to Mexican spotted owl responses to fire and, more importantly, the conclusion that the risk to Mexican spotted owl habitat posed by the threat of fire justifies large-scale restoration projects which is itself associated with significant negative effects to the Mexican spotted owl and its habitat.

Interestingly, evidence suggests that wildfire may actually promote the recovery of the Mexican spotted owl despite the 2012 Revised Recovery Plan's suggestion to the contrary. A recent paper published by owl experts asserts that the 'debate' over the impacts of fire or logging to spotted owls is not settled:

> "*Here, we argue that the existing literature is not sufficient to unambiguously quantify the response of spotted owls to high-severity wildfire, and that high-severity fire is pervasive enough within the range of the spotted owl to constitute a potential threat to owl habitat. We also provide evidence that forest restoration and fuels reduction treatments can mitigate fire behavior, but acknowledge that these treatments also can degrade spotted owl habitat. Based on these findings, we argue for cautious implementation of restoration treatments in or near spotted owl habitat, with the goal of identifying treatment types that successfully reduce fire risk while maintaining suitable habitat conditions for spotted owls*."[51]

A similar meta-analysis concluded that "*mixed-severity fire does not appear to be a serious threat to owl populations; rather, wildfire has arguably more benefits than costs for Spotted Owls*."[52] In another recent paper, scientists reiterate our concern that:

> "*Commercial timber harvesting remains a potential threat for all 3 spotted owl subspecies, but effects from forest thinning may be increasing because of the heightened emphasis on fuels reduction and forest restoration treatments on public lands. Owl response to mechanical tree removal, especially forest thinning, remains understudied.*"[53]

Notably, these researchers identified that threats to Mexican spotted owl are comparatively less studied than for other spotted owl subspecies:

> "*Mexican spotted owl papers represented a small fraction of manuscripts among major research topics, except for habitat selection ... Because the Mexican spotted owl was listed as Threatened primarily because of concerns over habitat loss, it is understandable that a relatively high proportion of Mexican spotted owl studies have focused on characterizing habitat. The general lack of population*

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[51] Page 4 in Ganey, J.L., H. Yi Wan, S.A. Cushman, and C.D. Vojta. 2017. Conflicting Perspectives on Spotted Owls, Wildfire, and Forest Restoration. Fire Ecology 13(3) doi: 10.4996/fireecology.130318020.

[52] Page 1 in Lee, D.E. 2018. Spotted Owls and forest fire: a systematic review and meta-analysis of the evidence. *Ecosphere* 9(7):e02354. 10.1002/ecs2.2354.

[53] Page 1 in Yi Wan, H., J.L. Ganey, C.D. Vojta, and S.A. Cushman. 2018. Managing emerging threats to spotted owls. *The Journal of Wildlife Management.* DOI: 10.1002/jwmg.21423.

> *dynamics studies for the Mexican spotted owl, however, is notable, and severely limits our understanding of factors causing population fluctuations in this owl and how it might respond to emerging threats*."[54]

Regardless of uncertainty in the literature or in the 2012 MSO Recovery Plan, caution is warranted. Many Forests are not taking caution and are risking serious impacts to owls. For example, the Prescott National Forest recently issued a Draft Decision Notice (Hassayampa Landscape Restoration Project) approving a plan to log in more than ½ of the PACs on the entire Forest with no diameter caps, no codified incorporation of management recommendations in Table C.2 or C.3 of the Recovery Plan, and also allowing mechanical treatment up to 80% slope. That project also doesn't include any "comprehensive" restoration practices like riparian restoration, making it a perfect example of a project that is "landscape restoration" in name only. Unless a BiOp addresses our concerns, it is likely that this project will be met with fierce legal resistance.

Currently, the best science indicates that the cautious approach presented in the 2012 Mexican spotted owl Recovery Plan should be followed, specifically guidelines in Tables C.2 and C.3. The 2012 Plan (at 284) states that:

> "*The values provided in Table C.2 define desired conditions to be achieved with time and management, or to be maintained where they already exist.* ***These values are based on the lower bound of 95% confidence intervals around estimates of means computed across stands.*** *Consequently, we view these values as minimum targets for managers. We also stress that values in Table C.2 must be met simultaneously. Management can occur within stands that exceed these minimum conditions, but such activities should not lower stand characteristics below these levels unless large-scale assessments demonstrate that such conditions occur in a surplus across the landscape*."

A complete monitoring plan for Mexican spotted owl, including study design and analysis protocols, should be made available for public review and comment before a decision is made to implement the project. The Center has specific questions regarding the monitoring plan, including but not limited to: (1) criteria for selection of PAC as paired treatment and control sites; (2) criteria for selection of measurable indicators of change; (3) sampling design power analysis and expected observational error rates; (4) sampling procedures including monitoring cycle; (5) confidence levels to be applied in data analysis and reporting; (6) timeframe for evaluation of results; and (7) triggers for management adaptation using new information. Furthermore, need for any amendment of the Forest Plan with respect to Mexican spotted owl and its critical habitat is a significant issue for analysis.

Recommendations for issue of treatments in Mexican spotted owl habitat:

Because of uncertainty over the effects of thinning on the Mexican spotted owl, we request that a conservative approach be taken to managing their habitats. We request the following:

[54] Id at 7.

► Defer any thinning or burning in owl PACs if breeding is detected.

► Do not thin (hand or mechanical) during breeding season (March 1 to August 31) within or adjacent to PACs by ¼ mile.

► Do not thin in nest cores, and use extreme caution with burning in next cores.

► In PACs outside of nest cores, limit thinning to hand felling of trees under 9" dbh, followed by pile burning, unless breeding is detected, then defer treatment.

► In forest, riparian, canyon, and woodland cover types typically used by Mexican spotted owls for nesting and roosting, limit thinning to a 17.9" dbh cutting limit, and conform to recommendations in Tables C.2 and C.3 of the 2012 Recovery Plan. "*Management can occur within stands that exceed these minimum conditions, but such activities should not lower stand characteristics below these levels unless large-scale assessments demonstrate that such conditions occur in a surplus across the landscape.*"[55]

► Any subsequent NEPA document should describe a monitoring plan in detail that is consistent with regional and USFWS direction for spotted owl monitoring, and addresses at the least the seven monitoring elements introduced above, consistent with BOX C.5. ASSESSING TREATMENT ACTIVITIES WITHIN PACs, OUTSIDE OF CORE AREAS of the 2012 Recovery Plan.

► Because spotted owls may use higher elevations forests than they currently are confirmed to use (due to scientific uncertainty or climate change effects), any subsequent NEPA document should describe how the Project will accommodate the considerations in BOX C.3. HIGH-ELEVATION, MIXED-CONIFER FOREST of the 2012 Recovery Plan.

ISSUE 3: TREATMENTS FOR DWARF MISTLETOE.

We recently toured, with a cadre of USFS staff, an active timber sale on the Apache-Sitgreaves NF where a very heavy cut was being completed because of perceived high severity mistletoe infection (August 29, 2018 site visit to Little Timber Sale, West Escudilla Landscape Restoration Project). The cutting has targeted many large and old trees, and reduced stand basal area predominantly in VSS 5+ classes.[56] This is contrary to many restoration objectives. We hope sincerely that the Santa Fe will avoid the humiliation we ushered onto the staff at the ASNF.

The Ecological Restoration Institute (ERI) recently released a new publication titled "*Restoration as a Mechanism to Manage Southwestern Dwarf Mistletoe in Ponderosa Pine Forests*" (attached to these comments). While the working paper does suggest that even-aged management is an appropriate response to moderate to severe infections, it is in the context of even aged groups separated by 40-80 feet between groups. It does not suggest even-aged

[55] 2012 Mexican spotted owl Recovery Plan at 284.

[56] See attached field report on the Little Timber Sale

approaches at scales larger than the group level. Of more importance, the report suggests that in severely infected stands, manager should use fire only, and that severely infested stands may be deferred and allowed to burn or left as wildfire habitat. Of most importance is the recommendation to retain presettlement trees, even if dwarf mistletoe is present. In this Project, this might include many VSS 5 trees that may otherwise be targeted for removal because of mistletoe due to the allowance to cut trees up to 24", as stated in the scoping document. Elsewhere in this letter we make clear that we seek an 18" diameter cap for this Project.

This ERI working paper provides a table (below) of recommended silvicultural prescriptions for three levels of dwarf mistletoe infection. It recommends that old trees are retained, and if the infection is severe, to defer mechanical thinning and use fire only.

Compatible Silvicultural Prescription

Light to Moderate DM infestation:
- Uneven-aged prescriptions that are relatively open, maintaining groups of presettlement trees (old trees) with interspaces and openings (40-80 ft between groups).
- Group selection with thinning in the matrix; Retain all presettlement trees and use interspaces and openings with intergroup spacing of 40-80 ft.
- Be flexible and take advantage of opportunities to leave size/age class diversity.
- Repeated entries with prescribed fire are necessary to maintain openings.

Moderate to Severe DM infestation:
- Even-aged management maintaining groups of presettlement trees and openings (40-80 ft between groups).
- Group selection with thinning between groups. Retain all presettlement trees and remove all blackjacks. Maintain openings and interspaces (40-80 ft between groups).
- Be flexible. If DM infestation is patchy, may need to divide up stand at treat accordingly. Take advantage of opportunities to leave size/age class diversity.
- Repeated entries with prescribed fire are necessary to maintain openings.

Severe DM infestation:
- Use of fire only. Severely infested stands may be deferred and allowed to burn or left as wildfire habitat.

Allow us to include as an attachment to this letter the Centers objection letter to the West Escudilla Restoration Project and the Luna Restoration Project wherein we requested that the project incorporate 4FRI stakeholder-developed treatment approaches for stands with occurrence of southwestern dwarf mistletoe, as well as the 4FRI stakeholder's letter addressing the unanimous rejection of the Forest Service's proposals to utilize aggressive overstory removal and even-aged management approaches in treating stands infected with mistletoe.

The aforementioned 4FRI Stakeholders (SHG) letter of April 27, 2017, rejecting the Forest Service's dwarf mistletoe proposal for 4FRI stated:

> • "*Dwarf mistletoe is a natural disturbance agent and component of coniferous forests within the planning area. The plant provides food and cover for wildlife; large-tree mortality caused by mistletoe is an important factor in recruiting snags that provide habitat for cavity-nesting birds and other species*."
>
> • "*The historical and recent data presented by USFS did not make a compelling case that mistletoe infections within the planning area are significantly outside the natural range of variability and pose a meaningful obstacle to meeting restoration objectives*."

• "*The SHG feels that restoration treatments consisting of mechanical or hand thinning, followed by application of prescribed/managed fire at regular intervals, meet the intent of the Forest Plans and are the preferred approach for stands with high levels of mistletoe infection. Where needed, those stands could also be buffered to reduce mistletoe spread*."

• "*The SHG also feels that traditional silvicultural approaches to managing dwarf mistletoe (e.g. overstory removal, even-aged management) are inconsistent with an ecological restoration approach and are not supported by the best available science*."

The 4FRI stakeholders group consists of representatives of the Center, The Nature Conservancy, the Ecological Restoration Institute, the Sierra Club, Grand Canyon Trust, partner federal and state agencies, local and regional governments, the timber industry, and others. If we could agree in consensus to reject the sanitation of mistletoe on the 4FRI landscape, the Santa Fe Mountains Landscape Resiliency Project can do it too.

Recommendation for the issue of mistletoe treatment:

► Any subsequent NEPA analysis should be unambiguous in stating that no large (>18") or old (>150 years) tree will be cut because of disease occurrence, and any treatment of mistletoe should be in accordance with accepted uneven-aged restoration prescriptions.

ISSUE 4: EFFECTS OF LIVESTOCK GRAZING ON MEETING PROJECT PURPOSE AND NEED.

The scoping document (p. 10) states that "*The primary resource concerns for riparian areas in the Project Area include departed vegetative conditions, wildfire risk, and impacts to water quality from roads and trails*" and that "*Fencing may be installed if needed to protect restored areas if it is determined that riparian vegetation regeneration is being hampered by browsing and grazing*" (p.14). These statements constitute a brazen dismissing of reality; that livestock grazing has destroyed many of New Mexico's ecosystems.

Livestock grazing an important factor to consider that adversely impacts ecosystem health and fire regime and will reduce the effectiveness of the proposed treatments in moving towards desired conditions. Potentially significant cumulative effects to soil productivity, plant communities, fire regime and wildlife may result from fuel management in combination with livestock grazing and other activities which disturb soils and spread exotic plant species.

Livestock grazing is a primary driver of fire regime disruption

Livestock grazing decreases understory biomass and density, reducing competition with conifer seedlings and reducing the ability of the understory to carry low-intensity fire, contributing to dense forests with altered species composition.[57] Livestock grazing directly contributes to fire

[57] Belsky A.J. and D.M. Blumenthal. 1997. Effects of livestock grazing on stand dynamics and soils in upland forests of the Interior West. *Conservation Biology* 11:316-27.

hazard in the project area by impairing soil productivity and altering vegetation communities, which indirectly contribute to delayed fire rotations, increased forest density, and reduced forage opportunities for herbivorous species and predators.

Continued livestock grazing risks post-treatment invasion of exotic plants

Livestock facilitate the spread of exotic species, particularly in combination with fire, and reduce the competitive and reproductive capacities of native species.[58] Exotic plant species, once established, can displace native species, in part, because native grasses are not adapted to frequent and close grazing in combination with fire disturbance.[59/60/61]

Livestock disturb soil, enable seeds of exotic species to spread, and reduce the competitive and reproductive capacities of native species. Exotic plant species, once established, can displace native species, in part, because native grasses are not adapted to frequent and close grazing in combination with fire disturbance.

Exotic plant spread is a potentially significant cumulative impact of the proposed action. Treatments similar to the proposed action in northern Arizona left forest sites overrun with cheatgrass (*Bromus tectorum*). Although it is not extensive in the project area today, exotic grass invasion is foreseeable and has important long-term implications for native plant communities in fire-adapted ecosystems and wildlife. Melgoza and others (1990[62]) studied cheatgrass soil resource acquisition after fire and noted its competitive success owing to its ability suppress the water uptake and productivity of native species for extended periods of time. They further showed that cheatgrass dominance is enhanced by its high tolerance to grazing. Its annual life-form coupled with the abilities to germinate readily over a wide range of moisture and temperature conditions, to quickly establish an extensive root system, and to grow early in the spring contribute to its successful colonization. In addition, Melgoza and others showed that cheatgrass successfully competes with the native species that survive fire, despite these plants being well-established adult individuals able to reach deeper levels in the soil. This competitive ability of cheatgrass contributes to its dominance when lands experience synergistic disturbances from grazing, mechanical treatments, and fire.

Continued livestock grazing threatens success of improving and maintaining diverse wildlife habitats and improving watershed conditions

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[58] Brooks, M.L., C.M. D'Antonio, D.M. Richardson, J. B. Grace, J.E. Keeley, J. M. DiTomaso, R.J. Hobbs, M. Pellant and D.Pyke. 2004. Effects of invasive alien plants on fire regimes. *BioScience* 54(7):677-688.

[59] Mack, R. N., and J. N. Thompson. 1982. Evolution in steppe with few large, hooved mammals. *American Naturalist* 119:757-72.

[60] Melgoza, G., R.S. Nowak and R.J. Tausch. 1990. Soil water exploitation after fire: competition *between Bromus tectorum* (cheatgrass) and two native species. *Oecologica* 83:7-13.

[61] Belsky, A.J., and J.L. Gelbard. 2000. Livestock Grazing and Weed Invasions in the Arid West. Oregon Natural Desert Association: Portland, OR. April. 31 pp.

[62] Melgoza, G., R.S. Nowak and R.J. Tausch. 1990. Soil water exploitation after fire: competition *between Bromus tectorum* (cheatgrass) and two native species. *Oecologica* 83:7-13.

Grazing of the most nutritious plants by livestock results in a loss of forage for native species and can alter habitat or insect prey base.[63/64] A decrease in prey base inevitably leads to a decrease in carnivores in the area, which are also eliminated by the government at the request of the livestock community. "*The productivity, diversity, and species richness of native grasslands are threatened by competition from noxious and invasive weeds/grasses. Productivity is threatened by other factors including drought, soil erosion, fire suppression, and improper livestock management practices.*"[65] Grazing also has negative effects on songbirds, reptiles and other mammals especially if their habitat is close to the ground.[66] Rosenstock and Van Riper reported that "*Livestock grazing and fire suppression commonly are cited as causes of woodland expansion.*"[67] Because of the severity and broad array of grazing impacts, livestock grazing is one of the most prevalent causes of species being federally listed in this region, especially those which are specifically dependent on aquatic and riparian habitat.[68/69/70]

Project purpose cannot be met with continued livestock grazing in riparian areas

Livestock grazing has both direct and indirect effects on streams. Livestock directly affect riparian habitats through removal of riparian vegetation[71] which in turn raises water

[63] Donahue, D. 1999. The Western Range Revisited: Removing Livestock from Public Lands to Conserve Native Biodiversity. Norman, OK: University of Oklahoma Press. 338 pages.

[64] Kie, John G., Charles J. Evans, Eric R. Loft, and John W. Menke. 1991. Foraging behavior by mule deer: the influence of cattle grazing. *The Journal of Wildlife Management* 55(4):665-674.

[65] Central Arizona Grasslands Conservation Strategy, page 21

[66] Finch, D.M., and W. Block, technical editors. 1997. Songbird ecology in southwestern ponderosa pine forests: a literature review. Gen. Tech. Rep. RM-GTR-292. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 152 p.

[67] Rosenstock, S. S. and Van Riper III, C. (2001) Breeding Bird Responses to Juniper Woodland Expansion. *Journal of Range Management*, 54:226-232.

[68] *See* 60 Fed. Reg. at 10707 ("*Overuse by livestock has been a major factor in the degradation and modification of riparian habitats in the United States … Livestock grazing in riparian habitats typically results in reduction of plant species diversity and density, especially of palatable plants like willow and cottonwood saplings*.")

[69] *See* 77 Fed. Reg. at 10,818)("*Impacts associated with roads and bridges, changes in water quality, improper livestock grazing, and recreation have altered or destroyed many of the rivers, streams, and watershed functions in the ranges of the spikedace and loach minnow*.").

[70] *See* 79 Fed. Reg. at 38718 ("*We found numerous effects of livestock grazing that have resulted in the historical degradation of riparian and aquatic communities that have likely affected northern Mexican and narrow-headed gartersnakes.*")

[71] *See* Clary, W. P., B. F. Webster. 1989. Managing grazing of riparian areas in the Intermountain Region. USDA Forest Service; Clary, W. P., D. E. Medin. 1990. Differences in vegetation biomass and structure due to cattle grazing in a northern Nevada riparian ecosystem. USDA Forest Service; Schulz, T. T., and W.C. Leininger. 1990. Differences in riparian vegetation structure between grazed areas and exclosures. *Journal of Range Management* 43(4): 295-299; and Armour, C. L., D. A. Duff, and W. Elmore. 1991. The effects of livestock grazing on riparian and stream ecosystems. *Fisheries* 16(1):7-11.

temperatures,[72/73] reduces bank stability and eliminates an important structural component of the stream environment that contributes to the formation of pools,[74] and by physically altering streambanks through trampling and shearing, leading to bank erosion.[75] Livestock also indirectly impact aquatic and riparian habitats by compacting soils, altering soil chemistry and reducing vegetation cover in upland areas, leading to increased severity of floods and sediment loading, lower water tables and altered channel morphology.[76]

Treated areas need substantial rest from or exclusion of livestock grazing

A critical and often overlooked consideration in effective vegetation treatments is the necessity for resting a treated area from domestic livestock grazing to allow establishment of fine fuels such that low-intensity ground fire can be applied to the forest floor, and aligning allotment management plans such that future livestock grazing does not deplete the fine fuels that are required to maintain a prescribed fire schedule. The Ecological Restoration Institute reviewed the research and perspectives on resting from grazing, and concluded that:

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[72] Kondolf, G. Mathias, Richard Kattelmann, Michael Embury, and Don C. Erman. 1996. Status of riparian habitat. Sierra Nevada Ecosystem Project: Final report to Congress, Volume 2

[73] Beschta, R.L., D.L. Donahue, D.A. DellaSala, J.J. Rhodes, J.R. Karr, M.H. O'Brien, T.L. Fleischner and C.D. Williams. 2013. Adapting to climate change on western public lands: addressing the ecological effects of domestic, wild, and feral ungulates. *Environmental Management* 51: 474-91.

[74] *See* Meehan, W. R., F.J. Swanson, and J.R. Sedell. 1977. Influences of riparian vegetation on aquatic ecosystems with particular reference to salmonid fishes and their food supply. USDA Forest Service; Kauffman, J. B., W. C. Krueger. 1984. Livestock impacts on riparian plant communities and streamside management implications. A review. *Journal of Range Management* 37(5): 430-438; Minckley, W.L., and J.N. Rinne. 1985. Large woody debris in hot-desert streams: an historical review. *Desert Plants* 7(3):142-153; and Platts, W. S. 1990. Managing fisheries and wildlife on rangelands grazed by livestock: A guidance and reference document for biologists, unpublished document, Nevada Department of Wildlife.

[75] *See* Armour, C.L. 1977. Effects of deteriorated range streams on trout. U.S. Bureau of Land Management, Boise, ID. 7 pp; Platts, W.S., and R.L. Nelson. 1985. Stream habitat and fisheries response to livestock grazing and instream improvement structures, Big Creek, Utah. *Journal of Soil and Water Conservation* 40(4):374-379; and Trimble, S.W., and A.C. Mendel. 1995. The cow as a geomorphic agent - a critical review. *Geomorphology* 13(1995):233-253.

[76] *See* Cooperrider, C. K. and B. A. Hendricks. 1937. Soil erosion and streamflow on range and forest lands of the upper Rio Grande watershed in relation to land resources and human welfare, USDA Technical Bulletin 567; Sartz, R. S., and D.N. Tolsted. 1974. Effect of grazing on runoff from two small watersheds in southwestern Wisconsin. *Water Resources Research* 10(2): 354-356; Gifford, G. F., R. H. Hawkins. 1978. Hydrologic impact of grazing on infiltration: a critical review. *Water Resources Research* 14: 305-313; Blackburn, W. H., R. W. Knight, M.K. Wood. 1982. Impacts of grazing on watersheds: a state of knowledge. College Station, Texas, Texas Agricultural Experiment Station, Texas A&M University; Orodho, A.B., M.J. Trlica, and C.D. Bonham. 1990. Long-term heavy-grazing effects on soil and vegetation in the four corners region. *The Southwestern Naturalist* 35(1):9-15; Schlesinger, W.H., J.R. Reynolds, G.L. Cunningham, L.F. Huenneke, W.M. Jarrell, R.A. Virginia, and W.G. Whitford. 1990. Biological feedbacks in global desertification. Science 246:1043-1048; and Elmore, W., and B. Kauffman. 1994. Riparian and watershed systems: degradation and restoration. Pp 212-231 in M. Vavra, W. A. Laycock, and R. D. Pieper, editors. Ecological implications of livestock herbivory in the west. Society for Range Management, Denver, CO.

> "*These research findings, although limited, suggest that federal agencies should be prepared to wait more than two years before allowing domestic grazing on restored allotments lest they jeopardize two important goals of restoration treatments—restoring the understory and returning low-intensity prescribed fire as an ecosystem process.*"[77]

Livestock need to be permanently excluded from riparian areas

The scoping document (p. 14) states that in riparian areas "*fencing may be installed if needed to protect restored areas if it is determined that riparian vegetation regeneration is being hampered by browsing and grazing.*" The near-complete and permanent removal of livestock from all riparian areas is necessary to ensure full restoration of these crucial habitats and scenic recreational gems.

As briefed here, the scientific literature documenting the impacts of livestock grazing on ecosystems is extensive, and universally shows severe and lasting negative impacts. The only is widely accepted way to eliminate these impacts and preserve stream health is the near-complete exclusion of cattle.[78]

Consider the following:

• An example of where removal of cattle from rangelands for 35 years led to the disappearance of rabbitbrush from previously shrub-dominated communities - and native grasses regained dominance;[79]

• An example of where Forest Service scientists at the Intermountain Forest and Range Experiment Station found that protection of an Idaho range from grazing increased grass and forb production by 30% and decreased shrub production by 20%.[80]

• An example of where University of Idaho range scientists documented a 20-fold increase in perennial grass cover after 25 years of grazing exclusion while shrub cover only increased by

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[77] Egan, D. 2011. Integrating Domestic and Wild Ungulate Grazing into Forest Restoration Plans at the Landscape Level. Issues in Forest Restoration, ERI White papers. Ecological Restoration Institute, Flagstaff, AZ. 14p.

[78] Fleischner, T.L. 1994. Ecological costs of livestock grazing in western North America. *Conservation Biology* 8(3):629-644.

Conservation Biology 8(3): 629-644; Ohmart, R. D. 1996. Historical and present impacts of livestock grazing on fish and wildlife resources in western riparian habitats. Rangeland Wildlife. P. R. Krausman. Denver, CO, Society for Range Management; and Belsky, A. J., A. Matzke, and S. Uselman. 1999. Survey of livestock influences on stream and riparian ecosystems in the western United States. *Journal of Soil and Water Conservation* 54(1):419-431.

[79] Austin, D.D., and P.J. Urness. 1998. Vegetal change on a northern Utah foothill range in the absence of livestock grazing between 1948 and 1982. *Great Basin Naturalist* 58(2): 188-191.

[80] Laycock, W.A. 1967. How heavy grazing and protection affect sagebrush-grass ranges. *Journal of Range Management* 20: 206-213.

1.5-fold, attributing the grass response to "*the availability of seeds as formerly depleted populations increase in size*." [81]

• An example of where in a southeastern Arizona rangeland excluded from cattle grazing for 14 years, grass cover was 45% higher, the grass community was more heterogeneous, herb cover was higher, and rodent and bird numbers were higher than grazed comparison areas.[82]

• USDA research has found that excluding cattle from a landscape for five growing seasons "*significantly increased: (1) total vegetative cover, (2) native perennial forb cover, (3) grass stature, (4) grass flowering stem density, and (5) the cover of some shrub species and functional groups.*"[83]

Recommendations on the issue of the effects of livestock grazing on meeting project purpose and need:

Persistent livestock grazing is a component of the compromised ecological condition of the Southwest's forests and riparian areas. We request that in any subsequent NEPA document related to the Santa Fe Mountains Landscape Resiliency Project that:

> ► The Forest Service should analyze the effects of livestock grazing on the success of the proposed vegetation treatments in achieving and maintaining desired future conditions as they relate to fire use, migratory bird, native fish and other sensitive species populations and habitats.

Recent studies into livestock grazing management[84/85] have identified ways to reduce negative impacts, primarily through changes in agency management of forage resources and grazing to reflect best available science. These changes would contribute significantly to improving the habitat for a range of species in the Project. We request that in any subsequent NEPA document related to the Santa Fe Mountains Landscape Resiliency Project:

> ► The Forest Service should identify areas with degraded soils or plant communities, areas with sensitive or high-erosion soils, and areas in need of recovery, and reduce or

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[81] Anderson, J.E., and K.E. Holte. 1981. Vegetation development over 25 years without grazing on sagebrush-dominated rangeland in southeastern Idaho. *Journal of Range Management* 34:25-29.

[82] Bock, C.E., J.H. Bock, W.R. Kenney, and V.M. Hawthorne. 1984. Responses of birds, rodents, and vegetation to livestock exclosure in a semidesert grassland site. *Journal of Range Management* 37(3): 239-242.

[83] Kerns, Becky K., Michelle Buonopane, Walter G. Thies, and Christine Niwa. 2011. Reintroducing fire into a ponderosa pine forest with and without cattle grazing: understory vegetation response. *Ecosphere* 2(5):1-23.

[84] Carter, J., J. Chard, and B. Chard. 2011. Moderating Livestock Grazing Effects on Plant Productivity, Nitrogen and Carbon Storage. *In* Monaco, T.A. *et al.,* 2011. Proceedings – Threats to Shrubland Ecosystem Integrity; May 18-20, 2010, Logan, UT. *Natural Resources and Environmental Issues* 17.

[85] Carter, J., J.C. Catlin, N. Hurwitz, A.L. Jones, and J. Ratner. 2017. Upland water and deferred rotation effects on cattle use in riparian and upland areas. *Rangelands* 39(3-4): 112-118.

eliminate grazing in those pastures altogether to contribute to the success of resiliency treatments.

Removal of livestock grazing pressure from riparian areas has been found to have a positive effect on growth, distribution, and vigor of riparian communities.[86] We request that in any subsequent NEPA document related to the Santa Fe Mountains Landscape Resiliency Project:

► The Forest Service should permanently fence livestock out of riparian areas.

The Center's proposed alternative includes these three recommendations for analysis independent from the baseline proposed action.

ISSUE 5: CONDITIONS BASED MANAGEMENT, MONITORING, AND ADAPTIVE MANAGEMENT.

The scoping notice (pp. 11-12) states

> "*This Proposed Action does not define specific treatment units, but rather general areas throughout the project area where treatments are most likely to occur and the suite of tools that would be used. We do not have complete information about the conditions found on every acre, but we do have enough information to make informed decisions about the types of treatments that work best in certain conditions… This 'condition-based' approach provides flexibility and lets us account for imperfect information and adapt to changes in environmental conditions*."

The Center finds this approach troubling considering the amount of time and attention that has been given to this project already. Was there not a voluminous modelling study completed by The Nature Conservancy? Why wouldn't these data and results be used in this analysis? Weren't useful data used in that project?

The Forest service has some serious explaining to do to validate their abandonment of baseline conditions and real project planning.

"*In analyzing the affected environment, NEPA requires the agency to set forth the baseline conditions.*"[87] Specifically, NEPA requires agencies to "*succinctly describe the environment of the area(s) to be affected or created by the alternatives under consideration*."[88] The Council on Environmental Quality, the agency charged with interpreting NEPA, has explained that "*[t]he concept of a baseline against which to compare predictions of the effects of the proposed action*

[86] Schulz, Terri Tucker, and Wayne C. Leininger. 1990. Differences in riparian vegetation structure between grazed areas and exclosures. Journal of Range Management 43(4):295-299.

[87] *Western Watersheds Project v. BLM*, 552 F.Supp.2d 1113, 1126 (D. Nev. 2008)

[88] 40 C.F.R. § 1502.15.

and reasonable alternatives is critical to the NEPA process."[89] Federal courts hold that "*[w]ithout establishing ... baseline conditions ... there is simply no way to determine what effect [an action] will have on the environment and, consequently, no way to comply with NEPA*."[90]

Without baseline data, neither the public nor the agency can understand the effects of the proposed action or craft and analyze alternatives and mitigation measures to protect these values. As such, the Forest Service must identify the environmental baseline and affected environment, as well as the scope of impacts and where those impacts are most likely to be felt. The vague "conditions-based" approach does not satisfy this requirement.

NEPA requires federal agencies to take a "*hard look*" at the environmental impacts of proposed actions.[91] To do so, federal agencies must prepare an environmental impact statement (EIS) for all "*major Federal actions significantly affecting the quality of the human environment*."[92] An EIS must "*provide [a] full and fair discussion of significant environmental impacts*" associated with a federal decision and "*inform decisionmakers and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment*."[93] Taking the required "*hard look*" requires agencies to "*utiliz[e] ... the best available scientific information*."[94]

NEPA's review obligations are more stringent and detailed at the project level, or "*implementation stage*," given the nature of "*individual site specific projects*."[95] "[G]*eneral statements about possible effects and some risk do not constitute a hard look, absent a justification regarding why more definitive information could not be provided*."[96]

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[89] Council on Environmental Quality, Considering Cumulative Effects Under the National Environmental Policy Act 41 (1997), https://ceq.doe.gov/publications/cumulative_effects.html (last visited July 5, 2019).

[90] *Half Moon Bay Fishermans' Mktg. Ass'n v. Carlucci*, 857 F.2d 505, 510 (9th Cir. 1988); *see also N. Plains Res. Council, Inc. v. Surface Transp. Bd.*, 668 F.3d 1067, 1084–85 (9th Cir. 2011) (holding that agency did not take a sufficiently "hard look" at environmental impacts because it did not collect baseline data).

[91] *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350 (1989).

[92] 42 U.S.C. § 4332(2)(C); *see also* 40 C.F.R. § 1501.4.

[93] 40 C.F.R. § 1502.1.

[94] *Colo. Envtl. Coal. v. Dombeck*, 185 F.3d 1162, 1171 (10th Cir. 1999).

[95] *Ecology Ctr., Inc. v. United States Forest Serv*., 192 F.3d 922, 923 n.2 (9th Cir. 1999); *see also Friends of Yosemite Valley v. Norton*, 348 F.3d 789, 800-01 (9th Cir. 2003); *New Mexico ex rel Richardson v. Bureau of Land Management*, 565 F.3d 683, 718-19 (10th Cir. 2009) (requiring site-specific NEPA analysis when no future NEPA process would occur); *Colo. Envtl. Coal. v. Ofc. of Legacy Mgmt*., 819 F. Supp. 2d 1193, 1209-10 (D. Colo. 2011) (requiring site-specific NEPA analysis even when future NEPA would occur because "environmental impacts were reasonably foreseeable").

[96] *Or. Natural Res. Council Fund v. Brong*, 492 F.3d 1120, 1134 (9th Cir. 2007) (citation omitted); *see also Or. Natural Res. Council Fund v. Goodman*, 505 F.3d 884, 892 (9th Cir. 2007) (holding the Forest Service's failure to discuss the importance of maintaining a biological corridor violated NEPA, explaining that "[m]erely disclosing the existence of a biological corridor is inadequate" and that the agency must "meaningfully substantiate [its] finding").

Analyzing and disclosing site-specific impacts is critical because where (and when and how) activities occur on a landscape strongly determines that nature of the impact. As the Tenth Circuit Court of Appeals has explained, the actual "*location of development greatly influences the likelihood and extent of habitat preservation. Disturbances on the same total surface area may produce wildly different impacts on plants and wildlife depending on the amount of contiguous habitat between them*."[97] The Court used the example of "*building a dirt road along the edge of an ecosystem*" and "*building a four-lane highway straight down the middle*" to explain how those activities may have similar types of impacts, but the extent of those impacts – in particular on habitat disturbance – is different.[98] Indeed, "*location, not merely total surface disturbance, affects habitat fragmentation*,"[99] and therefore location data is critical to the site-specific analysis NEPA requires.

NEPA further mandates that the agency provide the public *"'the underlying environmental data' from which the Forest Service develop[ed] its opinions and arrive[d] at its decisions*."[100] "*The agency must explain the conclusions it has drawn from its chosen methodology, and the reasons it considered the underlying evidence to be reliable*."[101] In the end, "*vague and conclusory statements, without any supporting data, do not constitute a 'hard look' at the environmental consequences of the action as required by NEPA*."[102]

CEQ's regulations establish specific ways agencies must analyze proposed actions, including project-level decisions, including a detailed discussion of direct, indirect, and cumulative impacts and their significance; and an analysis of reasonable alternatives to the proposed action. Such analysis is required for both environmental assessments and EISs.

Adaptive management

"Adaptive management" is an iterative process by which a decisionmaker sets clearly defined and measurable goals, conducts monitoring to assess whether they are being met, and then makes appropriate management changes where the desired outcomes are not being achieved.[103]

Science-based adaptive management involves "*treating management interventions as experiments, the outcomes of which are monitored and fed back into management planning.*"[104]

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[97] *New Mexico ex rel Richardson*, 565 F.3d at 706.

[98] *Id*. at 707.

[99] *Id*.

[100] *WildEarth Guardians v. Mont. Snowmobile Ass'n*, 790 F.3d 920, 925 (9th Cir. 2015).

[101] *N. Plains Res. Council, Inc. v. Surface Transp. Bd.*, 668 F.3d 1067, 1075 (9th Cir. 2011) (citation omitted).

[102] *Great Basin Mine Watch v. Hankins*, 456 F.3d 955, 973 (9th Cir. 2006).

[103] *See, e.g.*, U.S. Dep't of the Interior, Coordinating Adaptive Management and National Environmental Policy Act (NEPA) Processes (Jan. 7, 2013), available at https://www.doi.gov/sites/doi.opengov.ibmcloud.com/files/uploads/ESM13-11.pdf.

Essentially, as outlined by land management experts, an adaptive management approach to forest management should include the following:[105]

- Creation of management strategies (specific action alternatives in this case)
- Implementation of those strategies/actions
- Monitoring of the effects (under the monitoring framework developed as part of the planning process)
- Predetermined triggers for changes in management based on the results of monitoring

Forest Service experts in adaptive management have said that "[a]*daptive management requires explicit designs that specify problem-framing and problem-solving processes, documentation and monitoring protocols, roles, relationships, and responsibilities, and assessment and evaluation processes*."[106]

The fourth component is described by adaptive management experts in the following statement:

> "*The term trigger, as used here, is a type of pre-negotiated commitment made by an agency within an adaptive management or mitigation framework specifying what actions will be taken if monitoring information shows x or y. In other words, predetermined decisions, or more general courses of action, are built into an adaptive framework from the beginning of the process.*"[107]

In many projects the Forest Service often states repeatedly that it will rely heavily on monitoring and adaptive management to ensure that a project meets its goals without significantly harming key resources. Unfortunately, the Forest Service usually provides almost no details about its monitoring plan, and nothing at all about what will trigger changes in project design through so-called "adaptive management."

One recent example is the South Sacramento Restoration Project on the Lincoln National Forest where the Forest Service did not identify a specific monitoring plan, and made clear that it wouldn't develop a plan until after the agency completed its NEPA review and after it approved the project. The Draft EIS for that project stated that "*Monitoring would follow the established*

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[104] Gillson, L., T.P. Dawson, S. Jack, and M.A. McGeoch. 2013. Accommodating climate change contingencies in conservation strategy. Trends in Ecology & Evolution 28(3): 135-142.

[105] Schultz, C. and M. Nie. 2012. Decision-making triggers, adaptive management, and natural resources law and planning. *Natural Resources Journal* 52:443-521.

[106] Page 58 in Stankey, G.H., R.N. Clark, and B.T. Bormann. 2005. Adaptive management of natural resources: theory, concepts, and management institutions. Gen. Tech. Rep. PNW-GTR-654. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 73 p.

[107] Id at 455

monitoring plan written during the site-specific prescription development," which would not occur until after the Project is approved.

Of primary concern is that by doing this the Forest Service will thus make it impossible for the public to review any monitoring plan unless they are involved in prescription development, which is highly unlikely. Furthermore, Forest Service decisionmakers will not know what values, if any, the agency intends to evaluate before approving this decision. Not to mention that neither decisionmakers nor the public will have any idea of who will monitor, when they will do it, or what metrics will be assessed, or how it will be funded (if at all).

In the specific case of the South Sacramento Restoration Project, this was a surprise given the amount of attention throughout the life of that project to implementing treatments within an experimental framework.

Federal courts have found agencies violated NEPA or the ESA where, like the South Sacramento Restoration Project, the agency relies on an "adaptive management" plan that is too vague, sets no specific triggers for future action, fails to describe that future action, and fails to ensure that resource will be protected as the adaptive management plan asserts. Reliance on an adaptive management plan to achieve desired conditions also appears to violate the National Forest Management Act because amendments to a Forest Plan may not ensure the protection of values identified in the 2012 forest planning rule.

In *Natural Resources Defense Council v. U.S. Army Corps of Engineers*, 457 F. Supp. 2d 198 (S.D.N.Y. 2006), the court found that the Army Corps attempt to supplement an inadequately-explained finding of no significant impact concerning a dredging project was arbitrary and capricious where the agency relied on ill-defined "adaptive management" protocols to conclude that impacts would be mitigated.

> "*The EA makes several promises that it will alter its monitoring plan should it prove necessary. For example, the EA relies on a general promise that it will "as appropriate, reevaluate, the need for altering its dredging methods" ... through the use of its coordination plan and monitoring program. The EA also explains that the Corps will follow "adaptive management practices as it moves through construction of its contracts," thus allowing it to change future contracts should the data indicate it is necessary. These promises, however, provide no assurance as to the efficacy of the mitigation measures. The Corps did not provide a proposal for monitoring how effective "adaptive management" would be*."[108]

In another case, the judge set aside a Forest Service decision to open motor vehicle trails where the agency proposed to monitor impacts to wildlife and potentially change the trails later based on an adaptive management plan. The court stated that these adaptive management strategies "*amount ... to a 'build-first, study later' approach to resource management. This backward-looking decision making is not what NEPA contemplates*."[109]

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[108] *NRDC v. United States Army Corps of Eng'rs*, 457 F. Supp. 2d at 234 (citations omitted).

[109] *Mountaineers v. United States Forest Serv.*, 445 F. Supp. 2d at 1250.

While some courts have upheld less than precise monitoring or adaptive management plans, they have done so largely where the NEPA analysis at issue was programmatic in nature and where the agency would be required to comply with NEPA, and thus re-assess mitigation, at a later stage when more site-specific data was available. *See, e.g.*, *San Juan Citizens Alliance v. Stiles*, 654 F.3d 1038, 1055 (10th Cir. 2011) (agreeing with case that held the development of more specific mitigation measures was not required at the "early stage of a multi-step process"). Other cases similarly conclude that NEPA forbids the use of ill-defined adaptive management plans cannot be used to assume away likely impacts of agency action.[110]

Courts also find unlawful agency projects that may impact species protected by the Endangered Species Act where the biological opinion is based on the assumption that a vague and ill-defined monitoring and adaptive management plan will somehow mitigate impacts to the species at issue. *Natural Resources Defense Council v. Kempthorne*, 506 F. Supp. 2d 322 (E.D. Ca. 2007) is a key precedent. There, plaintiffs challenged a proposed plan to manage water diversions in a manner that could adversely impact the delta smelt, a species listed as threatened under the Endangered Species Act. The Fish and Wildlife Service prepared a biological opinion (BiOp) on the proposal which concluded that the project would neither jeopardize the smelt nor adversely modify the smelt's critical habitat. "*Although the BiOp recognize[d] that existing protective measures may be inadequate, the FWS concluded that certain proposed protective measures, including ... a proposed 'adaptive management' protocol would provide adequate protection.*"[111]

Plaintiffs alleged, among other things, that the BiOp "*relie*[d] *upon uncertain (and allegedly inadequate) adaptive management processes to monitor and mitigate the* [project's] *potential impacts*."[112] They asserted that the adaptive management plan, which required a working group meet and consider adaptive measures in light of monitoring, failed to meet the ESA's mandate that mitigation be

> "'*reasonably specific, certain to occur, and capable of implementation'" because: (1) the [working group] has complete discretion over whether to meet and whether to recommend mitigation measures; (2) even if the [working group] meets and recommends mitigation measures, the [agency management team] group is free to reject any recommendations; (3) there are no standards to measure the effectiveness of actions taken; (4) reconsultation is not required should mitigation measures prove ineffective; and (5) ultimately, no action is ever required.*[113]

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[110] *See, e.g., High Sierra Hikers Association v. Weingardt*, 521 F. Supp. 2d 1065, 1090-91 (N.D. Ca. 2007) (overturning a Forest Service decision to liberalize the rules limiting campfires in high country parts of a wilderness area on the grounds that the agency could not rely on adaptive management to overcome an inadequate response to the problems raised in the record).

[111] *NRDC v. Kempthorne*, 506 F. Supp. 2d at 333-34 (emphasis in original).

[112] *NRDC v. Kempthorne*, 506 F. Supp. 2d at 329.

[113] *NRDC v. Kempthorne*, 506 F. Supp. 2d at 352. See also id. at 350 (explaining the "certain to occur" standard and citing *Ctr. for Biological Diversity v. Rumsfeld*, 198 F. Supp. 2d 1139, 1152 (D. Ariz. 2002)).

The *Kempthorne* court cited prior caselaw holding that "*a mitigation strategy* [in the ESA context] *must have some form of measurable goals, action measures, and a certain implementation schedule; i.e., that mitigation measures must incorporate some definite and certain requirements that ensure needed mitigation measures will be implemented.*"[114] The court found that adaptive management plan "*does not provide the required reasonable certainty to assure appropriate and necessary mitigation measures will be implemented.*"[115] The court concluded that

> "*Adaptive management is within the agency's discretion to choose and employ, however, the absence of any definite, certain, or enforceable criteria or standards make its use arbitrary and capricious under the totality of the circumstances*."[116]

Considering the range of interested and qualified stakeholders involved in this Project, we are cautiously optimistic that a robust and effective adaptive management and monitoring plan will be crafted.

Recommendations for the issue of conditions based management, adaptive management, and monitoring:

► In the Santa Fe Mountains Landscape Resiliency Project, the Forest Service should pay careful attention to disclose what adaptive management measures it might adopt, how such measures might mitigate the project's impacts, or what the impacts could be absent adoption of those measures. Any Forest Service reliance on an adaptive management without these elements clearly described would be arbitrary and capricious.

► In the Santa Fe Mountains Landscape Resiliency Project, the Forest Service should pay careful attention to avoid making the same mistakes as the plan in the *Kempthorne* case; for example, if monitoring relies on annual meetings of an interdisciplinary team, if the agency provides no standards to measure the effectiveness of "adaptive" actions, and if nothing requires the Forest Service to take any action on its monitoring data.[117]

► In the Santa Fe Mountains Landscape Resiliency Project the monitoring and adaptive management plan must contain "*definite, certain, or enforceable criteria or standards*." Looking forward, if the BiOp for the Project relies in any way on an insufficient adaptive management plan, it would also likely be struck down in court.

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[114] *NRDC v. Kempthorne*, 506 F. Supp. 2d at 355, citing *Rumsfeld*, 198 F. Supp. 2d at1153.

[115] *NRDC v. Kempthorne*, 506 F. Supp. 2d at 356.

[116] *NRDC v. Kempthorne*, 506 F. Supp. 2d at 387.

[117] Because no BiOp has been prepared for the Project, it is as yet unclear how that document will incorporate or address any adaptive management plan.

ISSUE 6: IDENTIFICATION OF AND TREATMENTS IN ROADLESS AND UNROADED AREAS.

Roadless lands are ecologically important and play a critical role in ensuring the persistence of species, providing connectivity, and ensuring watershed functionality, which is only more important in light of climate change. They also can be important for providing nature-based non-motorized recreational experiences, which are very popular in and around Santa Fe.

The Project should maintain and restore roadless and unroaded lands, including inventoried-but-not-recommended and not-yet-inventoried lands. Maintaining and enhancing the roadless character of these lands will contribute to the achievement of the substantive provisions in sections 219.8, 219.9, and 219.10 of the 2012 planning rule, ensuring that the Project does not prematurely foreclose decisions in the current plan revision.

Forest Service roadless lands are heralded for their conservation values. Those values are described at length in the preamble of the Roadless Area Conservation Rule (RACR)[118] and in the Final Environmental Impact Statement (FEIS) for the RACR.[119] They include: high quality or undisturbed soil, water, and air; sources of public drinking water; diverse plant and animal communities; habitat for threatened, endangered, proposed, candidate, and sensitive species and for those species dependent on large, undisturbed areas of land; primitive, semi-primitive non-motorized, and semi-primitive motorized classes of dispersed recreation; reference landscapes; natural appearing landscapes with high scenic quality; traditional cultural properties and sacred sites; and other locally identified unique characteristics (e.g., uncommon geological formations, unique wetland complexes, exceptional hunting and fishing opportunities).

Roadless lands are also responsible for high quality water and watersheds. Anderson and others[120] assessed the relationship of watershed condition and land management status, and found a strong spatial association between watershed health and protective designations. DellaSala and others[121] found that undeveloped and roadless watersheds are important for supplying downstream users with high-quality drinking water, and that developing those watersheds comes at significant costs associated with declining water quality and availability. Protecting and connecting undeveloped areas is also an important action agencies can take to enhance climate change adaptation and resiliency.

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[118] 66 Fed. Reg. at 3245-47.

[119] Final Environmental Impact Statement, Vol. 1, 3–3 to 3–7, available at http://www.fs.usda.gov/roaddocument/roadless/2001roadlessrule/finalruledocuments.

[120] Anderson, H. Mike et al., 2012. Watershed Health in Wilderness, Roadless, and Roaded Areas of the National Forest System. The Wilderness Society, Washington DC. http://wilderness.org/resource/watershed-health-wilderness-roadless-and-roaded-areas-national-forest-system.

[121] DellaSala, D., J. Karr, and D. Olson. Roadless areas and clean water. Journal of Soil and Water Conservation, vol. 66, no. 3. May/June 2011.

The Roadless Rule states:

> (a) Timber may not be cut, sold, or removed in inventoried roadless areas of the National Forest System, except as provided in paragraph (b) of this section.
>
> (b) Notwithstanding the prohibition in paragraph (a) of this section, timber may be cut, sold, or removed in inventoried roadless areas if the Responsible Official determines that one of the following circumstances exists. The cutting, sale, or removal of timber in these areas is expected to be infrequent.
>
> (1) The cutting, sale, or removal of *generally small diameter timber* is needed for one of the following purposes and will maintain or improve one or more of the roadless area characteristics as defined in § 294.11.
>
> (i) To improve threatened, endangered, proposed, or sensitive species habitat; or
>
> (ii) To maintain or restore the characteristics of ecosystem composition and structure, such as to reduce the risk of uncharacteristic wildfire effects, within the range of variability that would be expected to occur under natural disturbance regimes of the current climatic period.[122]

Thus, any proposed treatments can only take place within the any IRA if the Forest Service can demonstrate that:

- The project is an "infrequent" occurrence on roadless forest; and
- The project generally logs small diameter timber; and
- The project meets the exception's purpose (improving threatened, endangered, proposed, or sensitive species habitat, or maintaining or restoring the characteristics of ecosystem composition and structure); and
- The project "*maintain*[s] *or improve*[s] *one or more of the roadless area characteristics.*"[123]

The rule defines "*roadless area characteristics*" to include:

> (1) High quality or undisturbed soil, water, and air;
>
> (2) Sources of public drinking water;
>
> (3) Diversity of plant and animal communities;

[122] 36 C.F.R. § 294.13.

[123] *See Alliance for the Wild Rockies v. Krueger*, 950 F. Supp. 2d 1196, 1214 (D. Mont. 2013), affirmed on other grounds, 663 Fed. Appx. 515 (9th Cir. Nov. 1, 2016).

(4) Habitat for threatened, endangered, proposed, candidate, and sensitive species and for those species dependent on large, undisturbed areas of land;

(5) Primitive, semi-primitive nonmotorized and semi-primitive motorized classes of dispersed recreation;

(6) Reference landscapes;

(7) Natural appearing landscapes with high scenic quality;

(8) Traditional cultural properties and sacred sites; and

(9) Other locally identified unique characteristics."[124]

Recommendations for the issue of identification of and treatments in roadless and unroaded areas:

The scoping document (p. 12) makes clear that "*No new roads or temporary roads would be constructed*" and that up to 20 miles of roads would be decommissioned. We applaud the Forest Service for proposing a project that does not require new roads, either temporary or permanent. This is a very rare proposal in this regard.

Any subsequently prepared NEPA document must:

►Disclose whether and how hand or mechanical treatments will comply with the Roadless Rule.

►Disclose the impacts of hand or mechanical treatments to roadless characteristics.

►Disclose as well as analyze impacts to unroaded lands that the Forest Service does not classify as inventoried roadless areas but may be under analysis in the current plan revision.

►Identify any Forest Plan direction upon which any proposed action may rely on for direction concerning roadless areas.

► Include for analysis the Center's proposed alternative which would implement a more ambitious road closure and decommissioning program.

ISSUE 7: LOCALLY SPECIFIC REFERENCE CONDITIONS ARE NEEDED

General Technical Report 310 (Reynolds et al. 2013[125]) is cited as a primary source for formulating desired conditions for the Santa Fe Mountains Landscape Resiliency Project. We

[124] 36 C.F.R. § 294.11

[125] Reynolds, R.T., A.J. Sánchez Meador, J.A. Youtz, T. Nicolet, M.S. Matonis, P.L. Jackson, D.G. DeLorenzo and A.D. Graves. 2013. *Restoring Composition and Structure in Southwestern Frequent-Fire Forests: A*

have considerable concerns with GTR-310 because it generalizes desired conditions for the entire southwest region based off of reference site studies that were predominantly completed around Flagstaff. Desired conditions for dry conifer forests provided in GTR-310 are not specific to the Santa Fe National Forest, and should be critically reviewed prior to assuming they are applicable to the Project.

The authors of GTR-310 admit the need for developing site-specific guidance:

> "*Management informed by reference conditions and natural ranges of variability (the range of ecological and evolutionary conditions* ***appropriate for an area)*** *allow for the restoration of the characteristic composition, structure, spatial pattern, processes, and functions of ecosystems*"[126]

Disturbance patterns are driven by spatial and temporal variation in climate, vegetation growth habitats, and management history. These are place-specific and cannot reliably be generalized over broad landscapes or timeframes.[127/128] Ecologists stress definition of locally specific reference conditions to justify restoration goals and outcomes due to scale dependence of ecological pattern.[129/130/131] For example, Korb and others[132] stated this about their study results from the San Juan Mountains of southern Colorado:

> "*Our findings demonstrate the need to develop site-specific reference conditions and for managers to exercise caution when extrapolating fire regimes and forest structure from one geographic locality to another given a projected warmer climate making conditions more favorable to frequent, large wildfires*."

Science-Based Framework for Improving Ecosystem Resiliency. USDA For. Serv. Rocky Mtn. Res. Sta. Gen. Tech. Rep. RMRS-GTR-310. Fort Collins, CO.

[126] Page 2 in Reynolds et al. 2013 (emphasis added)

[127] Agee, J.K. 1996. The influence of forest structure on fire behavior. Pp. 52-68 in: J.W. Sherlock (chair). *Proc. 17th Forest Vegetation Management Conference.* 1996 Jan. 16-18: Redding, CA. Calif. Dept. Forestry and Fire Protection: Sacramento.

[128] DellaSala, D.A., J.E. Williams, C.D. Williams and J.F. Franklin. 2004. Beyond smoke and mirrors: a synthesis of fire policy and science. *Conservation Biology* 18: 976-86.

[129] Noss, R., P. Beier, W. W. Covington, R. E. Grumbine, D. B. Lindenmayer, J. W. Prather, F. Schmiegelow, T. D. Sisk, and D. J. Vosick. 2006. Recommendations for integrating restoration ecology and conservation biology in ponderosa pine forests of the Southwestern United States. *Restoration Ecology* 14: 4-10.

[130] Swetnam, T.W., C.D. Allen and J.L. Betancourt. 1999. Applied historical ecology: Using the past to manage the future. *Ecological Applications* 9(4):1189-1206.

[131] White, P.S. and J.L. Walker. 1997. Approximating nature's variation: selecting and using reference information in restoration ecology. *Restoration Ecology* 5: 338-349.

[132] Korb, J.E., P.Z. Fule, P.Z. and R. Wu. 2013. Variability of warm/dry mixed conifer forests in southwestern Colorado, USA: Implications for ecological restoration. *Forest Ecology and Management* 304:182-191.

We reviewed the 111 studies cited in GTR-310 as sources of information for reference conditions, disturbance histories, disturbance effects, stand structure and composition, and canopy openness. These studies are listed by location in a table and a map on the following pages.

It's vitally important for planners at the Santa Fe National Forest to recognize that none of the reference studies cited in GTR-310 were from the Sangre de Cristo Mountains, and the two locations in the Jemez Mountains on the Santa Fe National Forest amount to approximately 12 acres of sampled forest.

If you search GTR-310 for the name "Santa Fe" you will not find it. The information used in GTR-310 to craft regionally generalized desired conditions for ponderosa pine and mixed conifer forest is derived mainly from valid and vetted studies completed *more than 200 miles from the Project*. Because of the reliance on sites predominantly around Flagstaff, and a near-total lack of study sites anywhere on the Santa Fe National Forest, GTR-310 has limited applicability to the Project. Please, Santa Fe, pay close attention to this.

The Project landscape is unique in its elevational gradient and topographic position, and it bears little resemblance to the Flagstaff area. Weather and climate in the Sangre de Cristo's is not the same as Flagstaff. A compilation and averaging of sites surrounding Flagstaff is not a surrogate for locally-derived information specific to the southern Rocky Mountains.

GTR-310 promulgates the "Flagstaff Model" of forest restoration and relies on recurring mechanical interventions

GTR-310 is the Forest Service's own self-published desired conditions for dry conifer forest in the southwest and we believe it was intentionally designed to implement the "Flagstaff Model" of forest restoration across the southwest. We believe that the Forest Service crafted GTR-310 based on the Flagstaff Model because the lower densities and more "open, park-like" conditions typical to the Flagstaff area would allow the Forest Service to apply more intensive logging treatments in areas where stands were historically more dense and closed-canopy than around Flagstaff.

In essence GTR-310 is scientific is cover for "getting the cut out."

Close inspection of place-specific information reveals that Reynolds and others selectively interpreted literature to make their case for sustained mechanical intervention as a surrogate for restoration of natural fire regimes. In GTR-310, Reynolds and others (p. 48-49) state:

> "*The re-establishment of frequent, low-severity fire is critical to the success of our restoration framework. However, because of limitations such as proximity to human developments, air quality restrictions, and workforce capacity, the use of fire will probably continue to be limited. Therefore, mechanical-only treatments, or perhaps combinations of fire and mechanical treatments, are likely to be the restoration tools of choice in much of the Southwestern landscape… Yields between 400 and 700 cubic ft per acre seem reasonable from a cutting cycle of 25 to 30 years once restoration achieves an approximate balance of structural stages in frequent-fire forests*."

That statement is the sole basis presented by the authors for their recommendation of landscape-scale mechanical treatments of vegetation in ponderosa pine and mixed conifer forest. Contrary to their assessment, we would argue that workforce limitations will affect mechanical thinning operations more than fire management crews. GTR-310's "implementation recommendations" (p. 35-37) do not present a compelling fact-based case for the efficacy of mechanical treatments to manage structure or composition in fire-adapted forest, other than to allude that such treatments may be desirable for unstated reasons, perhaps including "getting the cut out."

GTR-310 Uncertain of Desired Conditions in Mixed Conifer Forest

In GTR-310, Reynolds and others (p. 12) admit uncertainty in their recommendation of desired conditions for dry conifer forest resulting from a paucity of supporting information and geographic imbalance of accessible data:

> "*There is a clear need for additional reference condition data sets, including sites from a wider spectrum across environmental gradients (e.g., soils, moisture, elevations, slopes, aspects) occupied by frequent-fire forests in the Southwest, especially in dry mixed-conifer. While the quantity of reference data sets is increasing, existing data represent a largely unbalanced sampling across gradients (e.g., most data sets are from basaltic soils and on dry to typic plant associations), and there have been few studies quantitatively*."

In this statement, the authors of GTR-310 admit a bias towards the studies completed on basaltic soils in drier sites, in other words: the Flagstaff model.

The GTR-310 approach to uncertainty is to blur site-specific forest variation across a vast geographic area and *scale up* desired conditions to broad landscapes with a generic "*pooled natural range of variability*"[133]:

> "*The natural range of variability can be estimated by pooling reference conditions across sites within a forest type. Reference conditions for a forest type typically vary from site to site due to differences in factors such as soil, elevation, slope, aspect, and micro-climate and manifests as differences in fire effects, tree densities, patterns of tree establishment and persistence, and numbers and dispersion of snags and logs. When pooled, these sources of variability comprise the natural range of variability of a site or forest type*."

Pooling reference conditions would be appropriate if there was even geographic distribution of reference sites, but as we are proving here, the Project area is in no way included in the sites that were pooled in GTR-310.

Most Reference Studies in GTR-310 Are Silviculture Plots in the Flagstaff Area

It is true that in GTR-310 Reynolds and colleagues synthesized a wide array of very high quality scientific literature, as well as some very interesting historical Forest Service timber research

[133] Reynolds et al. 2103: p. 11

documents. However, the studies used to substantiate the GTR-310 structural framework are disproportionately clustered around northern Arizona, including a number of studies at the same sites (Gus Pearson Natural Area and Fort Valley Experimental Forest). GTR-310 also places an emphasis on plot re-measures of the historic "Woolsey plots", which are not representative of the surrounding landscape.[134]

Much of GTR-310 is based on reconstruction studies of "Woolsey Plots." In 1909, T.S. Woolsey, Jr., Assistant District Forester and Chief of the Office of Silviculture (Southwestern District now Southwest Region 3), and G. A. Pearson, Director, Fort Valley Forest Experiment Station (Flagstaff, AZ), drafted instructions that led to establishment of a network of permanent plots in ponderosa pine, mixed conifer, and spruce-fir forests of the Southwest. Between 1909 and 1941 Woolsey and team established 140 plots in AZ and NM, of which 98 were in ponderosa pine. Of the pine plots, 30% are located southwest of Flagstaff at the Coulter Ranch site. Of the 140 plots, 44 were in the Coconino NF. These studies are the basis of GTR-310. A researcher from Flagstaff said this about the Woolsey Plots:

> "*So-called sample plots were established on logged over areas in order to ascertain how fast residual stands would grow, whether they could produce merchantable timber, and whether natural restocking would take place.*"[135]

Bell and others[136] compared current conditions of 14 Woolsey plots to 98 AZCFI and 58 FSFIA plots in the Flagstaff/western Mogollon Rim area. The metrics under comparison were Trees/Hectare, BA/Hectare, QMD, and frequency of DBH classes/hectare. Comparisons of forest structural data applied a distance-based multivariate nonparametric permutation method. All analyses indicated dissimilarity between the FIA and CFI plots compared to the Woolsey plots across the study area, and across TEU's. Within TEU's, the Woolsey plots were not statistically dissimilar, but current conditions were consistently denser in all metrics. Bell and colleagues results suggest that Woolsey plots are only representative of the TEU to which the plot belongs:

> "*The selection of [Woolsey] plot locations in the early 1900s followed a subjective nonrandom approach. [Our] results indicated that the Woolsey plots (1) were neither historically nor contemporarily representative of the entire study area because of environmental and current forest structural differences with respect to the FSFIA and AZCFI and (2) may be considered historically representative of their corresponding TEUs. Our study supports the use of TEUs for defining the applicability of information obtained from the Woolsey plots….Subjective plot selection, together with the small sample size of this rare*

[134] The reconstructions by ERI scientists on Woolsey plots have established a high bar for scientific integrity, but the plots were subjectively located by Woolsey and team as part of early silvicultural experiments, calling the usefulness of the results to be interpreted carefully and within a broader collection of multiple lines of evidence on representative sites.

[135] Page 272 in Pearson, G. A. 1933. A twenty-year record of changes in Arizona pine forest. Ecology 4:272–285.

[136] Bell, D.M., P.F. Parysow, and M.M. Moore. 2009. Assessing the representativeness of the oldest permanent inventory plots in northern Arizona ponderosa pine forests. *Restoration Ecology* 17(3): 369-377.

> *dataset, raises questions about the inference space with regard to the larger, heterogeneous landscape of ponderosa pine forests in northern Arizona.*"[137]

Woolsey and team surveyed a mere six plots on the Santa Fe National Forest, but one-third of those historic plots and accompanying data have not been discovered.[138]

Based on these findings, Woolsey plots (which are the underpinning of GTR-310) are not representative in any way of the Sangre de Cristo Mountains, calling into question the usefulness of GTR-310 for the Santa Fe Mountains Landscape Resiliency Project.

The densest single hectare of forest on the Bluewater demonstration site, where GTR-310 came to life.

Is this what you want for the Santa Fe Mountains?

Photo by Joe Trudeau, June 2017

[137] Page 369 in Bell et al. 2009.

[138] Moore, M.M., D.W. Huffman, J.D. Bakker, A.J. Sanchez Meador, D.M. Bell, P.Z. Fulé, P.F. Parysow, and W.W. Covington. 2004b. Quantifying Forest Reference Conditions for Ecological Restoration: The Woolsey Plots. *Final Report to the Ecological Restoration Institute for the Southwest Fire Initiative.* School of Forestry & Ecological Restoration Institute, Northern Arizona University, Flagstaff, AZ.

FIGURE 1: LOCATIONS OF CERTAIN REFERENCE SITES* USED IN GTR-310 (REYNOLDS ET AL., 2013)

*Specifically Tables 3, 6 and 9

Sites referenced by Reynolds et al (2013) are biased towards conditions at the Grand Canyon and Mogollon Plateau around Flagstaff. All sites shown for New Mexico are limited to original inventory by Woolsey (1909-1913) and subsequent re-measures of those sites (Moore et al. 2004). Polygons represent work by Abella and Denton (2009; square around Flagstaff) and Williams and Baker (2012; two polygons along Mogollon Rim). None of the studies assessed in GTR-310 include sites with ponderosa pine-evergreen oak or ponderosa pine-shrub types.

"The minimum diameters reported in Table 6 may also result in a source of error that can lead to small underestimates of historical tree densities reported in studies. Additional error may result from missing fully decomposed structures at time of measurement and reconstruction" (Reynolds et al., 2013: p.17).

"To date, only six studies report tree spatial reference conditions in the Southwestern ponderosa pine forests" (Reynolds et al., 2013: p.17).

"Management informed by reference conditions and natural ranges of variability (the range of ecological and evolutionary conditions ***appropriate for an area****) allow for the restoration of the characteristic composition, structure, spatial pattern, processes, and functions of ecosystems"* (Reynolds et al., 2013: p.2, emphasis added).

"Some dry mixed-conifer forests and ponderosa pine-shrub communities experienced mixed-severity fires, which included combinations of surface and crown fires, sometimes resulting in larger patches of tree aggregation" (Reynolds et al., 2013: p.1).

Figure 2: Locations Of Studies Cited In Reynolds et el. (2013) *see GTR-310 for full citations	
General Location of Referenced Literature	**Literature cited for that location in GTR-310** **Bold** denotes measurements at historic Woolsey plots Underline denotes study specific to Gus Pearson Natural Area, Coconino NF
New Mexico	**Moore et al., 1994 (Gila & Zuni Mtns Woolsey remeasures); Woolsey, 1911 (Carson, Zuni, Gila, Alamo, Jemez sites);** Allen, 2007 (northern NM); Brown et al., 2001 (Sacramento Mountains); Conklin & Geils, 2008 (Jemez & Manzano Mountains); Kaye & Swetnam, 1999 (Sacramento Mountains); Negron, 1997 (Sacramento Mountains); Romme et al., 1999 (Carson & Santa Fe NF's); Swetnam & Dieterich, 1985 (Gila Wilderness); Touchan et al., 1996 (Jemez Mountains)
North Rim Grand Canyon/Kaibab Plateau/Uinkaret Plateau	Covington & Moore, 1994; Fule et al., 2002; Fule et al., 2003; Fule & Laughlin, 2007; Heinlein et al., 1999; Lang & Stewart, 1910; Rasmussen, 1941; Roccaforte et al., 2010; Waltz & Fule, 1998; White & Vankat, 1993
South Rim Grand Canyon	Fule et al., 2002; Harrington & Hawksworth, 1980; **Woolsey, 1911**
Mogollon Plateau (Flagstaff Area)	Abella & Denton, 2009; Abella et al., 2011; Biondi et al., 1994; Biondi, 1996; Cocke et al., 2005; Covington & Sacket, 1986; Covington & Moore, 1994a&b; Covington et al., 1997; Dieterich, 1980; Fule et al., 1997; Heinlein et al., 2005; Hoffman et al., 2007; Mast et al., 1999; Menzel & Covington, 1997; Pearson, 1950; White, 1985; **Sanchez Meador et al., 2011; Sanchez Meador & Moore, 2010; Woolsey, 1911;** Schneider, 2012; Williams & Baker, 2012
Mogollon Rim (Apache-Sitgreaves NF, White Mtn. Apache Reservation)	Cooper, 1960, 1961; Greenamyre, 1913; Lynch et al., 2010; Williams & Baker, 2012; **Woolsey, 1911**
Colorado	Binkley et al., 2008 (Uncompahgre Plateau); Boyden et al., 2005 (Front Range); Brown & Wu, 2005 (SW of Pagosa Springs); Ehle & Baker, 2003 (RMNP); Fornwalt et al., 2002 (Front Range); Fule et al., 2009 (San Juan Mountains); Grissino-Mayer et al., 2004 (San Juan Mountains); Korb et al., 2012 (San Juan Mountains); Mast et al., 1998 (Front Range); Mast & Veblen, 1999 (Front Range); Romme et al., 1999 (SW Colorado)
Southwestern Utah	Madany & West (Zion National Park)
Pacific and Inland Northwest/Northern Rocky Mountains/Black Hills (South Dakota)	Agee, 2003; Arno et al., 1995; DeLuca & Sala, 2006; Franklin et al., 2002 (incorrectly cited as 2012); Harrod et al., 1999; Hessberg et al., 1994, 2004, 2005; Lundquist, 1995; Nacify et al., 2010; Taylor, 2010; Taylor & Skinner, 2003; Von Schrenck, 1903; West, 1969; Wickman, 1963; Youngblood et al., 2004
Mexico/Baja California	Minnisch et al., 2000; Stephens et al., 2008
California	Fettig, 2012; Parsons & DeBenedetti, 1979 (Sequoia & Kings Canyon NP); Scholl & Taylor, 2010 (Yosemite NP)
Sky Islands Region	Barton, 2002; Grissino-Mayer et al., 1995
Illinois	Dhillon & Anderson, 1993
Macro-scale studies (west-wide/regional) * denotes utilization of Gila NF data	Bentz et al., 2010; Drummond, 1982; Littell et al., 2009; Maffei & Beatty, 1988; Moeck et al., 1981; Negron et al., 2009; Swetnam & Baison, 1996*; Savage & Mast, 2005*; Swetnam & Betancourt, 1990*; Wood, 1983
Review Reports, books, or general literature inappropriately cited as reference-site studies or original research	Abella, 2008; Abella, 2009; Castello et al., 1995; Edmunds et al., 2000; Ferry et al., 1995; Fitzgerald, 2005; Friederici, 2004; Goheen & Hansen, 1993; Hart et al., 2005; Hawksworth & Weins, 1996; Jenkins et al., 2008; Larson & Churchill, 2012; Miller & Keen, 1960; Miller, 2000; Rippy et al., 2005; Smith, 2006a,b,c; Stevens & Hawksworth, 1984; Tainter & Baker, 1996; Weaver, 1950

GTR-310 Excludes Reference Sites that Corroborate Occurrence of Higher Density Forests in the Southwest than the Forest Service Wants to Admit

Some important historical reference sites were notably excluded from GTR-310, such as the Long Valley Experimental Forest, which was established in 1936 as a comparison site to the much-studied Fort Valley unit. Long Valley "*contained some of the best stands of ponderosa pine on the Coconino and Sitgreaves National Forests*"[139] but for an unknown reason it does not appear in GTR-310. The regional desired conditions document does mention the Long Valley site noting that:

> "*On the Long Valley Experimental Forest (sedimentary soils on the Mogollon Rim, central Arizona), the sampled trees per acre (1938) ranged up to 99 trees per acre, with an estimated 75 trees per acre being present prior to the cessation of frequent fire (circa 1880-1900, USDA Forest Service, unpublished data from Long Valley Experimental Forest).*"[140]

If the pre-settlement trees per acre value (~75TPA) was included in GTR-310, it would have been more dense than any other ponderosa pine reference site cited in Arizona, with the exception of the Grand Canyon sites studied by Fule and colleagues[141] or the Malay Gap site studied by Cooper.[142]

Why does the Forest Service ignore Long Valley's dense forest in GTR-310? The only site included in GTR-310 that is denser Long Valley is Malay Gap, studied by Cooper. Coopers Malay Gap study area pushes the limits for density metrics reported in GTR-310, but surprisingly this site was in fact not even as dense as Coopers Maverick study site that, like Long Valley, was not included in GTR-310. Long Valley may have been even denser than Maverick, assuming that not all of the remaining 24 post-fire suppression trees would have been killed by fire. In addition, Long Valley's densities, if reported in GTR-310, would have been essentially equal to Williams and Bakers studies along the Mogollon Rim which have been widely criticized by the restoration community for inference of high severity fire.[143]

Lessons from Coopers Seminal 1960 Reference Site Study

Cooper studied three sites on the White Mountain and San Carlos Apache Reservations in 1957. His paper is one of the most oft-cited sources of reference conditions data and descriptions for

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[139] https://www.fs.usda.gov/main/longvalley/home

[140] Page 14 in the Southwest Region Desired Conditions Document

[141] Fulé, P.Z., W.W. Covington, M.M. Moore, T.A. Heinlein, and A.E.M. Waltz. 2002. Natural variability in forests of the Grand Canyon, USA. *Journal of Biogeography* 29:31-47.

[142] Cooper, C.F. 1960. Changes in vegetation, structure and growth of southwestern pine forests since white settlement. *Ecological Monographs* 30: 129-64.

[143] See Fule et al., 2014. "Unsupported inferences of high-severity fire in historical dry forests of the western United States: a response to Williams and Baker." *Global Ecology and Biogeography* 23:825-830.

southwestern ponderosa pine, including by GTR-310. Cooper's Bog Creek site was selectively logged in the 1930's, but his Maverick and Malay Gap sites were unlogged, the latter also having never experienced fire suppression nor livestock grazing.

Of the Malay Gap site, Cooper (p. 139) wrote "*this is perhaps the closest approach to a truly primeval forest left in the Southwest*." Prior to 1910, the Malay Gap site had experienced wildfire on average every 7 years, and then burnt again in 1910, 1919, 1935, and lastly in 1943. By the time of his field work, in 1957, the fire regime was effectively uninterrupted. Cooper's extensive report is indeed one of the most essential studies to read and comprehend, and it is important to fully examine the breadth and depth of his analyses, as well as the photographs included therein, in order to responsibly reference this detailed work.

In addition to simple density metrics, Cooper reported on spatial arrangement, age/size distributions, regeneration patterns in time and space, fire effects on stand development, and many other important ecological processes that are still being debated. Of particular relevance to the current debate in ponderosa pine restoration are his observations on the grouping habits of this species.

The concept of "interspaces" is a central tenet in the formulation of desired conditions by some within the U.S. Forest Service, wherein these "interspaces" are areas not occupied by trees and serve to define somewhat even-aged groups. The entire basis of the model promulgated in Reynolds and others is built around this notion. However, Cooper's analysis of Malay Gap might suggest that this model is not applicable to all areas. In discussing structural patterns in the virgin pine forest, he remarked (at p. 158):

"*The relatively small size of the even-aged groups in the southwestern forest is due to the small size of the openings in which the groups can become established*."[144]

It is a step backwards for restoration ecologists to dilute his work to a few numbers, such as his determination that mean basal area at Malay Gap, where a visitor "*is immediately struck by the open nature of the forest*", was 70 ft^2/acre.[145] The figure below, taken directly from Cooper (1960: p. 150), shows an image that does not support most contemporary notions of an "open" forest, and in fact might be considered overly dense by many land managers.

[144] Cooper's report does not specifically provide data as to how many trees occur per group, but he does state (at p. 149) that "*analysis indicates that the mature stands at both Maverick and Malay Gap are aggregated into groups with an area of .16 to .32* [acres]", within the range described by Reynolds et al. (2013). However, the definition of a "group" would seem to differ greatly between the two sources based on comparison of Cooper's example photos and observations at the Bluewater demonstration site and other contemporary treatments.

[145] Interestingly, Reynolds et al. (2013) cite Malay Gap as a reference site, but ignore the results from the Maverick study location, which had a mean basal area of 102 ft^2/acre, to which Cooper (1960: p. 150) remarked: *"Although similar in basic composition and structure, the forests at Maverick and Malay Gap are quite different in appearance… The site at Malay Gap is clearly not as good as that at Maverick. The average height of mature dominants at Malay Gap is 95 ft, while those at Maverick average about 110 ft…The difference reflects inherent differences in site productivity*." The basal area of old growth at Maverick exceeds the range reported in Reynolds et al. (2013) and is outside of the basal area range given in Table 2 in the regional desired conditions document.

The figure below (Cooper, 1960: p. 148) is a typical example of the "*conspicuous… grouped arrangement of the trees*." Similarly to the figure provided on the previous page, this image again contradicts the widespread contemporary notion of what constitutes a "*distinct group*". Nowhere in his report does Cooper specify how he determined what a "group" was, but it would seem apparent that his definition is markedly different than many offered today.

PATTERN

A conspicuous feature of the ponderosa pine forest is the grouped arrangement of the trees. It is obvious that the forest is composed of distinct groups, each made up of several trees similar in size and apparent age (Fig. 17). This fact has long been recognized, but surprisingly little attention has been given to the structure of these groups or to their mode of origin.

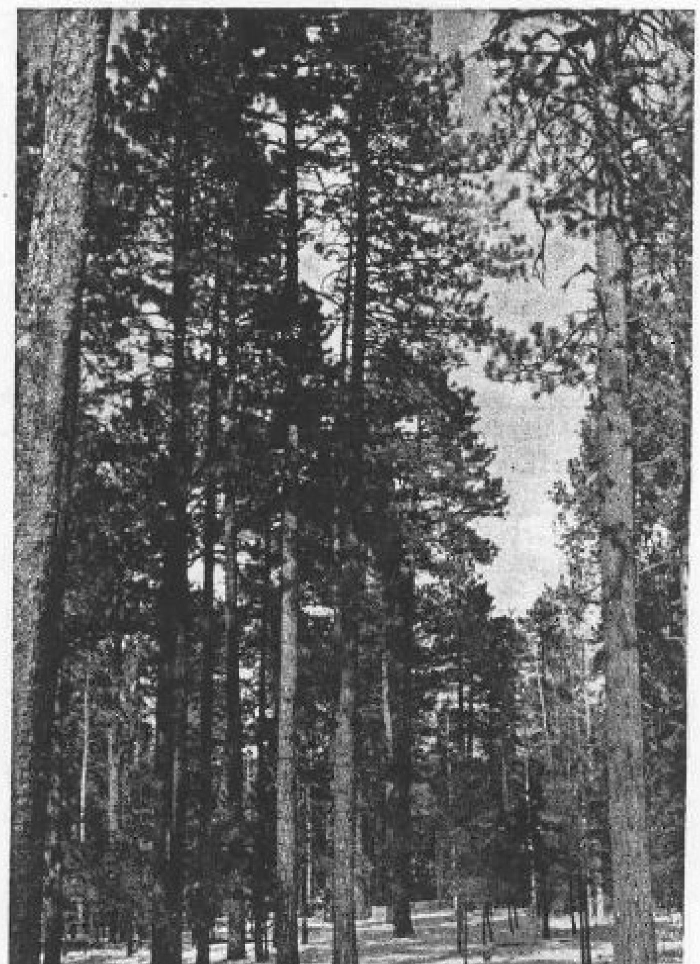

FIG. 17. Typical stand of mature ponderosa pine, showing grouped distribution of trees.

FOREST CONDITIONS AT MAVERICK AND AT MALAY GAP

Although similar in basic composition and structure, the forests at Maverick and at Malay Gap are quite different in appearance. A visitor to Malay Gap, conditioned by acquaintance with the over-dense thickets characteristic of most of the Southwestern pine region, is immediately struck by the open nature of the forest (Fig. 20). The forest floor is carpeted with a deep layer of grass, and small discrete patches of young trees are dispersed among groups of stately pines. The pure beauty of the Malay Gap region more than compensates for its difficulty of access.

FIG. 20. Typical view of the ponderosa pine forest in the primitive area at Malay Gap.

LONG VALLEY EXPERIMENTAL FOREST: 2 TO 3 TIMES DENSER THAN FORT VALLEY, BUT IGNORED BY GTR-310
Photo: Joe Trudeau, 10.11.2017 (compare to Cooper's photo on the previous page)

Recommendations for the issue of locally specific reference conditions:

The scoping document states that "*The desired conditions for this project are informed by reference conditions*." If the Santa Fe Mountains Landscape Resiliency Project is to base its desired conditions on GTR-310, then the project is lacking some significant guidance provided by other neglected reference sites and local information. Additionally, it's critical to remember that very little scientific attention has been given to determining reference conditions for the wet or dry mixed conifer forests common to the Project landscape, and there's been virtually no research on reference conditions in spruce-fir forests. The Project is not proceeding under the direction of good science without seeking to better understand reference conditions in the unique forests and woodlands of this landscape.

► At an absolute minimum, any subsequently prepared NEPA document on the Project must address the science referenced here and explain why, in the face of this contrary science, the Forest Service continues to rely on GTR-310 to guide forest treatments in the Sangre de Cristo Mountains. NEPA requires agencies to explain opposing viewpoints and their rationale for choosing one viewpoint over the other.[146] Federal courts have set aside NEPA analysis where the agency failed to respond to scientific analysis that calls into question the agency's assumptions or conclusions.[147] We trust that the Santa Fe National Forest will give substantial consideration to determining locally specific reference conditions before adopting the metrics describe din GTR-310 as desired conditions.

► A fundamental principle of southwestern forest restoration is development of site-specific reference conditions.[148] Any subsequent NEPA document needs to evaluate the applicability of GTR-310 to the Project, cross-referencing GTR-310's recommendations to specific local characterizations described sources which describe local site conditions, and if necessary, conduct additional studies to develop more accurate local reference conditions. Please list and summarize locally-specific literature describing reconstructed reference conditions.

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[146] 40 C.F.R. § 1502.9(b) (requiring agencies to disclose, discuss, and respond to "any responsible opposing view").

[147] *See Ctr. for Biological Diversity v. U.S. Forest Serv.*, 349 F.3d 1157, 1168 (9th Cir. 2003) (finding Forest Service's failure to disclose and respond to evidence and opinions challenging EIS's scientific assumptions violated NEPA); *Seattle Audubon Soc'y v. Moseley,* 798 F. Supp. 1473, 1482 (W.D. Wash. 1992) ("The agency's explanation is insufficient under NEPA – not because experts disagree, but because the FEIS lacks reasoned discussion of major scientific objections."), *aff'd sub nom. Seattle Audubon Soc'y v. Espy,* 998 F.2d 699, 704 (9th Cir. 1993) ("[i]t would not further NEPA's aims for environmental protection to allow the Forest Service to ignore reputable scientific criticisms that have surfaced"); *High Country Conservation Advocates v. Forest Service*, 52 F. Supp. 3d 1174, 1198 (D. Colo. 2014) (finding Forest Service violated NEPA by failing to mention or respond to expert report on climate impacts).

[148] Allen, C.D. M.A. Savage, D.A. Falk, K.F. Suckling, T.W. Swetnam, T. Schulke, P.B. Stacey, P. Morgan, M. Hoffman, and J.T. Klingle. 2002. Ecological restoration of southwestern ponderosa pine ecosystems: A broad perspective. *Ecological Applications* 12(5): 1418-1433.

SECTION II. PROPOSAL OF A REASONABLE ALTERNATIVE FOR ANALYSIS.

When federal agencies prepare an EIS, NEPA requires that they must take a "*hard look*" at the project's environmental impacts and the information relevant to its decision.[149] In taking the required "*hard look*," an EIS must "*study, develop, and describe*" reasonable alternatives to the proposed action.[150] This alternatives analysis "*is the heart of the environmental impact statement*."[151]

As a result, agencies must "[r]*igorously explore and objectively evaluate all reasonable alternatives*."[152] "*To comply with the National Environmental Policy Act and its implementing regulations,* [agencies] *are required to rigorously explore* <u>*all*</u> *reasonable alternatives ... and give each alternative substantial treatment in the environmental impact statement*."[153] "*Without substantive, comparative environmental impact information regarding other possible courses of action, the ability of an EIS to inform agency deliberation and facilitate public involvement would be greatly degraded*."[154]

When a federal agency prepares an EIS, it must consider "*all reasonable alternatives*" which are consistent with its stated purpose and need.[155] An agency may dismiss a reasonable alternative if it is not "'*significantly distinguishable from the alternatives already considered*.'"[156]

Federal courts have struck down Forest Service EISs where the agency evaluated several alternatives, but where those alternatives were all fairly similar. *See, e.g., California v. Block*, 690 F.2d 753, 767-69 (9th Cir. 1982) (setting aside Forest Service EIS that evaluated eight alternatives because all of the alternatives considered protecting less than 34% of eligible lands as potential wilderness).

In addition, NEPA "*does not permit the agency to eliminate from discussion or consideration a whole range of alternatives, merely because they would achieve only some of the purposes of a*

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[149] *Wyoming v. U.S. Dep't of Agriculture*, 661 F.3d 1209, 1237 (10th Cir. 2011).

[150] 42 U.S.C. §§ 4332(2)(E); 4332(2)(C)(iii).

[151] 40 C.F.R. § 1502.14; *see also All Indian Pueblo Council v. United States*, 975 F.2d 1437, 1444 (10th Cir. 1992).

[152] 40 C.F.R. § 1502.14.

[153] *Custer County Action Ass'n v. Garvey*, 256 F.3d 1024, 1039 (10th Cir. 2001) (emphasis added). *See also New Mexico ex rel. Richardson v. Bureau of Land Management*, 565 F.3d 683, 703 (10th Cir. 2009) ("[A]n EIS must rigorously explore and objectively evaluate all reasonable alternatives to a proposed action, in order to compare the environmental impacts of all available courses of action."); *Colo. Envtl. Coalition v. Dombeck*, 185 F.3d 1162, 1174 (10th Cir. 1999) (explaining reasonable alternatives).

[154] *New Mexico ex rel. Richardson*, 565 F.3d at 708.

[155] 40 C.F.R. § 1502.14(a). *See also Colorado Environmental Coal. v. Salazar,* 875 F. Supp. 2d 1233, 1245 (D. Colo. 2012) (stating that the agency's objectives dictate the range of reasonable alternatives).

[156] *Colorado Environmental Coal. v. Salazar,* 875 F. Supp. 2d at 1245 (quoting *New Mexico ex rel. Richardson,* 565 F.3d 683, 708-09 (10th Cir. 2009).

multipurpose project."[157] If a different action alternative "*would only partly meet the goals of the project, this may allow the decision maker to conclude that meeting part of the goal with less environmental impact may be worth the tradeoff with a preferred alternative that has greater environmental impact*."[158]

Federal courts routinely find that agency that fail to consider reasonable middle-ground alternatives violate NEPA,[159] so we sincerely hope that our proposed alternative will receive fair consideration by the Forest Service.

The Strategic Treatments for Fire Use Alternative Framework.

USFS research scientists have long worked to develop decision support, risk management, and prioritization tools for use in applications like the current Project. Their work has been fundamental in establishing the science of optimization that is increasingly being explored and implemented in the western United States. Important considerations for utilizing wildland fire use have been identified by fire management professionals[160] and agency-developed risk management and decision support systems, such as Fire Effects Planning Framework,[161] provide systematic geospatial techniques for managing fire for resource benefit.

Ager and colleagues stated in a 2013 article that "*Meeting the long-term goals of dry forest restoration will require dramatic increases in prescribed and managed fire that burn under conditions that pose minimal ecological and social risk. Optimization models can facilitate the attainment of these goals by prioritizing management activities and identifying investment tradeoffs.*"[162] That 2013 work, located in ponderosa pine forests on the Deschutes National Forest in Oregon, studied an optimization model "*…to locate project areas to most efficiently reduce potential wildfire loss of fire resilient old growth ponderosa pine while creating contiguous areas within which prescribed and managed fire can be effectively used...*"[163] The

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157 *Town of Matthews v. U.S. Dep't. of Transp*., 527 F. Supp. 1055, 1057 (W.D. N.C. 1981).

158 *North Buckhead Civic Assoc v. Skinner*, 903 F.2d 1533, 1542 (11th Cir. 1990). *See also Natural Resources Defense Council v. Callaway*, 524 F.2d 79, 93 (2d Cir. 1975) ("the EIS must nevertheless consider such alternatives to the proposed action as may partially or completely meet the proposal's goal and it must evaluate their comparative merits"); *Natural Resources Defense Council v. Morton*, 458 F.2d 827, 836 (D.C. Cir. 1972) ("(it is not) appropriate, as Government counsel argues, to disregard alternatives merely because they do not offer a complete solution to the problem.").

159 See, e.g., *Wilderness Soc'y v. Wisely*, 524 F. Supp. 2d 1285, 1312 (D. Colo. 2007) (striking down BLM NEPA analysis where agency failed to analyze in detail "*a potentially appealing middle-ground compromise between the absolutism of the outright leasing and no action alternatives*.")

160 Black *et al.* 2008. Wildland Fire Use Barriers and Facilitators. *Fire Management Today* 68(1): 10-14. Doane *et al.* 2006

161 Black and Opperman 2005. Fire Effects Planning Framework: a user's guide. RMRS-GTR-163.

162 p. 11 in Ager *et al.* 2013

163 p. 3 in Ager *et al.* 2013

complex modelling and algorithms used by the researchers ultimately identified locations where strategically deployed mechanical treatments would reduce flame length and thus save old growth ponderosa pine.

One common fundamental similarity between all optimization models is that they seek to reduce fire-severity or minimize wildfire risk, balancing tradeoffs between the size of treatment units, the placement of treatments, and the proportion of the landscape treated.[164] Collins and colleagues[165] also reviewed fuel treatment strategies, including much of Finney and Ager's work, and arrived at some basic parameters for optimizing fuel reduction treatments at the landscape scale that provide some guidance for those evaluating tradeoffs and can be used as guidelines in the *Strategic Treatments for Fire Use Alternative*:

> • Treating 10% of the landscape provides notable reductions in modeled fire size, flame length, and spread rate across the landscape relative to untreated scenarios, but treating 20% provides the most consistent reductions in modeled fire size and behavior across multiple landscapes and scenarios.
>
> • Increasing the proportion of area treated generally resulted in further reduction in fire size and behavior, however, the rate of reduction diminishes more rapidly beyond 20% of the landscape treated.
>
> • Random placement of treatments requires substantially greater proportions of the landscape treated compared with optimized or regular treatment placement.
>
> • The improvements offered by optimized treatments are reduced when 40-50% of the landscape is unavailable for treatment due to land management constraints.
>
> • Treatment rates beyond 2% of the landscape per year yield little added benefit.

Considering the fire modeling that we presume is already underway by the Forest Service, and the key takeaways reviewed here, we believe that a modified version of the methodology developed by the Hurteau lab and used by Krofcheck and colleagues[166] is most appropriate for this Project analysis.

Let us be clear: we hereby request formally that an alternative for analysis be concluded that represents the core principles of this Strategic Treatments for Fire Use Alternative Framework.

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[164] Collins *et al.* 2010. Challenges and approaches in planning fuel treatments across fire-excluded forested landscapes. *Journal of Forestry* Jan/Feb 2010: 24-31

Chung 2015. Optimizing fuel treatments to reduce wildland fire risk. *Current Forestry Reports* 1: 44-51.

Krofcheck *et al*. 2017a

[165] Collins *et al.* 2010

[166] Krofcheck *et al*. 2017a; Krofcheck *et al*. 2017b

The Krofcheck and colleagues optimization model, which mechanically treats only the operable areas with a high probability of mixed- and high-severity fire, was shown in multiple fire simulations to be as effective as thinning all operable acres at reducing wildfire burn severity and facilitating landscape scale low-severity fire restoration. The authors summarize their methods here:

> "*We developed three scenarios: no-management, naive placement, and optimized placement. Both management scenarios employed combinations of mechanical thinning and prescribed burning. The naive placement scenario aimed to simulate mechanical thinning from below and prescribed fire to all forest types that have experienced a fuels load departure from their historic condition due to fire exclusion. Within each forest type that received mechanical thinning, thinning was constrained based on operational limits (slope>30%, which totaled 22,436 ha available for mechanical thinning). The optimized placement scenario further constrained the area that received mechanical thinning by limiting thinning to areas that also had a high probability of mixed- and high-severity wildfire…In both treatment scenarios, stands identified for mechanical treatment were thinned from below, removing roughly one-third of the live tree biomass over the first decade of the simulation. Stands selected for mechanical thinning were only thinned once in the simulations, and all thinning was completed within the first decade*."[167]

Their results suggested that thinning the most optimum 33% of the operable acres could achieve the same effect as thinning all operable acres. The study was simulated in the Sierra Nevada of California, but the authors asserted that their approach was *"broadly applicable to historically frequent-fire ecosystems, or systems which have transitioned away from a low severity and fuel limited fire regime to one characterized by high-severity fires*."[168]

The authors have recently completed similar optimization simulations in the Santa Fe Fireshed, which is likely to provide additional direction for utilizing such an approach in Southwestern ponderosa pine and mixed conifer forests (findings are to be published soon).[169]

Why doesn't the scoping document make mention of this important, local research?

We believe that it is possible and beneficial to integrate the existing fire behavior and risk assessment modelling into an optimization simulation based on that work. We recommend that the Hurteau Lab is contacted immediately to begin dialogue as to how an optimization process can take existing fire modelling to the next level of strategic utility.

Three-tier Management Area Strategy

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[167] p. 2 in Krofcheck *et al*. 2017a

[168] p. 6 in Krofcheck *et al*. 2017a

[169] Personal communication: Matt Hurteau, University of New Mexico, March 29, 2018

Reflecting advances in landscape level planning, the *Strategic Treatments for Fire Use Alternative* proposes a three-tier strategy, basing management area decisions on optimized treatment locations rather than just arbitrary distances from values-at-risk. Past management zone strategies have been proposed by fire ecologists to facilitate resource benefit fire in Wilderness areas, and were based on distance from the wildland-urban interface.[170] Later, those approaches were extended to non-Wilderness public lands beyond a 5 ½ mile buffer around private land.[171] Both of those distance-dependent approaches resulted in identification of community protection zones, restoration management zones, and fire use zones. More recently, USFS and academic scientists called for a similar three-zone approach to be incorporated into National Forest Land and Resource Management Plans, with no specification of zone distances from the wildland-urban interface.[172] Conversely, the *Strategic Treatments for Fire Use Alternative* proposes that thinning treatments be prioritized in the Wildland Urban Interface, around critical infrastructure, and in areas having the highest probability of active crown fire, irrespective of proximity to human values-at-risk.

The three tiers of the Alternative are as follows:

Tier 1) Community Protection. These areas should be highest priorities for mechanical treatment, where feasible. Identification of the Community Protection Areas follows a ½ mile around homes and critical infrastructure. Additional areas that demand special attention may be addressed through a collaborative stakeholder process.

Tier 2) Strategic Thinning Treatment. These areas should be the next level of priority for mechanical treatment. *Strategic Thinning Treatment* areas would be identified through optimization analysis. An additional, secondary prioritization could be developed collaboratively to identify those stands which are the foremost priority for accelerated mechanical treatment within this zone. This analysis should include all "other projects" within the Project footprint, because "*Understanding where past fuel treatments and wildfires have occurred is important for prioritizing future fuel treatment.*"[173] Based on the 2010 synopsis competed by Collins and colleagues, a reasonable starting point may be that approximately 20% of the operable landscape could be targeted for strategically placed treatments, which would equate to approximately 28,000 acres of the project footprint. Krofcheck and colleagues optimization simulations from the Sierra Nevada resulted in approximately 8.5% of the landscape being identified for mechanical treatment. It will be important to let the process speak for itself, but if the optimization successfully locates thinning treatment priorities within those ranges, that amount of available acreage would provide decades of contracts to local industry. These acres may be in

[170] Wilmer and Aplet 2005. Managing the Landscape for Fire: A Three-Zone, Landscape-Scale Fire Management Strategy. The Wilderness Society, Washington, DC.

[171] Aplet and Wilmer 2010. The potential for restoring fire-adapted ecosystems: exploring opportunities to expand the use of wildfire as a natural change agent. *Fire Management Today* 70(10): 35-39.

[172] North *et al.* 2015b

[173] p. 301 in Vaillant and Reinhardt 2017

addition to those within the *Community Protection* areas and would be determined through the optimization analysis.

Tier 3) Fire Use. Areas located outside Tier 1 and 2 are not prioritized for mechanical treatment. Instead, management prioritizes prescribed and resource benefit fire at frequencies appropriate to local fire regimes. Because progressively warmer and drier winters may be conducive to year-long prescribed fire,[174] we recommend that increased resources are made available for burning, including the use of Prescribed Fire Training Exchanges (TREX), Wildland Fire Modules, forming prescribed fire councils, and a dedicated prescribed fire implementation team.[175] The Project is lucky that the Forest Guild is so conveniently poised to provide this support.

Why Analyze the Strategic Treatments for Fire Use Alternative?

The *Strategic Treatments for Fire Use Alternative* seeks to achieve a realistic, attainable outcome where values-at-risk are protected from undesirable fire effects, while natural process-structure interactions drive ecosystem restoration and improve resiliency. We stand by our assertion that workforce limitations render impossible the goal of logging one-half of the project area. Therefore, it is reasonable and prudent to consider an intermediate approach, whereby a subset of strategically located thinning treatments can be implemented in order to facilitate fire-based restoration across the broader landscape.

Fundamental to nearly every published research on forest restoration practices is the need for strategically prioritizing and placing mechanical thinning treatments that facilitate safe application of prescribed and wildland fire. At the core of the *Strategic Treatments for Fire Use Alternative* is our position that the current direction in planning, analysis and implementation in the Project is overly reliant on meeting structural and compositional targets, representing what is in effect a non-viable silvicultural solution to a complex ecological problem. The quest to create the ideal vegetative state across every operable acre has marginalized the overriding importance of fire-driven ecological processes. Applying a new form of growth and density regulation, as articulated in GTR-310, cannot by itself accomplish restoration at meaningful landscape scale; only the additive effects of frequent fire can fully restore these ecosystems.

Strategically placed mechanical thinning has a critical role in the Project in order to reduce the risk of uncharacteristic fire and prepare the landscape for safe wildfire re-entry.[176] Considering that much of the Project landscape is currently densely stocked with dangerous surface fuel loads and ladder fuels, mechanical thinning is a viable tool for preparing those areas for successful re-establishment of a predominantly low-intensity, frequent fire regime. However, if current workforce trends continue, that work cannot be accomplished at a pace commensurate with the scale of the ecological problem, and as such a course correction is needed. Because many acres

[174] Seager *et al.* 2007. Model projections of an imminent transition to a more arid climate in southwestern North America. *Science* 316:1181.

[175] Stephens *et al.* 2016

[176] Stephens *et al.* 2016. U.S. federal fire and forest policy: emphasizing resilience in dry forests. *Ecosphere* 7(11): 1-19.

identified for thinning may be poor candidates for economically-viable mechanical treatment but suitable for fire-based restoration, strategic placement of mechanical thinning is essential.

Leading fire scientists and managers have stated that nationwide "*The current priority and pace of fuels treatments outside the WUI is unlikely to significantly influence fire intensity and severity*."[177] Across the western United States, fuels reduction and forest restoration treatments are not keeping up with the historic fire return intervals for National Forest lands, including dry southwestern forests, resulting in a continued 'fire-deficit' where only about 50% of the required disturbance occurs on an annual basis.[178] The persistent disturbance deficit is a relic of failed past land management practices of commercial logging, fire suppression, grazing, and road building,[179] and continues to generate negative outcomes resulting from compensatory management responses, such as continued fire suppression.[180] Because of economic, legal, and logistical limitations which restrict effective large-scale restoration,[181] a full suite of techniques should be utilized to achieve restoration objectives, including dramatically increased use of prescribed fire and expanding the use of unplanned ignitions for resource benefit.[182]

The Strategic Treatments for Fire Use Alternative Follows National Agency Priorities

The dramatic deficit of annual acreage burned in frequent-fire adapted forests has led senior USFS scientists to call for increasing the scale and rate of fuels treatments following three key strategies:[183]

1) Increasing the extent of fuel treatments if resources permit;

2) Designing treatments to create conditions conducive to naturally ignited fires burning under desired conditions while fulfilling an ecological role; and

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177 p. 393 in North *et al.* 2012.

178 Vaillant and Reinhardt 2017. An evaluation of the Forest Service hazardous fuels treatment program—are we treating enough to promote resiliency or reduce hazard? *Journal of Forestry* 115(4): 300-308.

Personal communication: Tessa Nicolet, USFS Region 3 Fire Ecologist, Sept. 23, 2017.

179 Kauffman 2004. Death rides the forest: perceptions of fire, land use, and ecological restoration of western forests. *Conservation Biology* 18(4): 878-882.

180 Calkin *et al.* 2015. Negative consequences of positive feedbacks in US wildfire management. *Forest Ecosystems* 2:9.

181 Collins *et al.* 2010

182 Stephens *et al.* 2009. Fire treatment effects on vegetation structure, fuels, and potential fire severity in western U.S. forests. *Ecological Applications* 19(2): 305-320.

North *et al.* 2015b.

183 p. 301in Vaillant and Reinhardt 2017. An evaluation of the Forest Service hazardous fuels treatment program—are we treating enough to promote resiliency or reduce hazard? *Journal of Forestry* 115(4): 300-308.

3) Placing treatments to reduce hazard while providing options for firefighting when highly valued resources and assets are present.

These strategies are becoming widely accepted by fire scientists and managers, but intransigence remains firmly rooted in certain elements of USFS culture.[184] The *Strategic Treatments for Fire Use Alternative* is rooted in these strategies and demonstrative of the approach promoted in the *National Cohesive Wildland Fire Management Strategy* ("National Strategy").

The National Strategy identifies this general guidance for Vegetation and Fuels Management:[185]

i. **Design and prioritize fuel treatments.** Where wildfires are unwanted or threaten communities and homes, design and prioritize fuel treatments to reduce fire intensity, structure ignition, and wildfire extent.

ii. **Strategically place fuel treatments.** Where feasible, implement strategically placed fuel treatments to interrupt fire spread across landscapes.

iii. **Increase the use of wildland fire for meeting resource objectives.** Where allowed and feasible, manage wildfire for resource objectives and ecological purposes to restore and maintain fire-adapted ecosystems and achieve fire-resilient landscapes.

iv. **Continuing and expanding the use of all methods to improve forest and range resiliency.** Continue and expand the use of prescribed fire to meet landscape objectives, improve ecological conditions, and reduce the potential for high-intensity wildfires. Use and expand fuel treatments involving mechanical, biological, or chemical methods where economically feasible and sustainable, and where they align with landowner objectives.

The *Strategic Treatments for Fire Use Alternative* puts equal emphasis on these four courses of action.

The National Strategy clearly asserts that "*Prescribed fire and managing wildfire for resource objectives have the greatest potential for treating large areas at lower cost than mechanical treatments.*"[186] Researchers have long asserted that "*Prioritizing restoration efforts is essential because resources are limited. An initial focus on areas most likely to provide benefits and that*

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[184] Doane *et al.* 2006. Barriers to wildland fire use a preliminary problem analysis. *International Journal of Wilderness* 12(1): 36-38.

North *et al.* 2015b. Reform forest fire management – agency incentives undermine policy effectiveness. *Science* 349(6254): 1280–1281.

Stephens *et al*. 2009. Fire treatment effects on vegetation structure, fuels, and potential fire severity in western U.S. forests. *Ecological Applications* 19(2): 305-320.

[185] pp. 1 and 58 in National Strategy 2014: https://www.forestsandrangelands.gov/strategy/thestrategy.shtml

[186] p. 58 in National Strategy 2014

present a low risk of degradation of ecological values will build experience and credibility."[187] Prominent fire scientists have recently affirmed that "*Strategically placing fuel treatments to create conditions where wildland fire can occur without negative consequences and leveraging low-risk opportunities to manage wildland fire will remain critical factors to successful implementation of the* [National] *Strategy.*"[188] The *Strategic Treatments for Fire Use Alternative* considers these fundamental principles, and prioritizes mechanical thinning where it would be most effective to ensure community protection, preserve recreational opportunities, and restore predominantly low-intensity fire regimes.

This approach is further called for in the 2012 Mexican Spotted Owl Recovery Plan, which suggests that restoration projects "*Conduct a landscape-level risk assessment to strategically locate and prioritize mechanical treatment units to mitigate the risk of large wildland fires while minimizing impact to PACs*."[189]

Prominent fire scientists and managers are increasingly calling for strategically placed treatments on portions of the landscape in order to safely facilitate the use of prescribed and managed wildfire to achieve restoration of frequent fire adapted ecosystem processes, composition, and structure. USFS researchers have established that any science-based planning should ask "*Which locations provide the greatest strategic opportunity for fuel treatments that would facilitate attainment of desired conditions*?"[190] The *Strategic Treatments for Fire Use Alternative* asks this important question.

One of the Nation's foremost forest restorationists has stated that "*restoration of surface fire in most sites and thinning in strategic sites will increase resistance to severe wildfire at the stand and landscape scales, insect pathogens, and invasive non-native species.*"[191] We agree with that assertion and believe that the Forest Service should address this by analyzing our alternative.

We therefore request the USFS to analyze the *Strategic Treatments for Fire Use Alternative* as a standalone alternative in any subsequent NEPA document.

What is involved in the Strategic Treatments for Fire Use Alternative?

By integrating fire behavior modelling methodologies already used by the Forest Service with treatment optimization simulations, the *Strategic Treatments for Fire Use Alternative* builds

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[187] Brown *et al*. 2004. Forest restoration and fire: principles in the context of place. *Conservation Biology* 18(4): 903-912.

[188] p. 8 in Barnett *et al.* 2016. Beyond fuel treatment effectiveness: characterizing interactions between fire and treatments in the US. *Forests* 7(237): 1-12.

[189] p. 262 in USFWS 2012 Mexican Spotted Owl Recovery Plan, First Revision (*Strix occidentalis lucida*). Southwest Region U.S. Fish and Wildlife Service Albuquerque, New Mexico.

[190] Peterson and Johnson 2007. Science-based strategic planning for hazardous fuel treatments. *Fire Management Today* 67(3): 13-18.

[191] p. 529 in Fulé 2008

upon the work already underway by the USFS and eliminates any perceived need to "reinvent the wheel." The additional analytical overlays that define the *Strategic Treatments for Fire Use Alternative* would prioritize treatment areas following a treatment optimization technique developed by scientists at the Earth Systems Ecology Lab at the University of New Mexico (the Hurteau Lab). Their research[192] has developed "*prioritization strategies for implementing fuel treatments… with the goal to maximize treatment efficacy using optimal placement and prescription options under typical and extreme fire weather conditions*."[193] We propose a tiered implementation structure that combines existing treatment direction, optimized treatment locations, and fundamental restoration principles to define three zones with distinct management approaches. This approach could inform landscape-scale restoration planning nationwide, as "*Testing of strategic placement of treatments by resource managers will add data in the years ahead and provide information that can be shared and applied in other locations*."[194]

This framework offers a pathway to return to the New Mexico Forest Restoration Principles original intent of prioritizing and strategically placing treatments, consistent with the most frequently cited principles for ecological restoration of southwestern ponderosa pine forests, which explicitly urge practitioners to "*Prioritize and strategically target treatment areas.*"[195] The USFS's current emphasis on aggressive structural manipulation to very low densities, as articulated in GTR-310 is an essentially unproven approach that is well outside the current zone of agreement among the stakeholders signed on to this letter. Landscape scale thinning treatments should instead "*focus on creating conditions in which fire can occur without devastating consequences.*"[196]

Mechanical restoration treatments, while proven effective to emulate historical structural and compositional attributes,[197] are not the only valid approach to enhancing resiliency, diversity, and function in fire-adapted forests. A range of treatments that can be realistically implemented is required. In a sweeping review of federal fire policy, Stephens and others recommended that

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[192] Krofcheck *et al*. 2017a. Prioritizing forest fuels treatments based on the probability of high-severity fire restores adaptive capacity in Sierran forests. *Global Change Biology DOI: 10.1111/gcb.13913.*

Krofcheck *et al*. 2017b. Restoring surface fire stabilizes forest carbon under extreme fire weather in the Sierra Nevada. *Ecosphere* 8(1): 1-18.

[193] http://www.hurteaulab.org/

[194] p. 15 in Peterson and Johnson 2007

[195] p. 1424 in Allen *et al.* 2002. Ecological restoration of southwestern ponderosa pine ecosystems: A broad perspective. *Ecological Applications* 12(5): 1418-1433.

[196] p. 1988 in Reinhardt *et al.* 2008. Objectives and considerations for wildland fuel treatment in forested ecosystems of the interior western United States. *Forest Ecology and Management* 256: 1997-2006.

North *et al*. 2012. Using fire to increase the scale, benefits, and future maintenance of fuels treatments. *Journal of Forestry* 110(7): 392-401.

[197] Fulé *et al.* 2012. Do thinning and/or burning treatments in western USA ponderosa or Jeffrey pine dominated forests help restore natural fire behavior? *Forest Ecology and Management* 269: 68-81.

the number one improvement that could be made in planning and implementing forest and fire management is to "*mandate evaluation of opportunities for ecologically beneficial fire in land management planning*."[198]

A 2013 Ecological Restoration Institute synopsis titled *Fuel Treatment Longevity*[199] identified 25 factors affecting fuel treatment longevity. Among those was "Treatment Intensity," which was only briefly mentioned as a bulleted point, and no evidence was provided supporting the notion that high intensity thinning to very low basal areas increased resilience or prolonged treatment effectiveness. In fact the opposite effect was depicted, as that synopsis cited a study from northern Arizona where "*higher-intensity treatments were found to have twice the number of ponderosa pine seedlings as low-intensity restoration treatments*,"[200] an example of where aggressive thinning may encourage dramatic increases in ladder fuels.

Is the Santa Fe National Forest able to manage thousands of acres of regeneration filling all of the interspaces created under a GTR-310 management paradigm?

The Strategic Treatments for Fire Use Alternative Minimizes Significant Controversy Related to GTR-310 and Aggressive Logging Treatments in Protected Habitats

We reject a framework which assumes that complex ecosystems can be wrangled into fixed proportions of tree ages and sizes that must be repeatedly tinkered with at 20 or 30-year rotations to maintain "desired conditions." In areas where strategically located mechanical intervention is implemented, fire alone can and should be the primary future maintenance tool.[201] Measuring the health of the forest on the basis of density-metrics represents a worn-out allegiance to a past industrial paradigm. This regulated-forest model defines successful restoration as growing large, defect-free trees as quickly as possible and ignores the complexity of process-centered ecosystem function. Restoring a forest is not an exercise in manipulating every quantifiable metric into a neat category, or alleviating any form of stress that might lead to unexpected mortality.

Renowned fire ecologist Dr. Pete Fulé stated that "*The fire-related adaptations of pine forests are associated with fire's role as a selective force going far back in evolutionary time,*"[202] suggesting that restoration of fire adapted dry forests is inseparable from the influence of recurrent fire as a primary selective force.

The effect of mechanical thinning to very low density and basal area on drought resistance in ponderosa pine and mixed conifer forests has not been studied in long-term, replicated studies

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198 p. 4 in Stephens *et al.* 2016

199 Yocum 2013. Fuel Treatment Longevity. Ecological Restoration Institute Working Paper No. 27.

200 p. 5 in Yocum 2013

201 North *et al.* 2012, Reinhardt *et al.* 2008

202 p. 528 in Fulé 2008. Does it make sense to restore wildland fire in changing climate? *Restoration Ecology* 16(4): 526-531.

with broad geographic inference, and as such, is poorly understood.[203] Ecologists with USGS and USFS recently stated that "*the utility of basal area reduction for minimizing drought impacts in natural forests remains relatively unexplored, especially in dry forests like those of the Southwest US that may be particularly vulnerable to drought*."[204] There has been very little research to date assessing the effect of dramatic canopy reduction on soil heating and drying, which are significant concerns to forest managers.

Complicating the translation of best available scientific information into management direction is the lack of consistency among key descriptors of forest density, especially as it relates to the effects of mechanical thinning on tree ecophysiology and soil-water/drought relationships. Such was the case with Petrie and colleagues research which suggests that 'intermediate' level thinning that minimizes soil surface temperatures will likely promote survival of ponderosa pine seedlings under climate change driven temperature rise.[205] While they do not provide any clarity on what 'intermediate' thinning constitutes, it is noteworthy that they did not suggest 'low' density thinning as a panacea for drought resistance. Another example can be found with Zou and colleagues, who studied soil water dynamics in 'low-density' and 'high-density' ponderosa pine stands at 7,550 ft. on the Pajarito Plateau of New Mexico[206]. They found that over a 4-year period, the 'low-density' stand had an order of magnitude more water available on a per-tree basis than did the 'high-density' stand. It is important to note the condition of the two stands: the 'high-density' stand had 2710 trees/hectare (1120 trees/acre) while the low-density stand had 250 trees/hectare (103 trees/acre). These results suggest that thinning down to moderate densities at the upper end of the USFS's self-crafted "Desired Conditions" and GTR-310 is effective at increasing soil water significantly, and provide another example of how the scale of densities reported in research is not necessarily consistent with ranges debated within management dialogue or proposed for the Project.

Bradford and Bell studied the interactions between tree basal area and climate across 1,854 Forest Inventory and Analysis plots in Arizona, New Mexico, Utah, Colorado, and Wyoming.[207] They found strong evidence that tree mortality is positively related to 'high' stand basal area for ponderosa pine and Douglas-fir, and that managing to 'lower' basal areas may decrease future climate-induced mortality due to high temperatures and low moisture predictions. However, their study did not define 'high,' 'medium,' and 'low' basal areas, which essentially precludes managers from translating the results into actionable guidelines. Supplemental charts provided

[203] D'Amato *et al.* 2013. Effects of thinning on drought vulnerability and climate response in north temperate forest ecosystems. *Ecological Applications* 23(8): 1735-1742

[204] p. 12 in Bradford and Bell. 2017. A window of opportunity for climate-change adaptation: easing tree mortality by reducing forest basal area. *Frontiers in Ecology and the Environment* 15(1): 11-17

[205] Petrie *et al.* 2017. Climate change may restrict dryland forest regeneration in the 21st century. *Ecology* 98(6): 1548-1559.

[206] Zou *et al.* 2008. Soil water dynamics under low-versus high-ponderosa pine tree density: ecohydrological functioning and restoration implications. *Ecohydrology* 1: 309-315.

[207] Bradford and Bell 2017

on-line by the researchers did not provide clarity, as there are no labels noting whether density was reported in metric or standard units.

As another example, Kerhoulas and colleagues found that 'heavy thinning' of ponderosa pine stimulated growth, improved drought resistance, and provided greater climate change resilience.[208] Again, the definition of 'heavy' is not standardized, and in this case 'heavy thinning' equated to thinning down to approximately 70 ft^2/acre of basal area, while 'moderate thinning' was down to ~80 ft^2 /acre and 'light thinning' was down to ~98 ft^2. Overall, the effects of thinning to the low end of basal area range on soil surface temperatures, soil drying during pre-monsoon drought, and related variables has not been adequately studied. Until scientists can provide clear answers, caution is warranted.

The cumulative effects of re-establishing frequent fires should not be understated. Even with cool, low-severity burns, post-treatment mortality may range between 10% and 30% of the residual trees.[209] As an example, the photo below shows a portion of the GTR-310 Bluewater demonstration site on the Cibola National Forest, New Mexico. The 73-acre site was thinned to <32 ft^2/acre and ~25 trees/acre[210] in 2010. Despite the very low density of the remaining forest, a patch of more than 50 trees across 2 acres were killed by the first fire entry following thinning. This unexpected incident of torching led to the death of at least three old-growth trees and calls into question the efficacy of attempts to restore desired structure without consideration of the aggregate effects of re-establishing frequent fire.

A 2 acre patch of mortality at the GTR-310 Bluewater Demonstration site following initial prescribed fire re-entry, July 2017

[208] Kerhoulas *et al.* 2013. Managing climate change adaptation in forests: a case study from the U.S. Southwest. *Journal of Applied Ecology* 50: 1311–1320.

[209] Fulé *et al*. 2005. Pine-oak forest dynamics five years after ecological restoration treatments. *Forest Ecology and Management* 218: 129–145; Fulé *et al*. 2007. Posttreatment tree mortality after forest ecological restoration, Arizona, United States. *Environmental Management* 40: 623-634

[210] July 2017 Center for Biological Diversity field inventory of 13 paired 1/10th-acre and 1-acre inventory plots.

In response to the shortcomings inherent in restoration projects which rely on extensive mechanical thinning, government and academic scientists have called for reconsideration of the strict adherence to historic structural attributes as the clearest pathway towards building resilience into dry fire-adapted forests. Williams and colleagues suggested that in the dynamic context of climate change threatening the sustainability of transitional environments, restoration "*must move beyond frameworks where historic structure and composition are fixed targets for recovery.*"[211] Similarly, Millar and colleagues stated that "*attempts to maintain or restore past conditions require increasingly greater inputs of energy from managers and could create forests that are ill adapted to current conditions and more susceptible to undesirable changes… Decisions that emphasize ecological process, rather than structure and composition, become critical.*"[212] The *Strategic Treatments for Fire Use Alternative* is consistent with that framework, and more in line with widely accepted principles for ponderosa pine forest restoration[213] than the approach currently codified in the proposed action.

Restoring a Landscape Requires Expanding the Use of Fire

Abundant evidence points to the success of fuels reduction treatments including thinning, burning, and combinations of the two at restoring natural fire behavior,[214] even though restoration treatments may not produce significant changes in mean diameter, canopy base height, surface fuels, spatial aggregation, or vertical heterogeneity.[215] Despite the benefits accrued from thinning treatments, restoration of fire-adapted natural and human communities in the Project landscape will require a substantial increase in the area burned annually.

Among USFS Regions, Vaillant and Reinhardt found that the Southwest (Region 3) is far ahead of the rest of the country in returning fire to the landscape[216]. Their analysis showed that Region 3, compared to the 6 other western Regions, has proportionally the most acres burned by characteristic severity wildfire, the smallest deficit of land area needing treatment to match historical acreage-burned, and the least amount of area being mechanically treated

Strategically placed treatments that facilitate the management of wildfire for resource benefit can lead to the required increases in annual wildfire acres burned.[217] Resource benefit fires tend to

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[211] p. 21293 in Williams *et al.* 2010. Forest responses to increasing aridity and warmth in the southwestern United States. *Proceedings of the National Academy of Sciences* 107(50): 21289-21294.

[212] pp. 2145-2146 in Millar *et al.* 2007. Climate change and forests of the future: managing in the face of uncertainty. *Ecological Applications* 17(8): 2145-2151.

[213] See Allen *et al.* 2002

[214] Fulé *et al.* 2012

[215] Ziegler *et al.* 2017. Spatially explicit measurements of forest structure and fire behavior following restoration treatments in dry forests. *Forest Ecology and Management* 386: 1-12.

[216] Vaillant and Reinhardt 2017

[217] Vaillant and Reinhardt 2017

cover far more acres than do thinning and prescribed fire treatments.[218] Large treatments can be more effective at moderating fire behavior relative to smaller treatments because they contain more interior area and less edge and are more likely to be encountered by a wildfire.[219] Large fire footprints are more effective at modifying future fire activity than small fires and generally reduce the size of subsequent overlapping burns that occur within ten years of the initial fire, which increases manageability and benefits of subsequent fires.[220]

Breaking the typical cycle of management reaction and suppression response by increasing the scale and frequency of large prescribed and resource benefit fire use will support sustainable feedback mechanisms whereby future suppression efforts, even in severe fire-weather events, become less necessary.[221] Because the Southwest has entered an era of longer, hotter, drier, and unpredictable fire seasons, it is critical that fire use is accelerated in order to reduce fuels, restore ecosystem process, create landscape heterogeneity, and reduce the impact and severity of the next big blaze beyond the horizon.

Evidence of Mixed Fire Severities in Southwestern Frequent-Fire Forests

Multiple lines of evidence support the occurrence of fire effects outside the traditionally accepted notion that low-severity fire was characteristic of southwestern middle elevation forest types. This is particularly relevant to the Project as the project area includes a range of elevations spanning most fire regimes imaginable for the southwestern United States. Generalizing desired conditions to suggest that all fires should be low-intensity surface fires ignores the bulk of scientific evidence to support that pinyon-juniper, mixed conifer, and spruce fire ecosystems commonly burned at high severity, and occasionally ponderosa pine did as well.

This section discusses this growing body of evidence and is specifically focused on southwestern ponderosa pine and ponderosa pine dominated dry mixed-conifer ecosystems. These studies should form the basis of your decision making. Because the occurrence of mixed-severity fire is now recognized as within the historical range of variability for these forests, and there are noteworthy advantages of such effects, there is valid scientific support for utilizing it as a restoration tool *where appropriate and feasible in a manner that does not put communities, infrastructure, and other key values at risk*.

Traditionally, the extensive body of literature surrounding restoration of ponderosa pine and dry mixed-conifer ecosystems has supported the notion that fires burned almost exclusively at low-

[218] Hunter *et al.* 2011. Short- and long-term effects on fuels, forest structure, and wildfire potential from prescribed fire and resource benefit fire in southwestern forests, USA. *Fire Ecology* 7(3): 108-121.

[219] Barnett *et al.* 2016

[220] Teske *et al.* 2012. Characterizing fire-on-fire interactions in three large wilderness areas. *Fire Ecology* 8(2): 82-106.

[221] Calkin *et al*. 2015. Negative consequences of positive feedbacks in US wildfire management. *Forest Ecosystems* 2:9.

North *et al.* 2015b

severities. In a seminal paper on the subject, Moore and colleagues stated that "*low-frequency, high intensity stand replacement fires were very rare or nonexistent.*"[222] However, a growing body of research during intervening years, described here, suggests that a mix of severities have historically occurred across landscapes similar to or including the Project landscape. For example, Owen and colleagues stated frankly that "*ponderosa pines evolved under fire regimes dominated by low- to moderate-severity wildfire*"[223] which is a substantial philosophical departure from Moore and colleagues' statement. Additionally, Fulé and colleagues, in their noteworthy response to Williams and Bakers[224] claims of widespread high-severity fires in northern Arizona's forests, stated that "*historical fires in relatively dry forests dominated by ponderosa pine included a range of fire severities*."[225]

The historical phenomenon of stand-replacing fire and attendant debris flows in ponderosa pine dominated mixed-conifer forests have been recorded at Kendrick Mountain on the Kaibab National Forest, Missionary Ridge in the San Juan Mountains of Colorado, The Jemez Mountains of New Mexico, at Rio Puerco in northern New Mexico, the Sacramento Mountains of New Mexico, and elsewhere throughout the West.[226] While the methods used to age severe fire events cannot suggest the size of such events, these studies uniformly conclude that fire

[222] p. 1269 in Moore *et al.* 1999. Reference conditions and ecological restoration: a southwestern ponderosa pine perspective. *Ecological Applications* 9(4): 1266-1277.

[223] p. 134 in Owen *et al.* 2017. Spatial patterns of ponderosa pine regeneration in high-severity burn patches. *Forest Ecology and Management* 405: 134-149.

[224] Williams, M.A. and W.L. Baker. 2012. Spatially extensive reconstructions show variable severity fire and heterogeneous structure in historical western United States dry forests. *Global Ecology and Biogeography* 21(10): 1042-1052.

[225] p. 827-828 in Fulé, P.Z., T.W. Swetnam, P.M. Brown, D.A. Falk, D.L. Peterson, C.D. Allen, G.H. Aplet, M.A. Battaglia, D. Binkley, C. Farris, R.E. Keane, E.Q. Margolis, H. Grissino-Mayer, C. Miller, C.H. Seig, C. Skinner, S.L. Stephens, and A. Taylor. 2014. Unsupported inferences of high-severity fire in historical dry forests of the western United States: response to Williams and Baker. *Global Ecology and Biogeography* 23: 825-830.

[226] Jenkins *et al.* 2011. Late Holocene geomorphic record of fire in ponderosa pine and mixed-conifer forests, Kendrick Mountain, northern Arizona, USA. *International Journal of Wildland Fire* 20: 125-14

Bigio *et al.* 2010. A comparison and integration of tree-ring and alluvial records of fire history at the Missionary Ridge Fire, Durango, Colorado, USA. *The Holocene* 20(7): 1047-1061.

Fitch 2013. Holocene fire-related alluvial chronology and geomorphic implications in the Jemez Mountains, New Mexico. M.S Thesis, University of New Mexico, Albuquerque, NM.

Meyer and Frechette 2010. The Holocene record of fire and erosion in the southern Sacramento Mountains and its relation to climate. *New Mexico Geology* 32(1): 19-21.

French *et al.* 2009. Holocene alluvial sequences, cumulic soils and fire signatures in the middle Rio Puerco basin at Guadalupe Ruin, New Mexico. *Geoarchaeology* 24(5): 638-676.

Pierce and Meyer 2008. Late Holocene records of fire in alluvial fan sediments: fire-climate relationships and implications for management of Rocky Mountain forests. *International Journal of Wildland Fire* 17*:* 84-95.

behavior is highly sensitive to relatively modest climatic change and that it is important to include mixed-severity fire at centennial to millennial scales as a component of the natural range of variability. Roos and Swetnam reported that the combined effects of a century long fire-free period (1360 to 1455) punctuated by two unusually wet periods and followed by a hemispheric mega-drought may have led to conditions that supported widespread crown fires in southwestern ponderosa pine forests. They also suggested that similar periods of reduced fire frequency in the eighth, ninth, and sixteenth centuries may have "*led to altered forest structures that were more vulnerable to increased fire severity.*"[227] The likelihood of the past occurrence of similar large scale stand replacing fires in the Sangre de Cristo Mountains should not be discounted.

Fire history research has provided additional support for mixed fire severities in more recent centuries. Hunter and colleagues reported that high-severity burn patches within moderate severity burn matrixes in ponderosa pine and pinyon-juniper ecosystems on the Gila National Forest were generally smaller than, but up to, 120 hectares.[228] Those findings corroborate Abolt's determinations that historical stand-replacing patches in the Mogollon Mountains ranged from 6 to 103 hectares along an elevational gradient, based off of aged aspen stands.[229] In a fire history study in the Black Mesa Ranger District of the Apache-Sitgreaves National Forest, Huffman and colleagues determined that their 1,300 hectare study site (7,600-7,900 ft.) was dominated by frequent, low-severity fires that maintained a ponderosa pine-dominated mixed conifer plant community. However, they did suggest that fire-induced even-aged regeneration events up to 25 hectares in size did occur historically, based off of spatial patterns of large trees and stumps.[230] Williams and Baker concluded that around 30% of trees survived high-severity fires along the Mogollon Rim,[231] which was not refuted by Fule and Colleagues, although it led to a robust discussion of what the definition of 'high-severity' really is.[232]

Studies at Grand Canyon, the Mogollon Rim, and the Gila Wilderness are also consistent with research coming from the Sierra Nevada of California. For example, a study at Illilouette Creek Basin in Yosemite National Park (4,600-9,900 ft.) determined that in Jeffrey pine and mixed conifer forests that have seen a return to near-normal fire regimes, high-severity patch sizes

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[227] p. 288 in Roos and Swetnam 2011. A 1416-year reconstruction of annual, multidecadal, and centennial variability in area burned for ponderosa pine forests of the southern Colorado Plateau region, Southwest USA. *The Holocene* 22(3): 281-291.

[228] Hunter *et al.* 2011.

[229] Abolt 1997. Fire histories of upper elevation forests in the Gila Wilderness, New Mexico via fire scar and age structure analysis. MS Thesis, University of Arizona, Tucson, AZ.

[230] Huffman *et al.* 2015. Fire history of a mixed conifer forest on the Mogollon Rim, northern Arizona, USA. *International Journal of Wildland Fire http://dx.doi.org/10.1071/WF14005*

[231] Williams and Baker 2012.

[232] Fulé *et al.* 2014.

made up 15% of burned areas, and were typically less than 4 hectares, with occasional patches up to 60 hectares.[233]

Yocum-Kent and colleagues utilized three sampling and analysis approaches to estimate historical high-severity fire patches in a high-elevation (~8,000-9,000 ft.) mixed conifer forest at Grand Canyon National Park. By aging aspen stands, aging even-aged patches of fire-sensitive trees, and by interpolating patch-size based off the oldest fire-sensitive tree in each plot area, and comparing to existing fire chronologies, the authors were able to estimate minimum, maximum, and mean patch size for high-severity mortality events. They concluded that in those high-elevation forests high-severity patches of fire were historically common and that "*Patch size of high-severity fire during the 1800s likely ranged from small patches that allowed a few trees to establish to large patches that initiated multiple stands across the landscape, on the order of* [10 to 100 hectares]."[234]

Recent fire activity at Grand Canyon is apparently not overly departed from this historical pattern. Based off National Park Service records, during a twelve year period (2000-2012) at the North Rim, twenty-five mixed-severity fires burned 2,294 individual high-severity fire patches across 6,221 hectares. The majority of patches were small (95% were <5 hectares) but three patches were between 500 and 1,300 hectares, accounting for 44% of total high-severity fire area. Furthermore, because of the overall young age of the 1,400 hectare study are and the relative infrequency of very old trees, they couldn't "*rule out a large stand-replacing fire in* [our] *study region in 1685, or even later, in the mid-1700s,*" causing them to speculate that perhaps modern patch sizes at the North Rim were not necessarily unprecedented at the centuries-scale.[235] Margolis and colleagues reported that stand-replacing patch sizes in mixed-conifer forests above 8,500 ft. on the Mogollon Plateau were historically up to nearly 300 hectares in size, with some individual fires contributing multiple patches of 100 hectares or more.[236]

The restoration of functional natural fire processes in the future is likely to regulate ecosystem structure and composition[237] and re-establish a new dynamic equilibrium that tracks climate effects on vegetation and landscape pattern in real time.[238] Cutting-edge research has concluded

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[233] Collins and Stephens 2010. Stand-replacing patches within a 'mixed-severity' fire regime: quantitative characterization using recent fires in a long-established natural fire area. *Landscape Ecology* 25: 927-939.

[234] Yocum-Kent, L.L., P.Z. Fule, W.A. Bunn, and E.G. Gdula. 2015. Historical high-severity fire patches in mixed-conifer forests. *Canadian Journal of Forest Research* 45: 1587-1596.

[235] *Ibid* at page 1594

[236] Margolis, E. Q., and J. Balmat. 2009. Fire history and fire-climate relationships along a fire regime gradient in the Santa Fe Municipal Watershed, NM, USA. *Forest Ecology and Management* 258: 2416-2430.

[237] Parks, S.A., L.M. Holsinger, C. Miller, and C.R. Nelson. 2015. Wildland fire as a self-regulating mechanism: the role of previous burns and weather in limiting fire progression. *Ecological Applications* 25(6): 1478-1492.

[238] Falk 2006. Process-centered restoration in a fire-adapted ponderosa pine forest. *Journal for Nature Conservation* 14: 140-151.

that these small patches of near or total mortality contribute to spatial heterogeneity, and may be consistent with historical spatial patterns.[239] After observing the effects of numerous resource benefit fires in the Gila Wilderness, Holden and colleagues concluded that fire-caused openings ranged in size from 0.25 to 20 hectares and that "*most of the risks, in terms of mortality to medium- and large-diameter trees are associated with the first fire after long periods of fire exclusion.*"[240]

Increased frequency, extent, and severity of wildland fires may attend climate warming and increasing drought.[241] Numerous research approaches using a range of modelling techniques suggest that widespread conifer mortality, diminished recruitment opportunities, and high-severity fire feedbacks will reduce the range and sustainability of southwestern forested ecosystems.[242] Ponderosa pine forests have survived past mega-droughts and protracted mortality events, however,[243] suggesting that resilience-to and recovery-from extreme perturbations may be driven by complex multidirectional relationships between disturbance and abiotic and biotic factors.[244] Extreme droughts driving widespread mortality events can be followed by profoundly

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[239] Iniguez *et al.* 2009. Spatially and temporally variable fire regime on Rincon Peak, Arizona, USA. *Fire Ecology* 5: 3-21.

Margolis and Balmat 2009. Fire history and fire-climate relationships along a fire regime gradient in the Santa Fe Municipal Watershed, NM, USA. *Forest Ecology and Management* 258: 2416-2430.

Sensibaugh and Huffman 2014. Managing naturally ignited wildland fire to meet fuel reduction and restoration goals in frequent-fire forests. Ecological Restoration Institute Fact Sheet.

[240] p. 28 in Holden, Z.A., P. Morgan, M.G. Rollins, and K. Kavanaugh. 2007. Effects of multiple wildland fires on ponderosa pine structure in two southwestern wilderness areas, USA. *Fire Ecology* 3(2):18-33.

[241] Seager and Vecchi 2010. Greenhouse warming and the 21st century hydroclimate of southwestern North America. *Proceedings of the National Academy of Sciences* 107(50): 21277-21282.

Williams *et al.* 2010

[242] Savage *et al.* 2013. Double whammy: high-severity fire and drought in ponderosa pine forests of the southwest. *Canadian Journal of Forest Research* 43: 570-583.

McDowell *et al.* 2015. Multi-scale predictions of massive conifer mortality due to chronic temperature rise. *Nature Climate Change*

Petrie, M.D., J.B. Bradford, R.M. Hubbard, W.K. Lauenroth, C.M. Andrews, and D.R. Schlaepfer. 2017. Climate change may restrict dryland forest regeneration in the 21st century. *Ecology* 98(6): 1548-1559.

Williams, A.P., C.D. Allen, C.I. Millar, T.W. Swetnam, J. Michaelsen, C.J. Still, and S.W. Leavitt. 2010. Forest responses to increasing aridity and warmth in the southwestern United States. *Proceedings of the National Academy of Sciences* 107(50): 21289-21294.

[243] Brown and Wu 2005. Climate and disturbance forcing of episodic tree recruitment in a southwestern ponderosa pine landscape. *Ecology* 86(11): 3030-3038.

[244] Puhlick *et al.* 2012. Factors influencing ponderosa pine regeneration in the southwestern USA. *Forest Ecology and Management* 264: 10-19.

wet periods where fire frequency declines and tree recruitment increases.[245] Extensive bark beetle outbreaks, such as those which repeatedly occurred on the Kaibab Plateau up to the period of fire-suppression initiation,[246] can create large openings within the forest canopy, which may have increased fire severity at the patch scale as downed logs were consumed.

This evolution of our understanding of drought, insects and diseases, and occasional mixed-severity fire occurring at limited scales within the natural range of variability, as well as the utility of such fires in restoring forest structure, provides needed justification for concerns that arise from expanding the use of fire to achieve beneficial outcomes. Based on these studies, prescribed and resource benefit fires could mimic historical fire behavior by accepting higher levels of mortality in patches of up to 100 hectares in ponderosa pine, and perhaps up to several hundred or more in mixed-conifer forests during the initial fire entry, *and only in areas where such fires can be managed to protect communities, infrastructure, and other key values*.

Benefits of Mixed-Severity Fires in Southwestern Frequent-Fire Forests

Implementing a strategic approach to facilitate the expanded use of prescribed and resource benefit wildfire includes a greater acceptance of mixed-severity fire across all vegetation types in the Project landscape. In this section, we review the state of our understanding of how mixed-severity fire can be a useful tool to achieve beneficial ecological outcomes. As described in the next section, sufficient evidence exists to support the occurrence of a range of fire effects in the evolutionary environment at multiple temporal scales. The diversity of fire effects is driven by factors that are common on the Project landscape, such as topographic variation, disturbance history, vegetation characteristics, and proximity to values-at-risk. Because wildland fire use has been increasingly used throughout the west, research on its ecological and practical benefits has multiplied. An extensive body of science now points towards a wide range of fire intensities and severities as a critical driver of ecological restoration and fuels reduction success.

Reducing fuels and restoring historic structure.

Agee and Skinner suggested that prescribed fire is generally effective at reducing surface fuels and raising canopy base height, but because of undesirable "severity thresholds" reductions in crown density were less easy to achieve.[247] Implementing the *Strategic Treatments for Fire Use Alternative* requires reconsideration of acceptable severity thresholds. A growing body of research from dry, frequent-fire adapted forests supports the use of moderate-severity prescribed

[245] Brown, P.M., and R. Wu. 2005. Climate and disturbance forcing of episodic tree recruitment in a southwestern ponderosa pine landscape. *Ecology* 86(11): 3030-3038.

[246] Lang and Stewart 1910. Reconnaissance of the Kaibab National Forest. Available on-line at www.nau.edu/library/speccoll/manuscript/kaibab_recon.

Craighead 1924. The black hills beetle practicing forestry on the Kaibab. *Forest Worker*, November, 1924: 74.

Craighead 1925. The *Dendroctonus* problem. *Journal of Forestry* 23: 340-354.

[247] Agee and Skinner 2005. Basic principles of forest fuel reduction treatments. *Forest Ecology and Management* 211(1): 83-96.

and/or natural-ignition fire in a mosaic of severities to achieve fuels reduction objectives, as well as restoring historic structure and pattern. Patchy-mosaics resulting from mixed-severity fire provide timely opportunities to conduct additional prescribed burns while fuel continuity and density have been reduced.[248] Often, subsequent fires burn at lower severity and result in fewer changes to the forest.[249]

Low severity prescribed fire alone may not always reduce canopy density sufficient to meet fuels reduction or ecological restoration objectives.[250] On the Gila National Forest (outside of the Gila Wilderness) moderate-severity resource benefit fire more effectively reduced basal area, tree density, seedling density, crown bulk density, canopy base height, and surface fuel loads than did low-severity prescribed or resource benefit fires in ponderosa pine and pinyon-juniper ecosystems.[251] Because of reductions in crown bulk density and crown base height, moderate-severity resource benefit fires in ponderosa pine and pinyon-juniper ecosystem can be more effective at reducing predicted crown fire potential than low-severity prescribed fires, even under very severe fire weather conditions.[252]

Studying the effects of a mixed-severity fire in ponderosa pine and dry mixed-conifer forest on Kendrick Peak, Kaibab National Forest, Stevens-Rumann and colleagues observed that areas of moderate-severity burn effects with mortality rates generally ranging between 40%-80% had met target basal area thresholds the highest amount of ponderosa pine regeneration, optimum coarse woody debris loadings, adequate fine woody debris to carry a surface fire, and met minimum requirements for snags. The authors concluded that areas where 40-80% tree mortality occurred should be managed with reintroduction of frequent low-severity surface fires to maintain stand structure, and pointed out that these moderate-severity burned areas would be more resilient to future disturbance and would be easier to maintain than thinning overly dense ponderosa pine forests.[253] Similarly, Huffman and colleagues found that across ten single-entry resource benefit fires in northern Arizona, most structural and fuels targets were only met when fire-induced mortality exceeded 31%.[254] Hunter and colleagues compared prescribed and resource benefit fires on the Gila National Forest and their "*results show that a single fire of moderate severity alone can result in stand densities that more closely resemble pre-settlement conditions.*"[255]

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[248] Williams *et al.* 2010

[249] Holden *et al.* 2007

[250] Stephens *et al.* 2009

[251] Hunter *et al.* 2011

[252] Hunter *et al.* 2011

[253] Stevens-Rumann *et al.* 2012. Ten years after wildfires: How does varying tree mortality impact fire hazard and forest resiliency? *Forest Ecology and Management* 267: 199-208.

[254] Huffman *et al.* 2017a. Efficacy of resource objective wildfires for restoration of ponderosa pine (*Pinus ponderosa*) forests in northern Arizona. *Forest Ecology and Management* 389: 395-403.

[255] p. 117 in Hunter *et al.* 2011

Pulses of dead trees resulting from patches of high-severity fire have led to speculation increased fuel loadings may lead to amplified reburn severity. In the Southwest, patches of fire-killed trees can be expected to have fallen and substantially decomposed within one decade,[256] and even in areas of very high mortality coarse woody debris is unlikely to exceed management recommendations for fuel loadings.[257] Studies from the dry forests of the Pacific Northwest have shown that standing dead and dead/down woody debris actually experienced lower severity subsequent fires than salvage logged and replanted sites.[258] Similarly, Meigs and colleagues discovered after analyzing several hundred fires in the Pacific Northwest that burn severity was generally lower in forests with higher cumulative bark beetle damage, and that burn severity continued to decrease with time.[259]

A number of studies have reported inadequate post-fire ponderosa pine regeneration and type-conversion to shrub or grassland habitats with decades-long legacy effects.[260] However, this is not a universal phenomenon. Despite the size of high-severity burn patches in the Rodeo-Chediski fire, ponderosa pine appears to be regenerating in abundance, spatial pattern, and uneven-agedness along a trajectory that is similar to historical structural characteristics, albeit with a higher abundance of sprouting oak and juniper species. [261] Also on the Rodeo-Chediski Fire, Shive and colleagues reported significantly more ponderosa pine regeneration in high severity burn patches than in low-severity patches.[262]

In spite of the tremendous size of the Rodeo-Chediski Fire – which we agree is dramatically beyond the scale of characteristic fire behavior in the southwestern ponderosa pine forest – the

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[256] Roccaforte *et al.* 2012. Woody debris and tree regeneration dynamics following severe wildfires in Arizona ponderosa pine forests. *Canadian Journal of Forest Research* 42: 593-604.

Passovoy and Fulé 2006. Snag and woody debris dynamics following severe wildfires in northern Arizona ponderosa pine forests. *Forest Ecology and Management* 223: 237–246.

Savage and Mast 2005. How resilient are southwestern ponderosa pine forests after crown fire? *Canadian Journal of Forest Research* 35: 967-977.

[257] Stevens-Rumann *et al.* 2013. Pre-wildfire fuel reduction treatments result in more resilient forest structure a decade after wildfire. *International Journal of Wildland Fire* 22: 1108-1117.

[258] Thompson *et al.* 2007. Reburn severity in managed and unmanaged vegetation in a large wildfire. *Proceedings of the National Academy of Sciences* 104(25): 10743-10748.

[259] Meigs *et al.* 2016. Do insect outbreaks reduce the severity of subsequent forest fires? *Environmental Research Letters* 11.

[260] Haire and McGarigal 2008. Inhabitants of landscape scars: succession of woody plants after large, severe forest fires in Arizona and New Mexico. *The Southwestern Naturalist* 53(2): 146-161

Savage and Mast 2005

[261] Owen *et al.* 2017

[262] Shive *et al.* 2013. Pre-wildfire management treatments interact with fire severity to have lasting effects on post-wildfire vegetation response. *Forest Ecology and Management* 297: 75-83.

situation today is not as grim as it appeared in the fires immediate aftermath. Leveraging the reduced fuels across the Rodeo-Chediski fire area to return low-intensity prescribed fire would be useful for limiting the degree to which sprouting woody species dominate the post-fire community, breaking up fuel continuity in future fires, and restoring natural frequent fire processes.

Increasing spatial and temporal heterogeneity.

Fire and forest structure interact such that the variability in stand structures present within a landscape influences the distribution of fire behaviors and severities, which in turn influence successional trajectories of post-fire environments.[263] The patchy mosaic patterns attributed to historic forest ecosystems were influenced by a range of fires and other disturbances through time and space – including patches of high-severity fire – that "*create coarse-grained, high-contrast heterogeneity…*[and]… *a complex mosaic of seral stages at the landscape and local scales*."[264] Fine scale, site-specific factors can produce dissimilar spatial patterns between sites in close proximity[265] in response to site characteristics, disturbance, successional pathways, and management history.[266]

Fire can create heterogeneity in ways that mechanical approaches simply cannot. A study of eleven mixed-severity Arizona fires across a sixteen year chronosequence described dramatic variability between fires in residual structure, regeneration response, snag and coarse woody debris dynamics, and future trajectories.[267] On the Rodeo-Chediski Fire in Arizona, Shive and colleagues observed that pre-fire treatments combined with mixed fire-severities to produce landscape heterogeneity that defied simple classification by burn severity.[268] On the same fire Owen and colleagues observed unexpected and paradoxical regeneration characteristics that included the highest documented rates of ponderosa pine regeneration occurring intermixed with the highest density of re-sprouting species in a plot far from the nearest pine seed-source.[269] These types of complex spatial arrangements of vegetative successional stages with variations in patch size and shape enhance biological diversity and influence future fire spread and

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[263] Ziegler *et al.* 2017

[264] p. 310 in DellaSala *et al*. 2014. Complex early seral forests of the Sierra Nevada: what are they and how can they be managed for ecological integrity? *Natural Areas Journal* 34(3): 310-324.

[265] Rodman *et al.* 2016. Reference conditions and historical fine-scale spatial dynamics in a dry mixed-conifer forest, Arizona, USA. *Forest Science* 62: 268–280.

[266] Hessburg *et al.* 2015. Restoring fire-prone Inland Pacific landscapes: seven core principles. *Landscape Ecology* 30: 1805-1835.

[267] Roccaforte *et al.* 2012

[268] Shive *et al.* 2013

[269] Owen *et al.* 2017

behavior.[270] Diverse understory communities across a spectrum of disturbance histories and successional trajectories may provide additional resilience to future climate-induced changes.[271]

High-severity burn patches in the Rodeo-Chediski Fire on the White Mountain Apache Reservation in Arizona have been found to have significantly higher forb species richness, total understory plant cover, and ponderosa pine regeneration compared to low-severity areas.[272] A high-intensity escaped prescribed fire in a ponderosa pine dominated mixed-conifer forest at Grand Canyon National Park led to a dramatic increase in understory native plant cover, species richness, and composition.[273] Naturally recovering high-severity burn patches within mixed-severity mosaics have increased plant diversity and may be more resilient to future climate stress.[274]

The contemporary fire crisis is not so much predicated on high-severity fire being inherently "bad," but that the scale of patches exceeds what would have historically occurred. Determining the appropriate scale and frequency of fire-induced patch disturbance is an important step towards harnessing the efficacy of fire to achieve restoration objectives.

Promoting complex early-successional ecosystems

Early-successional forest ecosystems possess high structural complexity, spatio-temporal heterogeneity, and biological/foodweb diversity resulting from variability in disturbance severity, environmental conditions, and surviving trees.[275] Patches of moderate to high-severity fire can produce highly spatially variable forest structures as a response to uneven burn effects and patchy mortality dynamics.[276] Tree regeneration patterns in early-successional habitats reflect favorable environmental conditions[277] and variable thinning by fire and other

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[270] Teske *et al.* 2012

[271] Halofsky *et al.* 2011. Mixed- severity fire regimes: lessons and hypotheses from Klamath-Siskiyou Ecoregion. *Ecosphere* 2(4): art40.

Hurteau *et al.* 2014. Climate change, fire management, and ecological services in the southwestern US. *Forest Ecology and Management* 327: 280-289.

[272] Shive *et al.* 2013

[273] Huisinga *et al.* 2005. Effects of an intense prescribed fire on understory vegetation in a mixed conifer forest. *Journal of the Torrey Botanical Society* 32(4): 590-601.

[274] Hunter *et al.* 2011; Owen *et al.* 2017

[275] Swanson *et al.* 2011. The forgotten stage of forest succession: early-successional ecosystems on forest sites. *Frontiers in Ecology and the Environment* 9(2): 117-125.

[276] Fulé *et al.* 2004. Effects of an intense prescribed forest fire: is it ecological restoration? *Restoration Ecology* 12(2): 220–230.

[277] Savage *et al.* 1996. The role of climate in a pine forest regeneration pulse in the southwestern United States. *Ecoscience* 3(3): 310-318.

disturbance.[278] These areas of localized disturbances create valuable wildlife habitat[279] and provide opportunities to apply additional fire treatments which promote further spatial diversity.[280]

The common attributes of complex early seral forests include:[281]

•Abundant and widely distributed large trees, snags and downed logs

•Varied and rich understory flora

•Varied and rich floral invertebrate, avian and mammalian species composition

•Highly complex structural complexity with many biological legacies

•Complex and functional below-ground biological processes

•Complex and varied genetic diversity

•Rich ecosystem processes including pollination and predation

•Low susceptibility to invasive species

•Varied and complex disturbance frequency

•High landscape integrity with shifting mosaics and disturbance dynamics

•High resilience and resistance to climate change due to varied and complex genomes

Haire and McGarigal studied high-severity burn patches at Saddle Mountain (Kaibab Plateau, Arizona; burned in 1960) and La Mesa (Pajarito Plateau, New Mexico; burned in 1977), both of which share similar soils, topography, and vegetative communities as the Project landscape. The purpose of their research was to "*better understand plant succession after severe fire events in the southwestern United States, given the possibility that these landscapes occupy an important place in long-term variability of ecosystems.*"[282] Fifty-two species of native trees and shrubs, arranged along dynamic spatially and temporally influenced gradients, were documented at the two sites. Distance from edge-of-burn was strongly correlated to prevalence of resprouting species (generally shrubs, including oaks) over off-site seeders (generally coniferous trees), and was influenced by conditions in the pre-fire landscape. However, evidence of continued tree establishment and succession was evident decades post-fire as environmental conditions permitted tree establishment.

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[278] Holden *et al.* 2007

[279] Halofsky *et al.* 2011; Hunter *et al.* 2011

[280] Williams *et al.* 2010

[281] p. 314 in DellaSala *et al.* 2014

[282] p. 147 in Haire and McGarigal 2008

The early-successional habitats encountered by Haire and McGarigal led to their conclusion that:

> *"Areas burned in severe fire at Saddle Mountain and La Mesa included communities that might diversify function of landscapes through creation of early successional habitats for wildlife. In addition, woody species at the study sites have a wide range of traditional and current uses; basketry and other building material important food sources, a plethora of medicinal remedies, and ceremonial uses in contrast to studies that emphasize undesirable effects when forests transition to openings and alternative habitats, our research elucidates the need for further consideration of both young forest communities, and the persistent species and communities described as landscape scars, in conservation plans for forest systems of the southwestern United States."*[283]

Recent work by Owen and colleagues at the Rodeo-Chediski and Pumpkin Fires confirmed ponderosa pine establishment > 300m from nearest seed source in spatial arrangements that were indistinguishable from forest-edge locations regardless of presence of sprouting woody species, suggesting forest recovery was in fact occurring.[284] Unfortunately, complex early seral forests are poorly understood in southwestern dry forests as reference site studies and stand reconstructions characteristically cannot account for small diameter trees and other small vegetation. In order to maintain biodiversity and support landscape heterogeneity it is imperative that scientists initiate more research on these ephemeral habitats in dry southwestern forests in order to account for their contribution in ecosystem management.[285] Meaningfully increasing the use of prescribed and wildland fire for ecological restoration requires recognition of the benefits of mixed fire severities in shrub, woodland and forested ecosystems. Based on the information presented above, small patches of high-severity fire effects interspersed within a matrix of low and moderate-severity can meet restoration objectives, create important ephemeral habitats, and reduce the risk of uncharacteristic reburn potential.

A Strategic Treatments for Fire Use Alternative meets the project Purpose and Need

Repeated fire application in prescribed and managed wildfire settings is needed and reflects the best available science. The objective of ecological restoration in southwestern fire-adapted forests is to restore resilience to the inevitable future fires that will come, regardless of climate, environmental or human influences.[286] A number of fires have occurred across the Project landscape that can be leveraged for additional gains in fuels reduction and ecosystem restoration. It's a lost opportunity to not follow recent prescribed, resource benefit, and uncontrolled wildfires with additional fire, knowing that past fires act as fuel breaks and that effect diminishes

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[283] p. 159 in Haire and McGarigal 2008

[284] Owen *et al.* 2017

[285] Swanson *et al.* 2011

[286] Allen *et al.* 2002

Schoennagel *et al.* 2017. Adapt to more wildfire in western North American as climate changes. *PNAS* doi/10.1073/pnas.1617464114.

with time.[287] It is critical to remember that "*historical … forest structure was a product of not one but of a series of fires over time.*"[288] The compounding effect of recurring fire through centuries was selection for functional traits that incur ecophysiological adaptive benefits for drought and fire tolerance.[289] Overlapping fire mosaics promote development of differential tree recruitment, increase structural diversity and successional pathways, and break up fuel beds, facilitating more beneficial fires in the future.[290]

Holden and colleagues, in an analysis of thirteen fires in the Gila and Aldo Leopold Wilderness areas found evidence that initial wildfire severity slightly influenced severity of subsequent fires. In that study, which did not provide information for the size or distribution of burn patches, initial high-severity burns frequently reburned at high-severities, but most often in moist, high-elevation sites. The authors ultimately concluded that satellite imagery must be interpreted carefully and that field verification of their sites was needed.[291] Later work provided a contrasting conclusion, that previous wildfires do in fact moderate the severity of subsequent fires and lead to proportionally more area burned at low-severity.[292]

Returning frequent fire to the landscape will continue to alter forest structure and composition in ways that are not yet fully known, especially for wildlife that utilize snags and coarse woody debris.[293] Consistently, however, research from throughout the western United States alludes to the efficacy of returning fire in a mixed-severity approach, and following up with repeated low-severity burning for restoring historical structure, pattern, and process.[294] Modelling by Shive and colleagues showed that under milder climate scenarios, prescribed fire combined with climate-induced growth reductions resulted in ponderosa pine basal areas within the HRV[295], consistent with field observations of fire-based restoration at Grand Canyon and the Gila Wilderness, described below.

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[287] Parks *et al.* 2015

[288] p. 118 in Hunter *et al.* 2011

[289] Strahan *et al*. 2016. Shifts in community-level traits and functional diversity in a mixed conifer forest: a legacy of land-use change. *Journal of Applied Ecology*, doi: 10.1111/1365-2664.12737.

[290] Teske *et al.* 2012

[291] Holden *et al*. 2010. Burn severity of areas reburned by wildfires in the Gila National Forest, USA. *Fire Ecology* 6(3): 77-85.

[292] Parks *et al*. 2014. Previous fires moderate burn severity of subsequent wildland fires in two large western US wilderness areas. *Ecosystems* 17: 29-42.

[293] Holden *et al*. 2006. Ponderosa pine snag densities following multiple fires in the Gila Wilderness, New Mexico. *Forest Ecology and Management* 221: 140–146.

[294] Hunter *et al.* 2011

[295] Shive *et al*. 2014. Managing burned landscapes: evaluating future management strategies for resilient forests under a warming climate. *International Journal of Wildland Fire* 23: 915–928

Repeated summer wildfires since 1946 at in the Gila and Saguaro Wilderness areas have successfully reduced density of small-diameter trees while not affecting large tree density, effectively shifting towards a larger tree distribution while reducing risk of crown fire, increasing resilience, and creating desired structural heterogeneity.[296] Similar effects have been documented on the Hualapai Indian Reservation, where more than fifty years of frequent prescribed fires have increased resilience to crown fire and climate change near the lower elevational limit of ponderosa pine.[297]

Repeated mixed-severity prescribed and natural-ignition fires in ponderosa pine dominated forests at Grand Canyon National Park have been shown to limit large tree mortality, reduce density of conifer seedlings and shade tolerant understory saplings, and reduce surface fuels consistent with restoration objectives and managing for climate resilience.[298] Initial mortality pulses resulting from initial fire entry create numerous snags, but many are consumed upon fire reentry as snag recruitment and persistence reaches a possible equilibrium.[299]

Studying the effects of prescribed fires on burn severity in the Rodeo-Chediski Fire, Finney and colleagues found that areas which were repeatedly burned significantly reduced subsequent burn severity, but the beneficial effects diminished with time since fire. Their observations of fire progression, captured via satellite, provided evidence "*consistent with model predictions that suggest wildland fire size and severity can be mitigated by strategic placement of treatments.*"[300] Researchers observed the same effect studying fires in New Mexico and Idaho, where the "*severity of reburns increases with time since the previous fire, likely due to biomass accumulation associated with longer fire-free intervals.*"[301] Although their data showed that previous fires did have an effect up to 22 years later, further study concluded that initial fires ability to act as a fuel break was as little as 6 years in warm/dry climates such as southwestern ponderosa pine forests.[302]

[296] Holden *et al.* 2007

[297] Stan *et al*. 2014. Modern fire regime resembles historical fire regime in a ponderosa pine forest on Native American lands. *International Journal of Wildland Fire* 23: 686-697.

[298] Fulé *et al*. 2002. Natural variability in forests of the Grand Canyon, USA. *Journal of Biogeography* 29: 31-47.

Fulé and Laughlin 2007. Wildland fire effects on forest structure over an altitudinal gradient, Grand Canyon National Park, USA. *Journal of Applied Ecology* 44: 136-146.

Laughlin *et al*. 2011. Effects of a second-entry prescribed fire in a mixed conifer forest. *Western North American Naturalist* 71(4): 557-562; and Fulé *et al.* 2004

[299] Holden *et al.* 2006; Laughlin *et al.* 2011

[300] p. 1714 in Finney *et al*. 2005. Stand- and landscape-level effects of prescribed burning on two Arizona wildfires. *Canadian Journal of Forest Research* 35: 1714-1722.

[301] p. 38 in Parks *et al.* 2014

[302] Parks *et al.* 2015

Repeated resource objective fires on the Kaibab National Forest were recently reported to be more effective at restoring desired structure when they burned at moderate-severity under active fire-weather conditions.[303] Collins and Stephens found that in two Sierra Nevada wilderness areas where fire use policies were adopted, contemporary low-severity fires had allowed forests to become more resistant to insects, drought, and disease despite not having been thinned to historical densities. They concluded that "*what may be more important than restoring structure is restoring the process of fire*…[which] *could be important in allowing these forests to cope with projected changes in climate.*"[304]

Collins and colleagues studied mixed conifer forests in Yosemite National Park (4,800 - 7,000 ft.) where up to seven management and lightning started fires burned between 1983 and 2009, following an approximately 80-year fire-free period. They found that recent low severity fires reduced surface fuels and understory trees but did not kill enough intermediate sized trees to move towards desired structural characteristics. Their findings indicated "*no significant differences between current forest structure in areas that burned recently with moderate severity and forest structure in 1911*"[305] which was the year that historical inventory data was available for, and that only moderate fire-severity could substantially alter the ratio of fir to pine trees.

Taylor reported that two late twentieth century fires in an old growth ponderosa pine-Kellogg oak forest in California's Ishi Wilderness were effective at restoring pre-fire-exclusion structural characteristics, including composition, density, basal area and spatial pattern.[306] Similar effects were reported by Larson and colleagues, where reintroduction of natural-ignition fire in the Bob Marshall Wilderness of Montana has restored low-density mixed conifer forest dominated by large, old ponderosa pine by consuming surface fuels and thinning shade-tolerant species from the forest understory and mid-canopy.[307]

These studies support the concept that repeated fires will move ponderosa pine and dry mixed-conifer systems towards predominantly low-severity fire equilibrium, consistent with the body of work focused on frequent fire systems achieving a self-regulating state.[308] The consistent theme is that a mixed-severity initial fire entry creates conditions conducive to repeat burning at low

[303] Huffman *et al*. 2017b. Restoration benefits of re-entry with resource objective wildfire on a ponderosa pine landscape in northern Arizona, USA. *Forest Ecology and Management* 408: 16-24.

[304] pp. 526-527 in Collins and Stephens 2007. Managing natural wildfires in Sierra Nevada wilderness areas. *Frontiers in Ecology and the Environment* 5(10): 523–527.

[305] p. 10 in Collins *et al*. 2011. Impacts of fire exclusion and recent managed fire on forest structure in old growth Sierra Nevada mixed-conifer forests. *Ecosphere* 2(4): 1-14.

[306] Taylor 2010. Fire disturbance and forest structure in an old-growth Pinus ponderosa forest, southern Cascades, USA. *Journal of Vegetation Science* 21: 561-570.

[307] Larson *et al*. 2013. Latent resilience in ponderosa pine forest: effects of resumed frequent fire. *Ecological Applications* 23(6): 1243–1249.

[308] Miller and Aplet 2015. Progress in Wilderness Fire Science: Embracing Complexity. *Journal of Forestry* 113: 1-11; and Parks *et al.* 2014; Parks *et al.* 2015

and moderate severities within the historical fire regime.[309] By allowing for moderate sized patches of high mortality that do not generally exceed 100 to 200 hectares (where determined appropriate by optimization analysis), there is relatively little risk of high-severity re-burning, inadequate regeneration, excessive coarse woody debris loadings, or transition to non-forest types.

Because of a reliance on unproven logging treatments, the proposed action will likely produce significant harmful impacts to Mexican spotted owl habitat across a large area with an unusually high concentration of PACs. To avoid unnecessary disturbance and habitat loss, and to ensure the most effective reduction in stand replacing fire risk, a vigorous treatment prioritization is necessary. The 2012 MSO Recovery Plan (at page 262) states that:

> "*As a general guide, forest management programs in PACs should…conduct a landscape-level risk assessment to strategically locate and prioritize mechanical treatment units to mitigate the risk of large wildland fires while minimizing impact to PACs.*"

This idea is expanded on later in the Recovery Plan (page 288):

> *"Treatments should be placed strategically to minimize risk of high-severity fire effects to the nest core while mimicking natural mosaic pattern. Emphasize treatments in other forest and woodland types over those of PACs and recovery habitats to the extent practicable. Treatments in these areas might buffer owl habitat as well as provide fire risk reduction to WUI communities. Where appropriate, areas surrounding PACs could be treated with higher prescribed fire and mechanical treatment intensities to better achieve management objectives (e.g., reduction of hazardous fuels and potential for stand-replacing fires, enhancement of landscape, and forest structural diversity)".*

Strategically locating and prioritizing mechanical treatments, rather than seeking to treat large expanses, is also an important component of recovering the MSO at the EMU scale because of limitations of the percentage of PACs that are to be treated across the EMU during the 10 year course of the Recovery Plan.

A Strategic Treatments for Fire Use Alternative is significantly distinguishable from the proposed action

The Strategic Treatments for Fire Use Alternative is significantly distinguishable from the proposed action in that:

• It identifies mechanical treatments areas primarily on the basis of where treatments can have the most effect on fire behavior and thus permit fire-based restoration in a scientifically derived

[309] Laughlin and Fule 2006. Meeting forest ecosystem objectives with wildland fire use. *Fire Management Today* 66(4): 21-24.

way, rather than identifying treatment areas on the basis of what structure does not meet the desired structural conditions as established in GTR-310.

• It reduces logging impacts to Mexican spotted owl habitat by identifying strategically placed treatment priority areas and allowing natural mixed-severity fire-processes to interact with owl habitat in response to climate and topography, consistent with the co-evolution of spotted owls and fire-adapted forests.[310]

A Strategic Treatments for Fire Use Alternative should implement a Travel Analysis Report & Minimum Road System

The Forest Service faces many challenges with its oversized, under-maintained, and unaffordable road system. The impacts from roads to water, fish, wildlife, and ecosystems are well documented in scientific literature. And the impacts to communities are felt when continued deferred maintenance leads to more washouts and road closures from winter storms. The Santa Fe National Forest is no exception with thousands of miles of system roads, the required maintenance of which exceeds annual maintenance budgets.

To address its unsustainable and deteriorating road system, the Forest Service promulgated the Roads Rule (referred to as "subpart A") in 2001.[311] The Roads Rule created two important obligations for the agency. One obligation is to identify unneeded roads to prioritize for decommissioning or to be considered for other uses.[312] Another obligation is to identify the minimum road system needed for safe and efficient travel and for the protection, management, and use of National Forest system lands.[313] Pursuant to Washington Office guidance, the national forests completed travel analysis reports in September of 2015. The next step under subpart A is to consider the valid portions of the travel analysis report and begin to identify and implement the minimum road system in its analysis of site-specific projects of the appropriate geographic size under NEPA.[314] National and regional guidance directs this to happen through analysis of site-specific projects of the appropriate geographic size under NEPA.[315]

[310] Ganey, J.L., H.Yi Wan, S.A. Cushman, And C.D. Vojta. 2017. Conflicting Perspectives on Spotted Owls, Wildfire, and Forest Restoration. Fire Ecology 13(3) doi: 10.4996/fireecology.130318020. (For example, Ganey et al. 2017 state that "*Treatments should be located strategically based on models of fire behavior and spread to optimize gains in reduction of fire risk relative to area treated*.")

[311] 66 Fed. Reg. 3206 (Jan. 12, 2001); 36 C.F.R. part 212, subpart A.

[312] 36 C.F.R. § 212.5(b)(2).

[313] *Id.* § 212.5(b)(1).

[314] *See* 2012 Weldon Memo at 2 (directing forests to "analyze the proposed action and alternatives in terms of whether, per 36 CFR 212.5(b)(1), the resulting [road] system is needed").

[315] *Id.* at 2 (directing forests to "analyze the proposed action and alternatives in terms of whether, per 36 CFR 212.5(b)(1), the resulting [road] system is needed").

The minimum road system is the road system the Forest Service determines is needed to:[316]

- "*meet resource and other management objectives adopted in the relevant land and resource management plan*";
- "*meet applicable statutory and regulatory requirements*";
- "*reflect long-term funding expectations*"; and
- "*ensure that the identified system minimizes adverse environmental impacts associated with road construction, reconstruction, decommissioning, and maintenance*."

The Forest Service should identify the minimum road system for particular forest segments by analyzing whether a proposed project is consistent with the relevant portions of the travel analysis report and considering the minimum road system factors under 36 CFR 212.5(b)(1) for each road the agency decides to keep as part of the specific project.[317]

Given the large geographic scale of this project and the overarching purpose of this project, this is precisely the type of project where the Forest Service must consider its travel analysis report for the Forest Service and identify the minimum road system for the project area.[318] We urge the Forest Service to carefully evaluate the project and each of its alternatives through this lens. This type of large-scale project is the perfect opportunity to begin making on-the-ground progress towards an economically and environmentally sustainable road network.

Identifying a resilient future road network is one of the most important endeavors the Forest Service can undertake to restore aquatic systems and wildlife habitat, facilitate adaptation to climate change, ensure reliable recreational access, and operate within budgetary constraints. And it is a win-win-win approach: (1) it's a win for the Forest Service's budget, closing the gap between large maintenance needs and drastically declining funding through congressional appropriations; (2) it's a win for wildlife and natural resources because it reduces negative impacts from the forest road system; and (3) it's a win for the public because removing unneeded roads from the landscape allows the agency to focus its limited resources on the roads we all use, *improving* public access across the forest and helping ensure roads withstand strong storms.

Close or Decommission Unneeded Roads

The Forest Service should consider all unneeded roads for closure or decommissioning. Subpart A of the Roads Rule also directs the agency to "*identify the roads on lands under Forest Service*

[316] 36 C.F.R. §212.5(b)(1).

[317] *Id.* ("The resulting decision [in a site-specific project] identifies the [minimum road system] and unneeded roads for each subwatershed or larger scale").

[318] 36 C.F.R. § 212.5(b)(1) ("For each national forest . . . the responsible official must identify the minimum road system needed for safe and efficient travel and for administration, utilization, and protection of National Forest System lands.").

jurisdiction that are no longer needed," and therefore should be closed or decommissioned.[319] The rule refers to all roads, not just National Forest System roads. The rules define a road as "[a] *motor vehicle travelway over 50 inches wide, unless designated and managed as a trail*."[320] Based on current natural resource conditions, assessed risks from the existing road network, road densities across the landscape, the agency's limited resources, and long-term funding expectations, additional road decommissioning or closures is warranted.

Road decommissioning can temporarily increase sediment to streams but has dramatic reductions in the long run. The Forest Service's Rocky Mountain Research Station has spent over a decade monitoring the effectiveness of road treatments. A 2012 report evaluating pre and post treatment of roads showed an 80% reduction in sediment delivery to streams when roads were decommissioned.[321] In addition, the 20-year monitoring report of the Northwest Forest Plan confirmed that watersheds that showed the most improvement in condition were those that completed road decommissioning actions.

As forest road users and conservationists, we understand that a strategic reduction in road miles does not necessarily equate to a loss of access. Some roads are already functionally closed due to lack of use, natural vegetation growth, etc. Other roads receive limited use and are costly to maintain. Resources can be better spent on roads providing significant access than to spread resources thinly to all roads. This is why we support the careful analysis and decision to decommission or close specific roads, and urge the Forest Service to utilize this opportunity to identify and implement a minimum road system in the project area.

In addition to the science-based optimization design criteria described above, the Strategic Treatments for Fire Use Alternative implements elements which make it distinctive from the proposed action:

► The Strategic Treatments for Fire Use Alternative adopts the NM Forest Restoration Principles as guiding principles.

► The Strategic Treatments for Fire Use Alternative analyzes the effects of livestock grazing on the success of the proposed vegetation treatments in achieving and maintaining desired future conditions as they relate to fire use, migratory bird, native fish and other sensitive species populations and habitats.

► The Strategic Treatments for Fire Use Alternative identifies areas with degraded soils or plant communities, areas with sensitive or high-erosion soils, and areas in need of recovery, and reduce or eliminate grazing in those pastures altogether to contribute to the success of resiliency treatments.

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[319] 36 C.F.R. § 212.5(b)(2). *See also Center for Sierra Nevada*, 832 F. Supp. 2d at 1155 ("The court agrees that during the Subpart A analysis the Forest Service will need to evaluate all roads, including any roads previously designated as open under subpart B, for decommissioning.").

[320] 36 C.F.R. § 212.1.

[321] Nelson N., Black T., Luce C. and R. Cissel, U.S. Forest Service Rocky Mountain Research Station, LRT Monitoring Project Update 2012.

► The Strategic Treatments for Fire Use Alternative permanently fences livestock out of all riparian areas.

► The Strategic Treatments for Fire Use Alternative allows only hand thinning in roadless and unroaded areas.

► The Strategic Treatments for Fire Use Alternative applies a Travel Analysis Report & Minimum Road System approach to analysis.

► The Strategic Treatments for Fire Use Alternative retains all existing old (>150 years) and large (>18" dbh) trees, and identifies and retains all old growth patches and stands.

► The Strategic Treatments for Fire Use Alternative adopts all recommendations of the 2012 Mexican spotted owl Recovery Plan as project design features.

► The Strategic Treatments for Fire Use Alternative does not treat dwarf mistletoe with any special category of treatment, not does it seek to reduce dwarf mistletoe from current levels beyond what typical thinning and burning treatments would accomplish.

► The Strategic Treatments for Fire Use Alternative develops a robust multi-party monitoring framework built upon established triggers and responses.

► The Strategic Treatments for Fire Use Alternative utilizes locally-specific references conditions that usurp those described in GTR-310.

We respectfully invite the Forest Service to analyze our proposed alternative as a comparison to the agencies preferred course of action. We are confident that our alternative can accomplish the projects purposes of:

1. Moving frequent-fire forests in the Project Area towards their characteristic species composition, structure and spatial patterns in order to improve ecological function;

2. Creating conditions that facilitate the safe reintroduction of fire, allowing fire to play its natural role in frequent fire forest types;

3. Reducing the risk for large high-intensity wildfires, create safe, defensible zones for firefighters and minimize the risk of fire to nearby valued resources;

4. Improving and maintaining diverse wildlife habitats to provide a large array of habitat types, habitat components, seral stages and corridors for a variety of species that utilize the area; and

5. Improving watershed conditions by restoring the vegetative structure and composition of riparian ecosystems and by maintaining and improving water quality.

Any refusal to analyze this alternative must be accompanied by a detailed justification for why the alternative would not meet the project purpose, how our alternative is not distinguished from the agencies preferred alternative, and how the agencies preferred alternative includes the proposed elements of our alternative.

CONCLUSION

The proof of this Projects success in achieving restoration and resiliency will be in how individual actions are implemented, and if the emphasis in spending and staff time is focused on logging only, or if the full range of treatments are implemented along similar timeframes. We are interested in seeing how various restoration treatments are deployed, and look forward to making site visits to a range of sites to learn together from the results. Please consider organizing additional field trips as these are opportunities to refine management approaches based on shared understanding of treatment efficacy.

We appreciate your consideration of the information and concerns addressed in this letter, as well as the information included in the attachments which have been mailed on a thumb drive to the project email address. Should you have any questions, please do not hesitate to contact Mr. Trudeau at the number provided below.

Respectfully,

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September 13, 2011

Old Growth Protection
&
Large Tree Retention
Strategy

Contents

I. Old Growth Protection & Large Tree Retention Strategy (OGP&LTRS) Overview

The goals of the Four Forests Restoration Initiative (4FRI) are to restore healthy, diverse stands, supporting abundant populations of native plants and animals; to protect communities in forested landscapes from destructive wildland fire; and to support sustainable forest industries that strengthen local economies while conserving natural resources and aesthetic values. In short, we seek to re-establish largely self-regulating forested landscapes including their associated fire regimes through a process of ecological restoration that benefits communities, economies, ecosystems and biodiversity.

Ecological restoration will require thinning post-settlement ponderosa pine trees[1] in unnaturally dense stands. While there is broad agreement for reducing small diameter tree densities, where and how this should be done has often been the subject of social and scientific debate. The purpose of this document is to affirm recommendations of the 4FRI Stakeholder Group relating to the retention of large post-settlement and old growth trees—recommendations that are critical to moving beyond those debates—and to provide specific, science-based recommendations for incorporation into 4FRI restoration plans and projects.

Retention of Old Growth and Large Post-settlement Trees

"The Path Forward"—a foundational document of the 4FRI—calls for blanket old growth protection, regardless of tree size. It states that, "No old-growth trees (pre-dating Euro-American settlement) shall be cut." The document also includes broad recommendations for retaining large post-settlement trees with some carefully specified exceptions.

In southwestern ponderosa pine forests, old-growth trees are important to ecosystem structure and function. They increase genetic diversity on the landscape; old trees have greater genetic diversity than even-aged groups of young trees (Kolanoski 2002) and, thus, may have a better chance of adapting to changing climatic and environmental conditions, an ability they can pass on to their progeny. In addition, when not surrounded by large amounts of fuel, the thick bark of old-growth trees makes them largely resistant to low-intensity surface fire (Agee 1998). Old-growth trees also increase forest structural diversity, which, in turn, provides more wildlife habitat. For example, large trees provide additional structure for bats, which roost under slabs of bark; nest trees for northern goshawks and Mexican spotted owls; continuous canopy for tassel-eared squirrels; and foraging habitat for bark-gleaning birds (Bull and Hohmann 1994, Humes et al. 1999, Dodd et al. 2003). In addition, old trees often become long-lasting snags when they die, which benefits many species of cavity-nesting birds and mammals (Chambers and Mast

[1] Large and old growth tree recommendations offered in this document refer specifically to ponderosa pine trees.

2005). Old, large trees also serve as long-term carbon stores (Harmon et al. 1990) and preserve a record of the past that can inform future research about insect outbreak, fire history, and climate change (Fulé et al. 1997, Soulé and Knapp 2006). Finally, old-growth trees enhance the aesthetics of forests (Brown and Daniel 1984) and, thus, increase public support for restoration projects. Old-growth trees are present on the landscape at similar or lower densities compared to presettlement times (Mast et al. 1999, Moore et al. 2004), depending on how many trees have been removed postsettlement by forest management practices (e.g., clearcut, thinning, seed tree, etc.). The three main threats to old-growth trees are high-severity wildfire, competition from mid- or under-story trees, and drought and subsequent bark beetle attacks (Kolb et al. 2007). Restoration treatments (thinning and prescribed burning) around old-growth trees can cause some mortality. However, this threat can be reduced through careful management (Hood 2010). In addition, restoration treatment should result in a reduced threat of wildfire, a release from competition, and increased tree growth (Fajardo et al. 2007, Fulé et al. 2007).

The Path Forward also calls for retaining large post-settlement trees (defined by the socio-political process as those greater than 16 inches diameter-at-breast height [dbh]) throughout the 4FRI landscape, except: (1) as necessary to meet community protection and public safety goals within the Community Protection Management Areas identified in the Analysis of Small Diameter Wood Supply in Northern Arizona and where stakeholder agreement identifies priority areas within approved CWPPs; and (2) when best available science and stakeholder agreement (as defined in the 4FRI Charter) identify sites where ecological restoration and biodiversity objectives cannot otherwise be met – specifically wet meadows, seeps, springs, riparian areas, encroached grasslands, aspen groves or oak stands, within-stand openings, and heavily stocked stands with high basal area generated by a preponderance of large, young trees.

We recognize that there are multiple causes of ecological degradation that may not be affected by mechanical thinning and different types of burning. The exceptions articulated in the following section are intended to be part of a more comprehensive and concurrent approach to treating causes (rather than just symptoms) of ecological decline. To that end, we are asking the Forests to work collaboratively on a comprehensive restoration assessment that identifies possible management actions to stem/reverse ecological decline. We believe this restoration assessment should focus on a wider range of forest resources than just timber and fire; such as hydrology, range, recreation, and wildlife. We ask the four National Forests to initiate this assessment with the 4FRI Stakeholders, upon release of the Draft EIS for the first project area.

The intention of the exception process is to increase landscape heterogeneity and conserve biodiversity. Thus we do not support implementing any exceptions where removing the trees would conflict with existing recovery/conservation plan objectives for managing sensitive, threatened or endangered species or their habitat. We also recognize there may be additional areas and/or circumstances where large trees need to be removed to achieve restoration. These circumstances should be identified through a site-specific, agreement-based, collaborative process as described in the 4FRI Charter.

II. OGP&LTRS Rationale: The Historical Debate Regarding Diameter Caps in the Southwest and the 4FRI's Large Tree Retention Policy

Introduction

Diameter caps for tree cutting have been used in forest management efforts across the West. They have been and continue to be the subject of much debate. In this section of the Large Tree Retention Strategy document, two different perspectives on diameter caps are presented. Recognizing that the 4FRI Large Tree Retention and Old Growth Protection Strategy is not meant to serve as a strict diameter cap, these perspectives are offered here to illuminate elements of the historical debate that have led to the 4FRI's formulation of the existing Large Tree Retention and Old Growth Protection Strategy.

Arguments in Favor of Diameter Caps

There is a generally recognized need to retain larger trees and protect old growth in southwestern ponderosa pine forest restoration. Some proponents of large tree retention have suggested that a 16" diameter cap is both ecologically and socio-politically warranted given the scarcity of mature and old growth forest cover in the region; the need to quickly re-establish lost mature and old forest structure; the necessity of retaining trees larger than 16" dbh to recruit new trees into regionally-underrepresented VSS 5, 6 and "old growth" structural stages; and the regional rarity of trees larger than 16" (approximately 96% of ponderosa pine trees in northern Arizona and New Mexico are smaller than 16-inch dbh).

Such proponents have proposed diameter caps as a means to (1) prevent large-tree logging for production-oriented, uneven-aged silvicultural goals, (2) discourage large-tree logging to pay for small-tree thinning or other activities, (3) favor small-diameter-specific industries over large-tree-dependent ones, (4) avoid population-level effects to imperiled species and wildlife that are associated with larger live and dead trees and denser canopy, (5) mitigate unforeseen large tree mortality during and following restoration treatments, (6) mitigate unknown rates of future large tree mortality resulting from re-establishing natural fire regimes and future climates, (7) mitigate under-estimates of historical tree densities owing to evidence undercounting and loss to fire, logging and decay, (8) accommodate differing reference scales, choices of reference attributes, restoration objectives and desired degrees of precision or rates of change, (9) mitigate uncertainty about future national forest policy, timber and wildlife habitat management, and (10) facilitate a restoration approach that reduces immediate crown fire threat while incrementally moving the forest toward its natural range of variability through a combination of thinning and natural fire.

Diameter limits and exception-thresholds for tree cutting are a common strategy for achieving ecological objectives in western forest landscapes. In their recommendations to Congress and the President, the Eastside Forests Scientific Society Panel proposed a 20" diameter limit for trees younger than 150 years old to protect late-successional and old-growth dry forests of eastern Oregon and Washington. They cited the ecological importance and scarcity of large and old trees and the need to retain them to replenish regionally-depleted supplies of large and old trees, snags, logs and associated wildlife habitat. Those recommendations formed the basis for interim management direction amending nine national forest plans and establishing a 21" diameter limit in dry forests which in turn carried forward into an exception-threshold of 21" diameter in legislation proposed to restore dry forests of eastern Oregon. The Sierra Nevada Framework set forth a 20" diameter limit for tree cutting to conserve late-seral forests across national forest land in the Sierra Nevada. Larger diameter limit and exception-thresholds in these examples reflect more productive forests and larger mean diameters than in southwestern forests. Diameter limits in Region 3 forest plans restrict large tree cutting in habitat for Mexican spotted owl and northern goshawk for their viability and in "old growth"; diameter-based "vegetative structural stages" guide management of those species' habitats.

Arguments Against Diameter Caps

Arbitrary diameter thresholds (or "caps") may assure that trees of a certain size are retained, but they do not guarantee that short- or long-term ecological restoration goals will be achieved. In fact, diameter caps can actually prevent attainment of ecological restoration objectives because they can have unintended consequences such as interfering with the restoration of herbaceous openings and, where unnaturally dense stands of larger, post-settlement trees predominate, caps can limit fuel reduction and, therefore, undermine the agency's ability to re-establish surface fire (Abella et al. 2006, Sanchez-Meador 2009). A diameter threshold also creates a "one-size-fits-all" guideline which can lead to treatments that are inconsistent with site-based conditions.

In general caps are arbitrarily chosen to achieve socio-political objectives that do not necessarily support comprehensive ecological restoration. Contemporary diameter caps, even as an informal agreement, have become <u>the</u> condition that allows fuel reduction and restoration to move forward without lengthy delays due to appeals and litigation. Examples of their arbitrary application include:

- In order to test restoration treatments in the Grand Canyon, a 5-inch cap was required by environmental advocates (Fulé 2006).
- For restoration to proceed in the White Mountains, a 16-inch cap was required (Abrams and Burns 2007).
- A 12-inch cap was employed to define forest biomass appropriate for generating renewable energy (Arizona Corporation Commission, 2006).
- On the Coconino National Forest, a 16-inch cap was imposed to allow restoration projects proposed by the Grand Canyon Forest Partnership to proceed (Friederici 2003).

Further evidence that caps undermine ecological restoration goals is reflected in a recent decision on the Marshall Fuel Reduction and Forest Restoration Project (USFS 2010). The Forest Service rejected an alternative that proposed a 16-inch diameter cap because, "A 16-inch cap would prevent the restoration of natural openings and more natural spatial distribution of clumps of trees important for wildlife habitat and forest health." When administrative and legal challenges to forest thinning and restoration projects prevail it is generally because of issues related to agency compliance with law and policy (Brown 2009)—not because there is a scientific basis for a diameter threshold.

Finally, a static diameter cap fails to account for the fact that trees grow, that restoration will occur over decades while those trees are growing, and that over time, retention of excess trees may undermine efforts to restore ecosystem resilience in the face of drier conditions associated with climate change (Glicksman 2009, Westerling et al. 2006).

Conclusions

Recognizing a need to move beyond the historical debate and move forward with landscape-scale restoration that is ecologically, socially, and economically viable, the 4FRI Collaborative has agreed that the 4FRI effort should implement large tree retention and old growth protection strategies that are not based on strict diameter limits, but are based upon a 16" diameter threshold that limits the cutting of trees larger than 16" to circumstances and criteria set forth in pre-defined exception categories that follow. In addition, we are committed to monitoring the outcomes of treatments that follow this guidance to determine if they achieve our ecological restoration goals. If they do not we are committed to adapting this policy to achieve better ecological outcomes.

It is our hope and expectation that this approach will balance the approaches and opinions expressed above, and will serve as a policy mechanism for supporting comprehensive ecosystem restoration while addressing stakeholders' needs for protecting old growth and large ponderosa pine trees.

III. Exception Process for Large Post-Settlement Tree Retention

The following section outlines a problem statement, specific identifying circumstances, ecological objectives and selection criteria for instances in which large post-settlement trees may be cut to meet restoration objectives. At specific locations, large trees may need to be removed, felled, or girdled for purposes of ecological restoration and biodiversity conservation. The purpose of this section is to provide sufficient specificity to translate those exception categories—where stakeholder agreement exists to do so—into management actions and tree-marking guidelines. For eight of the nine exception categories programmatic recommendations describe the circumstances and criteria in which large post-settlement trees may need to be removed. For the "Heavily Stocked Stands with High Basal Area Generated by a Preponderance of Large Young Trees" (or "Large Young Tree") exception category, getting to a higher level of social and scientific agreement entails more complexity and challenges, so we propose the initiation of additional collaborative discussion and planning that we hope will bolster restoration efforts by increasing confidence and knowledge-sharing, maximizing agreement and minimizing disagreement.

IV. Exceptions

Seeps & Springs

Suggested Tree Marking Exception Code: "S"

Identifiable Circumstance

Seeps are locations where surface-emergent groundwater causes ephemeral or perennial moist soil or bedrock, where standing or running water is infrequent or absent and that exhibit vegetation and other biological diversity adapted to mesic soils.

Springs are small areas where surface-emergent groundwater causes ephemeral or perennial standing or running water, wet or moist soils and that exhibit vegetation and other biological diversity adapted to mesic soils or aquatic environments (Feth and Hem 1963).

Problem Statement

Seeps exhibit unique, often isolated biophysical conditions that can sustain unique, mesic-adapted biological diversity and can facilitate endemism and speciation. In the absence of frequent fires and in the presence of livestock grazing, large post-settlement trees may have established and grown in such proximity to seeps to compromise available soil moisture or light upon that afford those unique biophysical conditions.

Springs exhibit unique, often isolated biophysical conditions that can sustain unique, mesic-adapted or aquatic biological diversity and can facilitate endemism and speciation. Springs also provide water and other habitat to terrestrial wildlife. In the absence of frequent fires and in the presence of livestock grazing, large post-settlement trees may have established and grown in such proximity to springs to compromise available soil moisture (Simonin et al. 2007) or light upon that afford those unique biophysical conditions.

Removal of these trees may constitute a relatively small part of an overall seep and spring restoration effort when compared to addressing root causes of overall degradation. Thinning alone without addressing other sources of degradation is unlikely to restore seeps and springs (Thompson et al. 2002).

Ecological Objectives

(1) Conserve and restore the biophysical conditions in seeps and springs upon which terrestrial, mesic-adapted and aquatic native biological diversity depend.

Criteria

Large (>16"dbh) post-settlement ponderosa pine trees may be removed to conserve the unique biophysical attributes of seeps & springs according to these criteria:

(1) Where large trees' roots are encroaching on mesic soils associated with a seep or spring, or such trees' drip lines are overlapping or nearly overlapping a seep or spring such that its shading compromises the integrity of a spring's unique biophysical attributes, and;

(2) Where removing the trees does not conflict with existing recovery/conservation plan objectives for managing sensitive, threatened or endangered species or their habitat.

Note:
Where there is evidence of pre-settlement trees having grown in similar root and crown proximity to said seep or spring in the past, leave an equivalent number of large replacement trees.

Riparian

Suggested Tree Marking Exception Code: "R"

Identifiable Circumstance

Riparian areas occur along ephemeral or perennial streams or are located down-gradient of seeps or springs. These areas exhibit riparian vegetation, mesic soils, and/or aquatic environments.

Problem statement

Riparian areas exhibit unique biophysical conditions that can sustain unique, mesic-adapted or aquatic biological diversity. Riparian areas and the streams, springs and seeps connected to them often harbor imperiled species and can be sources of endemism. Riparian areas also provide water and other habitat to terrestrial wildlife. In the absence of frequent fires and in the presence of livestock grazing, water development projects and other factors, large post-settlement trees may have established and grown within riparian areas such that they compromise available soil moisture or light that support those unique biophysical conditions. However, it is likely to be a very rare circumstance that trees of any size will need to be removed from forested riparian zones.

Cutting of any trees within riparian areas should minimize impacts by following Best Management Practices (BMPs).

Whenever possible, large trees identified for cutting should be left onsite as snags or downed logs.

Removal of these trees may constitute a relatively small part of an overall riparian area restoration effort when compared to addressing fundamental causes of overall degradation. Thinning alone without addressing other sources of degradation is unlikely to restore riparian areas.

Ecological Objectives

Conserve and restore the biophysical conditions in riparian habitat upon which terrestrial and aquatic native biological diversity depend.

Criteria

Large (>16"dbh) post-settlement ponderosa pine trees may be removed to conserve the unique biophysical attributes of riparian areas according to these criteria:

(1) Where large trees are growing (rooted) within a riparian area and compromising available soil moisture or light that support that area's unique biophysical conditions, and

(2) Where removing the trees does not conflict with existing recovery/conservation plan objectives for managing sensitive, threatened or endangered species or their habitat.

Notes:
Where there is evidence of pre-settlement trees having grown in similar root and crown proximity to said riparian in the past, leave an equivalent number of large replacement trees.

There may be additional areas and/or circumstances identified for riparian restoration through a site specific agreement-based, collaborative process as described in the 4FRI Charter.

Wet Meadows

Suggested Tree Marking Exception Code: "WM"

Identifiable Circumstance

High-elevation streamside or spring-fed meadows occur in numerous locations throughout the Southwest. However, less than 1% of the landscape in the region is characterized as wetland (Dahl 1990), and wet meadows are just one of several wetland types that occur. Patton and Judd (1970) reported that approximately 17,700 ha of wet meadows occur on national forests in Arizona and New Mexico.

These areas may be referred to as riparian meadows, montane (or high-elevation) riparian meadows, sedge meadows, or simply as wet meadows. Wet meadows are usually located in valleys or swales, but may occasionally be found in isolated depressions, such as along the fringes of ponds and lakes with no outlets. Where wet meadows have not been excessively altered, sedges (*Carex* spp.), rushes (*Juncus* spp.), and spikerush (*Eleocharis* spp.) are common species (Patton and Judd 1970, Hendrickson and Minckley 1984, Muldavin et al. 2000). Willow (Salix) and alder (Alnus) species often occur in or adjacent to these meadows (Long 2000, 2002, Maschinski 2001, Medina and Steed 2002). High-elevation wet meadows frequently occur along a gradient that includes aquatic vegetation at the lower end and mesic meadows, dry meadows, and ponderosa pine or mixed conifer forest at the upper end. These vegetation gradients are closely associated with differences in flooding, depth to water table, and soil characteristics (Judd 1972, Castelli et al. 2000, Dwire et al. 2006). While relatively rare, wet meadows are believed to be of disproportionate value because of their use by wildlife and the range of other ecosystem services they provide. Wet meadows perform many of the same ecosystem functions associated with other wetland types, such as water quality improvement, reduction of flood peaks, and carbon sequestration.

Problem statement

Wet meadows are one of the most heavily altered ecosystems. They have been used extensively for grazing livestock, have become the site of many small dams and stock tanks, have had roads built through them, and have experienced other types of hydrologic alterations, most notably the lowering of their water tables due to stream downcutting, surface water diversions, or groundwater withdrawal (Neary and Medina 1996, Gage and Cooper 2008). In the presence of livestock grazing and hydrologic changes, large post-settlement trees may have established and grown within wet meadows such that they compromise available soil moisture or light creating unique biophysical conditions.

Removal of these trees may constitute a relatively small part of an overall wet meadow restoration effort when compared to addressing root causes of overall degradation. Thinning alone without addressing other sources of degradation is unlikely to restore wet meadows.

Ecological Objectives

Conserve and restore the biophysical conditions of wet meadows upon which terrestrial native biological diversity depend.

Criteria

Large (>16”dbh) post-settlement ponderosa pine trees may be removed to conserve the unique biophysical attributes of wet meadows according to these criteria:

(1) Where large trees are growing (rooted) in a wet meadow, and

(2) Where removing the trees does not conflict with existing recovery/conservation plan objectives for managing sensitive, threatened or endangered species or their habitat.

Note:
Where there is evidence of pre-settlement trees having grown in similar root and crown proximity to said wet meadows in the past, leave an equivalent number of large replacement trees.

Encroached Grasslands

Suggested Tree Marking Exception Code: "EG"

Identifiable Circumstance

Encroached grasslands are herbaceous ecosystems that have infrequent-to-no evidence of pine trees growing prior to settlement. The two prevalent grassland categories in the 4FRI landscape are montane (includes subalpine) grasslands and Colorado Plateau (a subset of Great Basin) grasslands, with montane grasslands being most common (Finch 2004). A key indicator of grasslands is the presence of mollisol soils, which are typically deeper with higher rates of accumulation and decomposition of soil organic matter relative to soils in the surrounding landscape. Grasslands in this region evolved during the Miocene and Pliocene periods, and the dark, rich soils observed in grasslands today have taken more than 3 million years to produce. In addition to their association with mollic soils, grasslands in this region are maintained by a combination of climate, fire, wind desiccation, and to a lesser extent by animal herbivory (Finch 2004).

Typical montane grasslands in this region are characterized by Arizona fescue (Festuca arizonica) meadows on elevated plains of basaltic and sandstone residual soils. Montane grasslands are the most naturally fragmented grasslands in the region, ranging from thousands of acres in size (e.g., in the White Mountains, Baker 1983) down to only a few acres. They generally occur in small (<100 ac.) to medium-sized (100 to 1000 ac.) patches. Historic maintenance of the herbaceous condition in these grasslands is subject to some debate though appears to be primarily driven by periodic fire. The cool-season growth of Arizona fescue also plays a large role in maintenance of parks and openings by directly competing with ponderosa pine seedlings.

Identification of grasslands in this region should use a combination of the Terrestrial Ecosystem Survey, Southwest Regional GAP Analysis, Brown and Lowe Vegetation Classification (Brown and Lowe 1982; TNC GIS Layer 2006) among other existing vegetation and soils data.

This exception category will require an iterative process of collaborative mapping, field verification, and refinement. There are some debate and questions about where and how much the grassland-forest mosaic shifts over time and space. There are also debate and questions about whether some recently-burned areas are early seral forests or stable grasslands, whether or how they may be surrogates for historical grasslands, and if or how that should factor into the overall retention of forest cover. Recognizing the importance of montane grassland restoration, we encourage all parties to seek resolution to these issues on a case-by-case basis through field visits, literature review, and/or discussion.

Problem statement

Prior to European settlement, pine trees rarely established in grasslands because they were either outcompeted by production of cool-season grasses or killed by frequent fire (Finch 2004). In the late 1800s, unsustainable livestock grazing practices significantly reduced herbaceous cover, releasing competition pressure on pine seedlings. Coupled with the onset of fire suppression in the early 1900s, pine trees rapidly encroached and recruited into native grasslands (e.g., Allen 1984, Moore and Huffman 2004, Coop and Givnish 2007).Pine encroachment into grasslands has contributed to a significant loss of biodiversity (Stacey 1995) and wildlife habitat particularly for grassland-dependent species such as pronghorn. Plant diversity is particularly important in grassland ecosystems: grassland plots with greater specie diversity have been found to be more resistant to drought and to recover more quickly than less diverse plots (Tilman and Downing 1994); this resilience will become even more important in a warming climate. Pine tree removal, restoration of fire, and complementary reductions in livestock grazing pressure are all necessary to restore structure and function of native grasslands.

Ecological Objectives

(1) Enhance, maintain, and restore naturally functioning grasslands.

(2) Ensure native grassland composition, increase native species diversity, improve resilience to drought.

(3) Restore natural fire regime.

Criteria

Large (>16” dbh) post-settlement ponderosa pine trees may be cut and/or removed to restore the unique biophysical attributes of grasslands according to these criteria:

(1) Where existing grasslands are being encroached, and large trees are interfering with overall restoration objectives, and

(2) Where removing the trees does not conflict with existing recovery/conservation plan objectives for managing sensitive, threatened or endangered species or their habitat.

There may be additional areas and/or circumstances identified for grassland restoration through a site specific agreement-based, collaborative process as described in the 4FRI Charter.

Aspen Forest & Woodland

Suggested Tree Marking Exception Code: "AF"

Identifiable Circumstance

Quaking aspen (*Populus tremuloides*) occurs in small patches throughout the 4FRI area. Bartos (2001) refers to three broad categories of aspen: (1) stable and regenerating (stable), (2) converting to conifers (seral), and (3) decadent and deteriorating. Almost all of the aspen within ponderosa pine of the 4FRI area occurs as seral aspen, and regenerates after disturbance. Favorable soil and moisture conditions maintain stable aspen over time.

Problem Statement

Aspen occurs within ponderosa pine forests, and is ecologically important due to the high concentration of biodiversity that depends on aspen for habitat (Tew 1970, DeByle 1985, Finch and Reynolds 1987, Griffis-Kyle and Beier 2003). In addition, stable aspen stands serve as an indicator of ecological integrity (Di Orio and others 2005). However, aspen is currently declining at an alarming rate (Fairweather and others 2008).

The loss of fire as a natural disturbance regime in southwestern ponderosa pine forests since European settlement has caused much of the aspen-dominated lands to succeed to conifers (Bartos 2001). Other factors contributing to gradual aspen decline over the past 140 years include reduced regeneration from browsing by livestock and introduced and native wild ungulates in the absence of natural predators like wolves (Pearson 1914, Larson 1959, Martin 1965, Jones 1975, Shepperd and Fairweather 1994, Martin 2007). More recently, aerial and ground surveys indicate more rapid decline of aspen, with 90% mortality occurring in low elevation aspen sites and over 60% mortality observed in mid-elevations. Major factors thought to be causing this rapid decline of aspen include frost events, severe drought, and a host of insects and pathogens (Fairweather and others 2008) that have served as the "final straws" for already compromised stands.

Removal of encroaching pine trees constitutes part of an overall aspen restoration effort. Thinning alone without addressing other sources of degradation, such as excessive herbivory is unlikely to successfully restore aspen forests.

Some stakeholders expressed that considerable uncertainty exists around fire regimes for aspen in ponderosa pine, and that research questions remain unanswered around the prevalence of mixed-severity fire and its ecological role as a driving force for aspen stands at the top of its elevational range, and on steep slopes within this vegetation type.

Ecological Objectives

(1) Conserve and restore aspen forests and woodlands within 4FRI area by restoring appropriate fire regimes and decreasing competition from ponderosa pine.

(2) Protect regeneration, saplings, and juvenile trees from browsing.

Criteria

Large (>16"dbh) post-settlement trees may be cut in conifer-encroached seral aspen stands according to the following criteria:

(1) Where current post-settlement ponderosa pine tree numbers are above and beyond residual targets (identified using pre-settlement conifer tree evidences), and

(2) Where fire cannot be used safely and effectively to regenerate or maintain aspen, or

(3) Where site visitation and/or data collection and analysis indicates the need for encroachment mitigation, and

(4) Where removing large trees does not conflict with existing recovery/conservation plan objectives for managing sensitive, threatened or endangered species or their habitat

Note:
There may be additional areas and/or circumstances identified for aspen restoration through a site specific agreement-based, collaborative process as described in the 4FRI Charter.

Ponderosa Pine/Gambel Oak Forest (Pine-Oak)

Suggested Tree Marking Code: “P-O”

Identifiable Circumstance

A number of habitat types exist in the southwestern United States that could be described as pine-oak. Ponderosa pine forests are interspersed with Gambel oak trees in locations throughout the 4FRI area in a habitat association referred to as PIPO/QUGA (USFS 1997, USDI FWS 1995). Specifically, any stand within the Pinus ponderosa series where ≥10% of stand basal area consists of Gambel oak (*Quercus gambelii*) ≥13 cm (5 in) diameter at root collar (drc) is considered to be pine-oak within the 4FRI area (USDI FWS 1995). In southwestern ponderosa pine forests, Gambel oak has several growth forms distinguished by stem sizes and the density and spacing of stems within clumps. These include shrubby thickets of small stems, clumps of intermediate-sized stems, and large, mature trees that are influenced by age, disturbance history, and site conditions (Brown 1958, Kruse 1992, Rosenstock 1998, Abella and Springer 2008, Abella 2008a). Different growth forms provide important habitat for a large number of varying wildlife species (Neff and others 1979, Kruse 1992).

Gambel oak provides high quality wildlife habitat in its various growth forms, and is a desirable component of ponderosa pine forests (Neff and others 1979, Kruse 1992, Bernardos et al. 2004). Gambel oak enhances soils (Klemmedson 1987), wildlife habitat (Kruse 1992, Rosenstock 1998, USDI FWS1995, Bernardos et al. 2004), and understory community composition (Abella and Springer 2008). Large oak trees are particularly valuable since they typically provide more natural cavities and pockets of decay that allow excavation and use by cavity nesters than conifers. In addition to its important ecological role, Gambel oak has high value to humans as it is a popular fuelwood that possesses superior heat-producing qualities compared to other tree species (Wagstaff 1984).

Problem Statement

Although management on public lands with regard to oak has changed to better protect the species, illegal fuelwood cutting of Gambel oak and elk and livestock grazing negatively impact oak growth and regeneration (Harper et al. 1985, Clary and Tiedemann 1992, Rick Miller, 1993, unpublished report) and continues to result in the removal of rare, large diameter oak trees (Bernardos et al. 2004).

A literature review by Abella and Fule (2008) found that Gambel oak densities appear to have increased in many areas with fire exclusion, especially in the small and medium-diameter stems (<8” dbh). Chambers (2002) found that Gambel oak on the Kaibab and Coconino National Forests was distributed in an uneven-aged distribution, dominated by smaller size classes (<5 cm dbh) and few large diameter oak trees. Because of Gambel oak's slow growth rate, there may be little opportunity for these small Gambel oak trees to attain large diameters (>85 cm) (Chambers 2002).

Pine competition with oak has been identified as an issue in slowing oak growth, particularly for older oaks (Onkonburi 1999). Onkonburi (1999) also found that for northern Arizona forests, pine thinning increased oak incremental growth more than oak thinning and prescribed fire. Fule (2005) found that oak diameter growth tended to be greater in areas where pine was thinned relative to burn only treatments and controls. Thinning of competing pine trees may promote large oaks with vigorous crowns and enhanced acorn production (Abella 2008b), and may increase oak seedling establishment (Ffolliott and Gottfried 1991).

Ecological Objectives:

(1) Maintain and restore all growth forms of Gambel oak, focusing on enhancing and maintaining larger, older oak trees.

(2) Restore frequent, low intensity surface fire to ponderosa pine-Gambel oak forests.

(3) Restore and maintain brushy thicket, pole and dispersed clump growth forms of Gambel oak by allowing natural self-thinning, thinning dense clumps, and/or burning.

(4) Protect Gambel oak growth forms from fuel wood cutting, damage during restoration treatments including thinning and post thinning slash burning.

Criteria

In pine-oak, which occurs when $\geq$10% of the stand basal area consists of Gambel oak >13 cm (5 in) diameter at root collar, large (>16 dbh) post-settlement ponderosa pine trees may be removed to conserve oaks according to these criteria:

In MSO restricted habitat:

(1) Within MSO habitat and designated critical habitat, the Recovery Plan for the Mexican spotted owl should be followed to improve key habitat components and primary biological factors, which includes Gambel oak, or

Outside MSO restricted habitat: where large post-settlement trees' drip lines or roots overlap with those of Gambel oak trees exhibiting drc of >12"; and

(2) Where removing the trees does not conflict with existing recovery/conservation plan objectives for managing sensitive, threatened or endangered species or their habitat.

Within Stand Openings

Suggested Tree Marking Exception Code: "WSO"

Identifiable Circumstance

Within Stand Openings are small openings (generally 0.05 to 1.0 acres) that were occupied by grasses and wildflowers before settlement (Pearson 1942, White 1985, Covington and Sackett 1992, Sanchez-Meador et al. 2009). Pre-settlement openings can be identified by the lack of stumps, stump holes, and other evidence of pre-settlement tree occupancy (Covington et al. 1997). These openings are most pronounced on sites with heavy textured (e.g., silt-clay loam) soils (Covington and Moore 1994). Current openings include fine scaled canopy gaps. It is not necessary that desired within stand openings and groups be located in the same location that they were in before settlement (the site fidelity assumption). Trees might be retained in areas that were openings before settlement, and openings might be established in areas which had previously supported pre-settlement trees. The within stand opening criteria described here are distinct from and should not be considered as guidance relating to regeneration openings. The stakeholder group does not support the cutting of large trees to create regeneration openings.

Problem Statement

Within stand openings appear to have been self-perpetuating before overgrazing and fire exclusion (Pearson 1942, Sanchez-Meador et al. 2009). Fully occupied by the roots of grasses and wildflowers as well as those of neighboring groups of trees, these openings had low water and nutrient availability because of intense root competition (Kaye et al. 1999). Heavy surface fuel loads insured that tree seedlings were killed by frequent surface fires, reinforcing the competitive exclusion of tree seedlings (Fulé et al. 1997). These natural openings appear to have been very important for some species of butterflies, birds, and mammals (Waltz and Covington 2004). Often the largest post-settlement trees, typically a single tree, became established in these natural within a stand opening as soon as herbaceous vegetation was removed by overgrazing (Sanchez-Meador et al. 2009). Contemporary within stand openings or areas dominated by smaller post-settlement trees should be the starting point for restoring more natural within stand heterogeneity.

Ecological Objectives

(1) Conserve and restore openings within stands to provide natural spatial heterogeneity for biological diversity.

(2) Break up fuel continuity to reduce the probability of torching and crowning.

(3) Restore natural heterogeneity within stands.

(4) Promote snow-pack accumulation and retention to benefit groundwater recharge and watershed processes at small scale.

Criteria

Large (>16" dbh) post-settlement ponderosa pine trees may be removed to restore the unique biophysical attributes of within stand openings according to these criteria:

(1) When the presence of such trees would prevent the re-establishment of sufficient within stand openings to emulate natural vegetation patterns based on current stand conditions, pre-settlement evidences, desired future conditions, or other restoration objectives, and

(2) Where desired openings are tentatively identified as ≥0.05 acre (these openings should be established wherever possible by enlarging current within stand openings or where small diameter trees are predominant), and

(3) Where removing the trees does not conflict with existing recovery/conservation plan objectives for managing sensitive, threatened or endangered species or their habitat.

NOTE: It is not necessary that within stand openings and groups be located in the same location that they were in before settlement. That is, trees might be retained in areas that were openings before settlement, and openings might be established in areas that had previously supported pre-settlement trees.

[2]Heavily Stocked Stands with High Basal Area Generated By a Preponderance of Large Young Trees

Suggested Tree Marking Exception Code: "LYT"

Identifiable Circumstance
In some areas irruption of post-settlement has been so robust that current stand structure is characterized by high density and basal area of large, young ponderosa pine trees. These stands or groups of stands exhibit continuous canopy promoting unnaturally severe fire effects under severe fire weather conditions. At the small scales, this circumstance applies on a case-by-case basis where the cutting of large trees is necessary to meet site-specific ecological objectives such as reducing potential for crown fire spread into communities or important habitats such as for Mexican spotted owls and/or goshawk nest stands. This circumstance applies where other exception categories, when implemented, would not alleviate the afore-mentioned severe fire effects.

Problem Statement
In stands where pre-settlement evidences, restoration objectives, community protection, or other social or ecological restoration objectives indicate much lower tree density and BA would be desirable, large post-settlement pines may need to be removed to achieve post-treatment conditions consistent with a desired restoration trajectory. In stands where evidences indicate that higher tree density and BA would have occurred pre-settlement, only a few large pines may need to be removed. Many of these areas would support crown fire, and thus require structural modification to reduce crown fire potential and restore understory vegetation that supports surface fire.

Ecological Objectives

Natural heterogeneity of forest, savannah and grasslands occurs at the landscape scale.

Natural heterogeneity exists within stands.

Canopy fuel discontinuity reduces the probability of torching and crowning and restores herbaceous fuel continuity to carry surface fire.

Natural fire (rather than silviculture) is the principle regulator of forest structure over time.

Restore groups by retaining the largest trees on the landscape to most quickly re-establish old growth structure, where appropriate to site conditions, restoration and species conservation objectives.

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[2] The "Large Young Tree" exception was drafted, vetted with the Stakeholder Group, finalized and submitted to the USFS on July 15, 2011.

Criteria

Large (>16" dbh) post-settlement ponderosa pine trees may be removed to meet restoration objectives according to these criteria:

(1) When the presence of such trees contributes to continuous canopy promoting unnaturally severe mid- or larger-scale (100+ acre) fire effects under severe fire weather conditions;

(2) When the cutting of such trees is necessary to meet site-specific social or ecological objectives such as reducing potential for crown fire spread into communities or important habitats such as for Mexican spotted owls and/or goshawk nest stands;

(3) When other exception categories, if implemented, would not alleviate the afore-mentioned severe fire effects;

(4) When removing the trees does not conflict with existing recovery / conservation plan objectives for managing sensitive, threatened or endangered species or their habitat.

Note: It is not necessary that trees or groups be located in the same location that they were in before settlement. That is, trees might be retained in areas that were openings before settlement, and openings might be established in areas that had previously supported pre-settlement trees.

V. Description of Desired Next Steps and Ongoing Collaborative Clarification of OGP&LTRS

All of the exception categories listed in this document have been clarified such that they can be operationalized "programmatically", that is, the process of mapping and selecting areas for exceptions is ready to be tested with real data in specific areas. This means that the stakeholder group considers the guidance offered for these exception categories sufficient to operationalize large tree retention/removal per these criteria across the 4FRI area. This process will require the participation of stakeholders and USFS team members to ensure that the suggested process in this document achieves the stated restoration objectives, and is not burdensome in its approach and mechanics.

[3]The "Large Young Tree" exception category listed in this document will require additional collaborative analysis and clarification. Thus far, the group has discussed an opportunity and a need to carry these discussions forward with a combination of additional site visits to representative areas, analysis of USFS stand data, and further exploration of ForestERA remote sensing data that could inform our collective sense of the distribution and extent of areas exhibiting circumstances necessitating large tree removal, and an efficient means of analyzing data and selecting areas for treatment.

Recognizing the importance of finding additional clarity and agreement for these exception categories, the group intends to pursue additional field and data-centered explorations of these exception categories in 2011, working closely with the Forest Service to ensure that additional analysis occurs in a coordinated fashion, and that additional recommendations can be operationalized in a straightforward fashion. Analysis and visitation schedules are intended to be developed by March, 2011, and completed by May 6, 2011.

[3] The "Large Young Tree" exception was drafted, vetted with the Stakeholder Group, finalized and submitted to the USFS on July 15, 2011.

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Appendix 1 – Reservations

From Scott Harger, Coconino NRCD

From: Scott Harger [mailto:cannonbone@msn.com] Sent: Friday, March 04, 2011 6:57 PM To: Windy Greer Subject: Re: Old Growth Protection and Large Tree Retention Strategy Document for Stakeholders' review

Dear Windy, and LTRS Sub-Group of the LSWG:

I appreciate the accelerated effort to push this document for timely delivery to the USFS.

I like the descriptions captured here for the large tree strategy overview and rationale for the document and the 8-of-9 exception categories whose language appear to be resolved. Except for some very turgid prose in section V that can be edited, I can support this draft as a partial or preliminary version, subject to review of the 9th exception. Otherwise, I can support approval of this final draft without conditions. I would also support it if "Problem Description" were changed to "Management Issue" or "Concerns driving the Exception" or something that doesn't suggest that habitats are problems.

Scott Harger
Range Conservationist
Coconino NRCD
Flagstaff, AZ
928.527.9050

From Scott Hunt, Arizona State Forester

From: Scott Hunt [mailto:ScottHunt@azsf.gov] Sent: Friday, March 11, 2011 12:00 PM To: Windy Greer; 'Ethan Aumack'; Ed Smith Cc: Kevin Boness Subject: RE: Old Growth Protection and Large Tree Retention Strategy Document for Stakeholders' review

Thank you Ed and Ethan for the dedicated work on this strategy. The State Forestry Division agrees with reservations on this large tree retention policy. The arguments against diameter caps that you provided in the policy capture most of our reservations. We have two additional items we wish to offer for consideration:

-In the category "Seeps and Springs" under criteria: there should be an allowance for removal of large trees a considerable distance from the seep or spring to help invigorate infiltration and flow. Distance will need to be determined by the effective area that benefits the seep or spring.

-We believe a consideration needs to given for stands that may have a healthy understory of regenerated ponderosa pine with an overstory of trees that are heavily infected with dwarf mistletoe. Objectives for this type of stand may encourage and favor the vigorous, healthy understory. Removal of the larger trees that are infected would be required to meet the stand objectives.

We will look forward the opportunity to comment on the Larger Young Tree removal category when it is developed. Thanks again for all your time and effort.

Scott Hunt

Via Web
June 16, 2017
Calvin Joyner, Regional Forester
USDA Forest Service
333 Broadway SE
Albuquerque, NM 87102
Email: objections-southwestern-apache-sitgreaves@fs.fed.us
RE: Corrected Objection to West Escudilla Forest Restoration Project

Pursuant to 36 C.F.R. § 218, the Center for Biological Diversity ("Center") objects to the draft Decision Notice ("DN") for the West Escudilla Forest Restoration Project ("project") in the Alpine Ranger District of the Apache-Sitgreaves National Forests. On Oct. 7, 2015, the Center supplied timely written comment on a proposed action for the project. Also, the Center provided the Forest Service with timely written comment on the draft Environmental Assessment ("EA"). Previously, The Center may object per § 218.5. Legal notice of opportunity to object published in the *White Mountain Independent* newspaper and based on personal communications with the Forest Supervisor and Deputy Forest Supervisor the deadline for objection is June 16, 2017. Therefore, this objection is timely.

Project name: West Escudilla Forest Restoration Project
Deciding official: Forest Supervisor, Apache-Sitgreaves National Forests
Project location: Alpine Ranger District
Proposed decision: Proposed activities include vegetation treatments, prescribed fire, aquatic, and watershed activities on approximately 66,000 acres, including substantial acreage of group selection and intermediate thinning in Northern Goshawk PFA's and foraging habitat and shelterwood cutting in NGH foraging areas to deal with mistletoe.

Objector: Center for Biological Diversity
P.O. Box 710
Tucson, AZ 85702
Tel: (928) 853-9929
Email: tschulke@biologicaldiversity.org

Objector's interest
The Center is a non-profit, public interest organization headquartered in Tucson, Arizona, representing more than 50,000 members, many of whom reside in Arizona and maintain interests in the Apache-Sitgreaves National Forests. The Center's mission is to conserve and recover imperiled fauna and flora and their habitats through science, education, policy and law.
Members of the Center regularly use and enjoy, and will continue to use and enjoy the national forest lands located in the project area for observation, research, aesthetic enjoyment and other recreational, scientific and educational activities. Members of the Center will continue to research, study, observe

and seek protection for at-risk species associated with natural habitats found in the project area because they derive scientific, educational, conservation and aesthetic benefits from the existence of the full complement of native biological diversity found in the wild places of Arizona. Forest Service violations of law and policy in the project may cause significant adverse impacts to threatened and sensitive species and/or indicator species whose viability is of management concern. Agency violations of law and policy may degrade native vegetation and soil or habitat, food resources or populations of species whose viability the Forest Service is obligated to maintain. Direct, indirect or cumulative impacts of the project to the environment may harm the interests of the Center and its members in the conservation of nature and the recovery of wildlife.

Resolution
The reviewing officer may determine whether to discuss resolution. 36 C.F.R. § 218.11. Either the reviewing officer or the objector "may request to meet" and discuss resolution. *Id*. The Center will consider a request from the reviewing officer to meet and discuss this objection. In our view, a final decision implementing the project should:

1. Include updated language developed by the 4FRI Stakeholders Group designed to protect stands with mature/OG characteristics valuable to canopy dependent species (known as SPLYT stands - stands with a preponderance of large young trees). "SPLYT" stands are currently identified as those with a QMD of top 20 trees greater than 15" and 50BA or greater in trees 16" and larger on Site Class 1. These stands would receive treatment, where necessary, from least intensive prescriptions from the variety of prescriptive approaches proposed in the draft EA, in order to maintain large tree structure and higher levels of canopy cover.
2. Utilize alternative mistletoe treatment approaches being developed with the 4FRI Stakeholders Group that avoid overstory removal and removal of large and old growth trees.

Reasons
1. Including the "SPLYT" language offers clarification in response to comments and concerns addressing large tree protection and wildlife habitat protection. Additionally, including this language will bring the West Escudilla Restoration project in line with the mandate from the CFLRA to maximize the protection of large trees and help build consensus amongst the stakeholders group allowing agreement to include West Escudilla on the list of projects the stakeholders support for CFLRA funding.
2. Including the developing approach for addressing mistletoe offers clarification in response to comments and concerns addressing overstory removal and the protection of large and old trees. Additionally, including this language will bring the West Escudilla Restoration project in line with the mandate from the CFLRA to maximize the protection of large trees and help build consensus amongst the stakeholders group allowing agreement to include West Escudilla on the list of projects the stakeholders support for CFLRA funding.

Thank you for considering this objection. You may contact me at the email address or phone listed below.

Todd Schulke
707 N. Black St.
Silver City, NM, 88071
Tel: 575.574.5962
Email: tschulke@biologicaldiversity.org

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Because life is good.