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August 11, 2016

Laura Jo West
Stephen Best
Neil Bosworth
4FRI team
USDA Forest Service
1824 S. Thompson Street
Flagstaff, AZ 86001
Submitted via email to: 4FRI_comments@fs.fed.us

Dear Ms. West, Mr. Best, and Mr. Bosworth:

This letter provides scoping comments from Sierra Club – Grand Canyon Chapter on the "Rim Country Proposed Action" (PA) for the Four Forests Restoration Initiative (4FRI). This comment is timely because the Notice of Intent was published in the Federal Register on June 27, 2016, with a 45 day comment period ending August 11, 2016.

The Sierra Club's mission is "to explore, enjoy, and protect the wild places of the earth; to practice and promote the responsible use of the earth's ecosystems and resources; and to educate and enlist humanity to protect and restore the quality of the natural and human environments." Inspired by nature, the Sierra Club's more than 1.3 million members and supporters work together to protect our communities and the planet. Sierra Club has regularly participated in stakeholder meetings since 2010 and protection of the region's forests and wildlife is a high priority for our membership in Arizona. Our members have a significant interest in this proposed action as we have been very involved in protection of Arizona's public lands and the wildlife that depend on them.
We support the need for forest restoration to protect wildlife habitat, watersheds, forest resiliency, and ecosystem function. Our members believe that ecological values should always take priority over economic gain when treating our forests.

Bad logging practices during the last century removed most of the large trees and old growth from Arizona's landscape, while overgrazing eliminated much of the dense grasses and forbs from the understory. These factors along with fire suppression resulted in a crop of small, overly dense trees with an increased fire hazard across the landscape. While it is important to thin these dense stands, it is of paramount importance that we protect the limited remaining large and old growth trees to protect the wildlife that depend on them, including species such as the northern goshawk.

Because most trees remaining in the project area are small, we want to make sure that large and old trees are protected, and that enough acres of closed canopy habitat remain to ensure survival of species that rely on mature forest structure.

The goal of 4FRI must be ecological restoration above all else, including retaining old growth and large trees, and the return of natural fire processes to the landscape. Only through careful implementation and proper monitoring will we be able to achieve that goal.

In preparation of the 4FRI Rim Country Environmental Impact Statement (EIS), the Forest Service should take into consideration the following:

ALL EXISTING OLD GROWTH AND "PRE-SETTLEMENT" TREES SHOULD BE PROTECTED

The proposed action should prohibit old growth logging consistent with the stakeholders' Old Growth Protection and Large Tree Retention Strategy, developed for the first 4FRI EIS. The proposed action should not allow for logging old growth and "presettlement" trees—trees that established prior to the disruption of natural fire regimes. Old growth patches and presettlement trees should be retained in all cases, regardless of tree size.

The only way to restore and develop old growth as a natural process at the landscape scale is to preserve the old growth components that currently exist. This can best be accomplished by retaining old growth components such as yellow pines and large trees at the individual and group levels while identifying stands that as a whole generally exhibit old growth characteristics. The goal is to provide as much old growth as can be sustained in patterns that provide for a flow of functions and interactions at multiple scales across the landscape through time. While old growth is a term generally used to describe ecosystem function, it is also increasingly used by the public, academics and even some land managers to describe individual trees with the characteristics described below in "A."

(A) Retain old growth trees regardless of size, as old growth is a function of age, not size. Old growth is not a definitive age. Ponderosa pines begin to develop the thick yellow bark characteristic of an old growth tree between 120 and 150 years of age. As they age, the yellow-red bark also develops wide, large plates. In addition to bark characteristics, an old growth ponderosa pine tree typically exhibits complex structural attributes such as full crowns, flattened tops and large limbs. These trees are sometimes referred to as yellow pines, presettlement trees or mature trees. (Note that "The Path Forward" dated March 19, 2010, a document guiding the Four Forests Restoration Initiative uses the following language: "**8.No old growth trees (predating Euro-American settlement) shall be cut.")**

(B)When creating openings, protect old growth trees by removing excess competition from small, young trees. Initially, removal should focus on, but not be restricted to, trees 12 inches in diameter and smaller. Such a focus is warranted given the high density and high percentage of the forest landscape these trees occupy. According to the USDA, more than 82 percent of ponderosa pine trees in Region Three are smaller than 11 inches in diameter[1][2]. Thinning should occur within groups, as well as in identified openings between groups.

(C) Reduce the fire risk to old growth trees by removing small, younger trees, as well as some mid-aged trees, (VSS 4: 12 to 18 dbh) from within the drip lines of individual trees. Given the lack of trees larger than 16 inches in diameter, thinning should focus on trees smaller than 16 inches in diameter. Approximately 96 percent of the trees in Region Three are smaller than 15 inches in diameter[3][4]. This would reduce ladder fuels, lowering the potential for crown fires. It would also encourage the growth of an understory community.

(D)When developing future old growth stands and managing for mature age classes, larger diameter trees, in VSS 4, 5 and 6 should be retained to replace the structure and function of old growth trees that were

[1] USDA Forest Service. 1999. Forest Inventory and Analysis National Program—Forest Inventory Data Online (FIDO). http://www.fia.fs.fed.us/tools-data/

[2] USDA Forest Service. 2007. Forest Inventory and Analysis National Program—Forest Inventory Data Online (FIDO). http://www.fia.fs.fed.us/tools-data/

[3] USDA 1999.

[4] USDA 2007.

removed by logging.

(E) To provide for an uneven age structure, within old growth stands, retain groups of young and mid-aged trees to provide for multiple age classes and enhance structural diversity. Thin variably within retained groups, removing ladder fuels and avoiding even spacing.

(F) Identify and retain areas that would be best left unthinned as wildlife cover and for travel corridors.

(G) Preserve all snags. Downed logs with a diameter greater than **10**" will be preserved.

(H) Use prescribed fire and the management of natural ignitions to reduce ground fuels and to reintroduce fire to the ecosystem.

(I) Defer Livestock grazing, after the initial fire treatment to allow for understory recovery and change grazing management to allow for function of natural processes.

(J) Decrease road densities to enhance stand integrity by reclaiming old skid trails and log landings.

THE STAKEHOLDER LARGE-TREE RETENTION STRATEGY SHOULD FORM THE BASIS OF THE PREFERRED ALTERNATIVE

The Forest Service should include the Large Tree Retention Strategy, developed for the first 4FRI EIS, as a basis for the proposed action; the Forest Service has the authority to include the Large Tree Retention Strategy as a basis of a preferred alternative in the EIS. The Large Tree Retention Strategy should be implemented and honored in the Rim Country EIS.

THE EIS SHOULD DESCRIBE THE AFFIRMATIVE GOAL OF SAFELY RESTORING NATURAL FIRE REGIMES AND HOW STRATEGICALLY PLACED TREATMENTS DEPLOYED WITHIN FIRESCAPES WILL FACILITATE THE MANAGEMENT OF PLANNED AND UNPLANNED IGNITIONS

The proposed action should describe the project in the context of Federal Wildland Fire Policy and its goals of facilitating public and firefighter safety and maximizing fire’s natural role in wildland ecosystems.

> “Fire, as a critical natural process, will be integrated into land and resource management plans and activities on a landscape scale, and across agency boundaries. Response to wildland fire is based on ecological, social, and legal consequences of fire. The circumstances under which a fire occurs, and the likely consequences on firefighter and public safety and welfare, natural and cultural resources, and values to be protected dictate the appropriate management response to fire.” 1995/2001 Federal Wildland Fire Management Policy.

The EIS should discuss the affirmative goal of restoring fire as a critical natural process rather than focusing on the negative goal of avoiding undesirable fires. The EIS should discuss and present the idea of firescapes and strategically placed treatments in the context of safely managing planned and unplanned ignitions, including restoring fire as a critical natural process.

In the former case, the EIS should describe Firescapes as a geographic context within which to plan and deploy strategically placed treatments that can facilitate safely managing planned and unplanned ignitions. We refer the Forest Service to the definition and description of Firescapes in the 4FRI Stakeholders’ Landscape Strategy document; we suggest the Forest Service use this definition and description to provide additional clarity and specificity to the purpose of Firescapes as an geographic context for planning and deploying strategically placed treatments in a way that serves fire management goals.

In the latter case, the EIS should provide additional detail on the relationship between strategically placed treatments and fire management. Specifically, the EIS should describe how restoration treatments can be strategically designed, located and sequenced to efficiently and safely facilitate operational fire management, community protection, and landscape-scale restoration of ecologically beneficial fire regimes at landscape scales. Toward that end, some key questions that the Forest Service should be seeking to answer in the EIS and subsequent analyses are:

- Where and under what conditions can natural ignitions be managed for resource benefit under current Fire Management Plans?
- Where can treatments be located to facilitate containment and management of planned or unplanned ignitions within firescapes or subsets thereof?
- How can treatments be positioned and sequenced to most efficiently reduce the potential for landscape-scale crown fire?

Treatment units should be distributed in the project area with spatial patterns of crown fire spread in mind. Overlapping patterns of fuel treatment that reduce horizontal fuel continuity can fragment severe fire behavior and effects into smaller patches if they disrupt heading fire behavior and increase the area burned by fires exhibiting flanking behavior as they move upslope[5]. Slope aspects facing away from frontal or diurnal winds are a lesser priority for treatments because backing fires likely to occur on those sites are the most likely to exhibit mild intensity and cause low-severity effects to vegetation and soil with attendant benefits to ecosystem resources and fire worker safety.

The direction of fire spread (backing, flanking, heading) is an important aspect of fire behavior because fire interacts with weather, topography and vegetation to "back" and "flank" around certain fuel and topographic conditions or "head" through others as it moves across the landscape[6]. Steep slopes can facilitate wind-driven convection currents that drive radiant heat upward and bring flames nearer to adjacent unburned vegetation, pre-heating fuels and amplifying fire intensity as it moves upslope[7]. As a result, severe fire effects typically concentrate at upper slope positions and on ridges, whereas such effects are relatively rare on the lee side of slopes that do not directly receive frontal wind[8].
For starters, we suggest the Forest Service consider targeting treatments in fire suppressed VSS 3 stands that are (1) within ¼ mile of roads, (2) that exhibit active or passive crown fire behavior under 95th percentile conditions, and that (3) occur in patches of 50 acres or larger. We also urge the Forest Service to carefully review rationale and analyses employed in the 4FRI Landscape Strategy; the analyses unpinning that document reflect careful thinking about linking restoration and fire management goals in a landscape context. The Forest Service should explicitly include thinning with fire, either in single or multiple, repeated events, within the range of treatment options. Acres precluded from mechanical treatment should not automatically be excluded from fire use; rather, the planning document should consider thinned and non-thinned areas together within a landscape matrix that can safely accommodate natural fires with beneficial ecological effects.

Another approach to strategic location of fuel treatments is to identify landscape features that are currently resilient to fire disturbance and use those sites as anchor points for compartmentalization of the project area for long-term fire management oriented to use of unplanned ignitions for resource benefits. Such sites may include natural openings, meadows, relatively open ridges, riparian areas, patches of mature forest with relatively shaded and cool microclimates, and sites where fuel reduction work already has been completed. Such locations can facilitate appropriate fire management responses including confinement and containment strategies as alternatives to full control, as well as provide safe areas for workers to ignite prescribed fires for hazardous fuel reduction and ecological process restoration. Identification of such sites does not necessarily equate to actively treating them. Landscape features that are currently fire resilient, as well as proposed fuel treatment areas, should be spatially mapped and distinguished in analysis of the proposed action.

The Forest Service also can prioritize active fuel management in areas where relatively little resource investment

[5] Finney, M.A. 2001. Design of regular landscape fuel treatment patterns for modifying fire growth and behavior. Forest Science 47:219-228. *Available at:* http://www.fs.fed.us/rm/pubs/rmrs_gtr292/2001_finney.pdf, *accessed 8/11/16.*
[6] Graham, R.T., S. McCaffrey, and T.B Jain. 2004. Science basis for changing forest structure to modify wildfire behavior and severity. General Technical Report RMRSGTR-120. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. 43 p.
[7] Whelan, R. J. (1995). The ecology of fire. Cambridge University Press, Cambridge, UK.
[88] Finney 2001.

may create relatively fire resilient stand conditions. This may include low-productivity sites with little encroachment of small trees (e.g., dry southerly aspects) and relatively open stands that are currently dominated by large conifers. Targeting work in these areas will maximize the area treated and the effectiveness of treatments with available funds and personnel, and thereby provide the greatest opportunity to quickly reduce fuels and restore ecosystem function at larger spatial scales.

TREE-MORTALITY AND OTHER STRUCTURAL CHANGES RESULTING FROM FIRE USE

The EIS must describe tree mortality and other structural changes resulting from restoration treatments and from fire management following treatments on an ongoing basis. That is, the forest structure resulting from thinning, or the forest structure today in areas that will go unthinned, will change over time by virtue of fire effects. The EIS needs to characterize those ongoing changes and incorporate them into forest modeling. Losses of canopy, large trees, small trees and resulting recruitment of logs and snags will affect long-term forest dynamics, stand development and wildlife habitat suitability. We urge the Forest Service to exhibit caution in so doing: Post-treatment large tree mortality have exceeded planning targets at several restoration sites in northern Arizona.

THE FOREST SERVICE MUST PROTECT MEXICAN SPOTTED OWL (MSO) HABITAT AND VIABILITY WITHIN THE PROJECT AREA

Due to the scale of 4FRI, the Forest Service's actions will cause great changes to the forest during a short timeframe. Decisions made under this plan can have rapid and long-term consequences. Unfortunately, the Forest Service will not have a chance to incorporate lessons learned during implementation of the first 4FRI EIS and Record of Decision (ROD) into this Rim Country EIS. Because of this, the Forest Service risks incidental "take" of MSO as this project proceeds.

We are very concerned about the implementation of new management approaches for MSO, and that is one of the points on record as part of an unresolved appeal against the 2015 revised Apache-Sitgreaves National Forests Land and Resource Management Plan, which we filed in partnership with the Center for Biological Diversity, Grand Canyon Wildlands Council, Western Watersheds Project, and White Mountain Conservation League (Letter from Center for Biological Diversity et al. to USDA Forest Service dated December 24, 2015, p.21).

The Forest Service must disclose all sources of uncertainty about the impact to MSO from its actions related to this project, and detail how it will reduce uncertainty and learn from its actions. The Forest Service should act conservatively to protect MSO habitat and consider all cautions identified in the revised Recovery Plan for Mexican spotted owl (USDI 2012).

The Forest Service is proposing to cut trees up to 17.9 inches d.b.h. within MSO Protected Activity Centers (PACs). Since 1996, the Forest Service has only removed trees up to 9 inches in PACs, and there is not enough monitoring data to know how MSO are responding to this new treatment, which allows trees of double the size previously allowed to be removed. The Forest Service must report on how they will detect and respond to negative impacts on this threatened species' population.

According to a report prepared for the 4FRI team, median canopy cover for Mexican spotted owls foraging and roosting in mixed conifer forests is greater than 60 percent. Note, "75% of stands used for roosting had canopy cover >60%."[9]. The

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[9] Ganey, J.L., J.P. Ward, and D.W. Willey. 2011. Status and ecology of Mexican spotted owls in the Upper Gila Mountains Recovery Unity, Arizona and New Mexico. USDA Rocky Mountain Research Station General Technical Report RMRS-GTR-256WWW., figure 3.

Upper Gila Mountains Recovery Unit is an important unit for MSO populations, where management decisions can affect MSOs outside the Recovery Unit[10]. Further:

> "Current data indicate that owls within the UGM RU are most common in mixed-conifer and ponderosa pine–Gambel oak stands with high basal area and canopy cover. These stands frequently have a prominent hardwood component and numerous large trees and snags. Most are uneven-aged, with variable age-and size-classes of trees and snags and considerable volumes of down logs. These are not the kinds of stand structures that forest managers typically try to create in restoration activities in ponderosa pine and mixed-conifer forests that evolved with relatively frequent fire (for example, Cooper 1960, Dieterich 1983, Covington and Moore 1994, Fulé and others 1997, 2002, 2003, 2004, 2009, Cocke and others 2005, Kaufmann and others 2007; see also Beier and Maschinski 2003). The conditions typical of owl nesting and roosting habitat therefore are frequently viewed as "unsustainable" and unnatural in these systems (Johnson 1994). How then did Mexican spotted owls, which apparently occurred historically in these forest types (for example, Ligon 1926, Steele 1927, Bailey 1928, Huey 1930), come to specialize on these types of forest stands (for example, Hutto and others 2008)? Were such stands (or perhaps patches smaller than stands) present historically in these landscapes, for example in fire refugia (Camp and others 1997) such as north-facing slopes or rocky canyon slopes? If so, is there a minimum size to suitable patches for nesting and/or roosting owls? Or were spotted owls able to exist and persist in stands with lower basal area, canopy cover, and fuel loads?… **The problem is that we do not know where potential thresholds may lie, or how far we can reduce stand conditions before those stands no longer provide habitat for spotted owls.**"[11] (bold emphasis added)

In light of the fact that thresholds for Mexican spotted owl-occupied stand density have not been determined, the Forest Service should not risk destroying the habitat for this threatened species. The Forest Service should have a strong monitoring plan in place with clearly defined thresholds, trigger points for action, and a contingency plan in case those trigger points are met. The Forest Service must create a monitoring plan for MSO that includes a sufficient number of control and treatment sites to generate statistical power and usable data. The Forest Service should not construct roads within PACs.

THE FOREST SERVICE MUST PROTECT NORTHERN GOSHAWK AND CANOPY-DEPENDENT SPECIES

We are also concerned about the implementation of new management approaches for the sensitive northern goshawk, which is another of the points on record as part of an unresolved appeal against the 2015 revised Apache-Sitgreaves National Forests Land and Resource Management Plan, which we filed in partnership with the Center for Biological Diversity, Grand Canyon Wildlands Council, Western Watersheds Project, and White Mountain Conservation League (Letter from Center for Biological Diversity et al. to USDA Forest Service dated December 24, 2015, pp. 21-25). We incorporate our concerns about northern goshawk by reference to the letter from Center for Biological Diversity et al. to USDA Forest Service dated December 24, 2015, pp. 21-25, and it is attached with our email.

According to the 1996 Record of Decision for the northern goshawk plan amendments, which set forth the mandatory standards and guidelines for ecosystem management within Northern goshawk habitats, "it is important to maintain a diversity of cover types and vegetation structural stages across landscapes to sustain healthy wildlife populations and communities,"[12] and the Forest Service should, "Sustain a mosaic of vegetation densities (overstory

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[10] Ganey et al. 2011.

[11] Ganey et al. 2011, pp. 81-82.

[12] USDA 1995. *Final Environmental Impact Statement for Amendment of Forest Plans*. Southwestern Region: Albuquerque, NM.

and understory), age classes and species composition across the landscape. Provide foods and cover for goshawk prey."[13] The Forest Service should not implement a 'once size fits all' approach to treating forests, but instead should leave a mix of densities and cover types, including patches with high density. Later seral stages should be protected intact where possible. Dense understory habitats and coarse woody debris, which are important to goshawk prey species, should also be kept intact or enhanced where possible. Old growth patches with interlocking tree crowns should remain.

Appendix C to the 1996 Record of Decision for the northern goshawk plan amendments set forth mandatory standards and guidelines for ecosystem management within Northern goshawk habitats, including, but not limited to the following. We suggest adhering to these policies rather than experimentally applying new management protocols across a large part of the landscape, with unforeseen outcomes:

(1) The Forest Service must survey the management analysis area prior to any habitat modifying activities, including a ½ mile beyond the proposed project boundary. The Forest Service must use the R3 survey protocol in order to get complete coverage of the management analysis area, and must complete at least one year of surveys.

(2) The Forest Service must establish and delineate on a map, a post-fledgling family area that includes 6 nesting areas per pair of nesting goshawks for known nest sites, old nest sites, areas where there is historic data of past nest sites, and where there have been repeated sightings. A post-fledgling family area (PFA) must be approximately 600 acres in size, and must include the nest sites and habitat most likely to be used by the fledglings during their early development. The 6 identified nest sites should each be approximately 30 acres in size, requiring a minimum total of 180 acres of nest areas within each PFA.

(3) The Forest Service must manage for uneven-age stand conditions for live trees and retain live reserve trees, snags, downed logs, and woody debris levels;

(4) The Forest Service must manage for old age trees such that as much old forest structure as possible is sustained over time across the landscape;

(5) The Forest Service must sustain a mosaic of vegetation densities, age classes and species composition across the landscape;

(6) The Forest Service must provide foods and cover for goshawk prey;

(7) The Forest Service must limit human activity in nesting areas and near PFAs during the breeding season, which extends from March 1 to September 30;

(8) The Forest Service must manage the ground surface layer to maintain satisfactory soil conditions i.e., minimize soil compaction and maintain hydrologic and nutrient cycles;

(9) The required habitat structures, such as tree size, snags, dead and down material, etc., are to be evaluated at (a) the ecosystem management area level, (b) the mid-scale such as drainage, *and* (c) the small scale of site.

(10) For areas outside of PFAs, the required distribution of vegetation structural stages is 10% VSS1, 10% VSS2, 20% VSS3, 20% VSS4, 20% VSS5, and 20% VSS6. (Actual percentages may vary + or – up to 3%).

(11) Snags are to be 18 inches or larger dbh and 30 feet or larger in height, downed logs are to be 12 inches in diameter and at least 8 feet long, and woody debris must be 3 inches or larger on the forest floor.

(12) For areas outside PFAs, canopy cover for Ponderosa pine forest is to average 40+% for VSS4, 5, and 6.

October, pp. 28-29.

[13] USDA 1996. *Record of Decision for Amendment of Forest Plans in Arizona and New Mexico*. Southwestern Region: Albuquerque, NM. May. http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev3_021447.pdf

(13) Within PFAs, the canopy cover for Ponderosa pine forest is to average 50+% for VSS4, 5, and 6.

(14) Within nesting areas, the area must contain only mature to old forest (VSS5 and 6) having a canopy cover between 50-70% and with mid-aged VSS6 trees 200-300 years old.

(15) Road densities are to be managed at the lowest level possible, and where timber harvesting is prescribed to achieve desired forest conditions, the Forest Service is to use small, skid trails in lieu of roads.

RESTORATION OF SPRINGS AND STREAMS

We support the effort to improve the condition and function of streams and springs throughout the project area by reducing road density, improving road crossings, maintaining natural flow regimes, and providing habitat connectivity. (PA p. 5) Because of the high density of streams and wet meadows in the project area, efforts to protect soils, reduce erosion and sedimentation, and prevent noxious weed introductions are extremely important. A thorough scientific inventory of the springs within the project area has never been completed, and as part of this project, the Forest Service should document the location, condition, and type of all springs encountered during treatment. The Forest Service should work with university or US Geological Survey scientists to create a spring database (or augment an existing database) that will be useful into the future.

THE FOREST SERVICE MUST PROTECT ECOTONES AND DIVERSE HABITAT TYPES

According to the PA, "The Rim Country Project includes extensive areas where the ponderosa pine and mixed conifer cover types interface with the pinyon-juniper and oak woodland types. Because of this close association, some facilitative operations may be needed in these other, non-target cover types (such as pinyon-juniper) to support, increase the safety and effectiveness of, and minimize surface disturbance of treatments to restore the frequent-fire forest structure in the target cover types (ponderosa pine types)."

Pinyon pines in particular provide important wildlife habitat and cultural values, grow slowly, and are susceptible to drought[14][15][16][17]. These slow growing trees need to be protected, but there is no standard for prioritizing their retention on the landscape, and measurements applied to other trees such as diameter at breast height are not as useful for determining whether pinyon and juniper are old growth or newly established.

Pinyon-juniper woodlands support high avian abundance and diversity, with many obligate and semi-obligate species, and with a low level of avian community similarity to other forest habitats[18]. Sieg (1991)[19]

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[14] Whitham, T.G., M.P. Young, G.D. Martinsen, C.A. Gehring, J.A. Schweitzer, G.M. Wimp, D.G. Fischer, J.K. Bailey, and R.L. Lindroth. 2003. Community and ecosystem genetics: a consequence of the extended phenotype. *Ecology* 84:1171–1178.

[15] Mueller, R.C., C.M. Scudder, M.E. Porter, R.T. Trotter, C.A. Gehring, and T.G. Whitham. 2005. Differential tree mortality in response to severe drought: evidence for long-term vegetation shifts. Journal of Ecology, 93: 1085–1093. doi: 10.1111/j.1365-2745.2005.01042.x

[16] Breshears, D.D., N.S. Cobb, P.M. Rich, K.P. Price, C.D. Allen, R.G. Balice, W.H. Romme, J.H. Kastens, M.L. Floyd, J. Belnap, J.J. Anderson, O.B. Myers, and C.W. Meyer. 2005. Regional vegetation die-off in response to global-change type drought. Proceedings National Academy of Science USA 102: 15144-15148.

[17] Breshears, D.D., O.B. Myers, C.W. Meyer, F.J. Barnes, C.B.Zou, C.D. Allen, N.G. McDowell, and W.T. Pockman. 2009. Tree die-off in response to global change-type drought: mortality insights from a decade of plant water potential measurements. *Frontiers in Ecology and Environment* 7:185-189.

[18] USDA. 1999. Forest Service Proceedings RMRS-P-9. Paulin, K.M., J.J. Cook, and S.R. Dewey. Pinyon-juniper woodlands as sources of avian diversity.

[19] Sieg, Carolyn H. 1991. Rocky Mountain juniper woodlands: yearround avian habitat. Research paper RM-296. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 7 p.

found higher bird abundance in pinyon-juniper woodlands in Utah during every season than were found in adjacent grasslands. An estimated 1,000 species are associated with pinyon pines in the southwest[20], and pinyon pines hold cultural significance (i.e., pine nut gathering). Slow-growing pinyons are extremely drought sensitive, unlike their juniper counterparts[21][22]. Within the last 15 years, pinyon mortality has occurred throughout the southwest, exceeding 90% in some places[23]. Therefore, even though the two trees often coexist, pinyon and juniper may require separate management strategies to maintain biodiversity. After the massive die-offs of pinyon pine that have occurred over the last 15 years[24], we should not gratuitously remove them from the landscape. Pinyon pine should not be intentionally removed from the landscape when habitat restoration is a project goal.

No tree species should be unilaterally removed to create homogenous ponderosa pine stands. Ecotones can be areas of higher biodiversity, novel genotypes and adaptive variations[25][26] and therefore may provide refugia for species in a changing climate. They can also be places of rapid landscape response to climate, and a diverse forest will be more resilient than a monoculture[27].

Also, the Forest Service should acknowledge the role of grazing in juniper expansion. On page 8 of the PA, the Forest Service reports:

> In the meadows and grasslands of the Rim Country project area, conifers and junipers have encroached into these once open grassland habitats, decreasing the size and function of landscapes that were historically grasslands. As tree canopy increases, understory productivity decreases. The grasslands have impaired soil conditions due to inadequate protective ground cover, compacted soil surfaces, and encroaching pines and junipers. In many meadows, vegetative ground cover is low, hydrologic soil function is reduced from compaction, groundwater levels have dropped below root zones due to gully formation, and encroaching upland tree species are competing with desired species. (PA, p. 8)

The Forest Service must disclose the ways that livestock grazing led to these changes in soil compaction, ground cover, and hydrologic function.

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[20] Whitham, T.G., M.P. Young, G.D. Martinsen, C.A. Gehring, J.A. Schweitzer, G.M. Wimp, D.G. Fischer, J.K. Bailey, and R.L. Lindroth. 2003. Community and ecosystem genetics: a consequence of the extended phenotype. Ecology 84:1171–1178.
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[26] Lightfoot, D.C., S.L. Brantley, and C.D. Allen. 2008. Geographic patterns of ground-dwelling arthropods across an ecoregional transition in the North American Southwest. Western North American Naturalist 68:83-102.
[27] Allen, C.D., and D.D. Breshears. 1998. Drought-induced shift of a forest-woodland ecotone: rapid landscape response to climate variation. Proceedings of the National Academy of Sciences 95:14839-14842.

"REGENERATION" CUTS SHOULD NOT BE USED TO ENHANCE PONDEROSA SEEDLING RECRUITMENT IN NON-PONDEROSA DOMINATED FOREST TYPES

We support the restoration of a more natural forest structure that includes fine-scale openings (generally 0.05 to 1.0 acres) interspersing groups of trees. We do not support the use of "regeneration" gaps cut into mixed conifer types to create openings with the intention of drying out the forest floor and recruiting ponderosa pine seedlings. The Forest Service should focus on creating the next generation of old growth and the goal of these cuts runs counter to the goal of reducing the excess of small trees from the forest. Large trees should not be cut to create regeneration openings.

We agree that prescribed fire should be the preferred method for reducing tree density within ecotones and mixed forest types. (PA p. 4)

ROAD DENSITIES SHOULD BE KEPT TO A MINIMUM AND LOGGING ROADS SHOULD BE OBLITERATED AFTER USE

Road densities should be kept to the lowest density possible and all roads created for this project should be immediately closed, obliterated, and obscured when they are no longer needed. Small skid trails should be used in lieu of roads wherever possible. Roads should not be built in MSO PACs.

MONITORING

In order to ensure that wildlife is protected and the Forest Service is accountable for its actions, we want to see a carefully crafted and fully-funded monitoring plan. Without monitoring, there is no accountability. Without funding, there will be no monitoring. We are eager to see the final monitoring plan and its funding sources. All monitoring plans should be designed with appropriate statistical power to detect changes across the project area.

FOREST SERVICE MUST ACKNOWLEDGE CUMULATIVE EFFECTS OF 4FRI AND GRAZING

Livestock grazing and fire suppression continue to encourage unnaturally dense stands of small trees, resulting in elevated competition for available sunlight, water and soil nutrients, decreased abundance and diversity of understory grasses and forbs, and increased density of hazardous fuels.

Significant cumulative effects to the environment may result from the proposed action in combination with past, ongoing and foreseeable management activities within and around the project area. The Forest Service is required to take a hard look at such impacts rather than merely list potential causes or mention that some risk may result from a catalogue of activities. The Forest Service is about to engage in the largest forest "restoration" project ever undertaken, and it must address a root cause of the problem.

Livestock grazing may cause significant cumulative effects for several reasons. First, grazing directly contributes to fire hazard by impairing soil productivity and altering plant composition, which indirectly contributes to delayed fire rotations, increased forest density, and reduced forage for herbivorous species. In addition, livestock grazing combined with proposed mechanical thinning and prescribed fire treatments may spread exotic plants and reduce the competitive and reproductive capacities of native species. Once established, exotic species may displace natives, in part, because natives are not adapted to ungulate grazing in combination with fire. Grazing must be considered within the Cumulative Effects of this project.

Historically, grazing reduced understory vegetation and inhibited the spread of low intensity, low severity fire, creating conditions prime for natural regeneration of ponderosa pine. Livestock grazing decreases understory biomass and density, reducing competition with conifer seedlings and also reducing the ability of the understory to carry low-intensity, low-severity fire, thereby contributing to dense forests with altered species composition[28]. The increase in small tree density has led to the amount of forest acres burned in recent history. Simultaneously, grazing increases the presence of exotic plant species[29]. Livestock also compact soils, decreasing the soils' ability to absorb water and increasing erosion[30].

Restrictions in grazing of livestock after fires, cutting treatments, seeding, plantings, mulching, and aspen treatments may be required as mitigation to reduce impact to forage species. Release from grazing before fire may be required to enable sufficient fuels to accumulate. Post-treatment release from grazing could be required for several years. 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."[31]. Livestock and wildlife tend to concentrate in seeding treatments, which leads to soil compaction, soil surface disturbance and erosion, and overuse of vegetation.

Frequent grazing has in part facilitated invasion by grazing-tolerant, less palatable weedy species by reducing native perennial grass cover. These exotic weedy species have displaced native perennial grasses in parts of the intermountain west because the native plants are not adapted to frequent and close grazing[32]. Also, many native species are not adapted to frequent ungulate grazing in combination with fire. Grazing is not an effective means of reducing exotic plant cover, and instead can drive non-native plants to compensate and increase growth and reproductive potential in ways that native species cannot[33].

In the cumulative effects section, the Forest Service should specifically:

a) Link tree density to historic grazing and associated removal of understory.
b) Mention interaction of grazing with fire suppression to degrade forests, including old growth forests.
c) Mention reduced competitive and reproductive capacities of native species in grazed areas, and that actions associated with grazing can spread exotic plant seed such as cheatgrass.
d) Acknowledge that grazing and browsing contributes to aspen decline and is detrimental to aspen recruitment and survival.
e) Discuss how grazing impacts springs and riparian areas, and has a negative interaction with off highway vehicle use
f) Explain how future livestock management would differ from the past practices that helped lead to unhealthy forests in the first place
g) Explain how monitoring will detect problems and what changes might be made to grazing

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[28] 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 11:315-327. *Available at* http://onlinelibrary.wiley.com/doi/10.1046/j.1523-1739.1997.95405.x/abstract, *accessed 8/10/16.*
[29] Bakker, J.D., F. Rudebusch, and M.M. Moore. 2010. Effects of long-term livestock grazing and habitat on understory vegetation. Western North American Naturalist 70:334-344.
[30] Belsky and Blumenthal 1997.
[31] Kerns, B.K., M. Buonopane, W.G. Thies, and C. Niwa. 2011. Reintroducing fire into a ponderosa pine forest with and without cattle grazing: understory vegetation response. Ecosphere 2:1-23. *Available at* https://www.firescience.gov/projects/06-2-1-10/project/06-2-1-10_Kerns_et_al_2011_Ecosphere.pdf, *accessed 8/10/16.*
[32] Belsky and Bluementhal 1997.
[33] Kimball, S. and P.M. Schiffman. 2003. Differing effects of cattle grazing on native and alien plants. Conservation Biology 17:1681-1693. *Available at* https://eplanning.blm.gov/epl-front-office/projects/lup/36511/45862/49563/Western%20Watersheds/Kimball_%26_Schiffman_(2003)_Effects_grazing_native_alien_plants.pdf, *accessed 8/11/16.*

practices in the future, including changes to timing, duration, stocking rates, or availability of pastures

h) Acknowledge that removal of livestock after treatment (fire, cutting, or seeding/planting/mulching) may be necessary for a period of years. Only fire is mentioned as potentially impacting the availability of pastures to livestock, but if forests are returning to an unhealthy state (i.e., reduced understory, dense regeneration, altered fire regimes, noxious weeds) then livestock utilization may have to be altered.
i) Take a strong position suggesting *what* changes to grazing might be necessary to achieve a fully restored forest.
j) Cite the following sources. The science establishing an interaction between grazing, fire, understory health, and pine recruitment is well established and goes back over half a century. The following peer-reviewed literature contributes to the knowledge that cattle grazing can create effects counter to forest restoration efforts: Kerns et al. 2011[34] (which describes USDA research: "understory release from a long history of cattle grazing caused a greater degree of change than the initial reintroduction of fire."), Bakker et al. 2010[35], Kimball and Schiffman 2003[36], Allen et al. 2002[37], Belsky and Blumenthal 1997[38], Cooper 1960[39], Madany and West 1983[40], Savage and Swetnam 1990[41], Arnold 1950[42].

Use the 4FRI project as an opportunity to study the interactions between forest treatments and livestock grazing. The effects of grazing should be monitored as a learning opportunity. As part of the monitoring plan, the following measurements should be taken and analyzed in relation to presence of grazing and/or time since pasture was grazed: soil moisture, woody species regeneration in meadows, woody species regeneration in within-stand openings; understory density and composition, understory ability to carry fire, noxious weeds.

In the affected Environment section for Range in the EIS, the Forest Service should include the actual grazing numbers (annual operating instructions) going back over a period of time. This will help everyone understand what the current state of grazing on the landscape is, and provide a record for future comparisons.

THE FOREST SERVICE SHOULD ACKNOWLEDGE ALL CAUSES OF ASPEN DECLINE

The Forest Service intends to build and maintain "up to 200 miles of protective barriers springs, aspen, Bebb's willows, and big-tooth maples, as needed for restoration." (PA, p. 14). It is true that "Aspen are dying or rapidly declining in the Rim Country project area," (PA p. 8) and the causes of decline include browsing and grazing. Aspen has gradually declined in part due to browsing by livestock and introduced and native wild ungulates. Wolf reintroductions have improved aspen recruitment and survival

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[34] Kerns et al. 2011.
[35] Bakker et al. 2010.
[36] Kimball and Schiffman 2003.
[37] Allen, C.D., M. Savage, D.A. Falk, K.F. Suckling, T.W. Swetnam, and T. Schulke. 2002. Ecological restoration of southwestern ponderosa pine ecosystems: a broad perspective. Ecological Applications 12:1418-1433. *Available at* http://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1293&context=barkbeetles, *accessed 8/11/16.*
[38] Belsky and Blumenthal 1997.
[39] Cooper, C. F. 1960. Changes in vegetation, structure, and growth of southwestern pine forests since white settlement. Ecological Monographs 30(2): 129-164.
[40] Madany, M. H., and N. E. West. 1983. Livestock grazing-fire regime interactions within montane forests of Zion National Park, Utah. Ecology 64(4): 661-667.
[41] Savage, M. and T. W. Swetnam. 1990. Early 19th-century fire decline following sheep pasturing in a Navajo ponderosa pine forest. Ecology 71(6): 2374-2378.
[42] Arnold, J. F. 1950. Changes in ponderosa pine bunchgrass ranges in northern Arizona resulting from pine regeneration and grazing. Journal of Forestry 48: 118-126.

where elk were the limiting factor[43][44]. When large predators, particularly wolves, were reintroduced to Yellowstone National Park, USA, and Banff National Park, Canada, the wolves brought elk populations to levels that resulted in decreased grazing pressure, allowing aspen populations to rebound[45]. Elk populations consist of larger numbers than historically existed in the project area.

FENCING SHOULD ONLY BE USED WHERE ABSOLUTELY NECESSARY

Fencing is expensive, difficult to maintain, unsightly, and blocks movement of many wildlife species that aren't responsible for overgrazing and overbrowsing on aspen and wetland habitat types. The Forest Service must acknowledge that the lack of – or severely reduced populations of – top predators including wolves exacerbates the problem of overgrazing and overbrowsing on aspen, as does elk overpopulation. Suggested language, approved by stakeholders while developing the Large Tree Retention Strategy for the first 4FRI EIS: "Other factors contributing to gradual aspen decline over the past 140 years include reduced regeneration due to browsing by livestock and introduced and native wild ungulates in the absence of natural predators like wolves."

Fencing should only be used as a last resort to protect values at risk from grazing and browsing. The Forest Service instead should use jackstrawing or move stock tanks to deter grazing and browsing of aspen and riparian habitats. No water sources should be provided within a mile of aspen stands. Instead of providing new constructed waters, the focus should be on restoring and protecting natural water sources such as springs and seeps.

INVASIVE PLANTS

Domestic livestock, as well as logging, prescribed fire, and other practices that disturb soils, can spread alien weedy species in ponderosa forests. Livestock act as vectors for seed travel, disturb the soil, and reduce the competitive and reproductive capacities of native species. Exotic weeds can displace native species, in part, because native grasses are not adapted to frequent and close grazing[46][47]. In some portions of the planning area, although the locations relative to active grazing allotments is not disclosed, aggressive alien weeds such as cheatgrass (*Bromus tectorum*) and spotted knapweed (*Centaurea maculosa*) have displaced native species. The potential for significant cumulative impacts of noxious weed spread in the project area is high because McGlone and others (2009)[48] showed that cheatgrass abundance and distribution increased 90-fold above a pre-treatment baseline as a result of forest treatments similar to the proposed action.

The presence of cheatgrass has important long-term implications for native plant communities. Melgoza and co-workers (1990)[49] studied cheatgrass soil resource acquisition after fire and note its competitive success owing to its ability suppress the water uptake and productivity of native species for extended periods of time. They further note that cheatgrass dominance is enhanced by its high tolerance to grazing (also see Mack 1981[50]).

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[43] Ripple, W.J., and R.L. Beschta. 2007. Restoring Yellowstone's aspen with wolves. *Biological Conservation* 138: 514-19.

[44] Ripple, W.J., and R.L. Beschta. 2011. Trophic cascades in Yellowstone: The first 15 years after wolf reintroduction. *Biological Conservation* 145: 205-13.

[45] Hebblewhite, M., C.A. White, C.G. Nietvelt, J.A. McKenzie, T.E. Hurd, J.M. Fryxell, S.E. Bayley, and P.C. Paquet. 2005. Human activity mediates a trophic cascade caused by wolves. *Ecology* 86: 2135-44.

[46] Mack, R., & Thompson, J. (1982). Evolution in Steppe with Few Large, Hooved Mammals. *The American Naturalist, 119*(6), 757-773. Retrieved from http://www.jstor.org/stable/2460961

[47] Belsky and Blumenthal 1997.

[48] McGlone, C. M., Springer, J. D., & Covington, W. W. (2009). Cheatgrass encroachment on a ponderosa pine forest ecological restoration project in northern Arizona. *Ecological Restoration*, *27*(1), 37-46.

[49] Melgoza, G., Nowak, R. S., & Tausch, R. J. (1990). Soil water exploitation after fire: competition between Bromus tectorum (cheatgrass) and two native species. *Oecologia*, *83*(1), 7-13.

[50] Mack, R. N. (1981). Invasion of Bromus tectorum L. into western North America: an ecological chronicle. *Agro-ecosystems*, *7*(2), 145-165.

Cheatgrass is well adapted to fire and often dominates plant communities after disturbance[51]. 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[52]. Some native species also exhibit this trait, but greenhouse and field studies show that cheatgrass effectively competes with seedlings of perennial species[53][54][55]. In addition, 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[56]. This competitive ability of cheatgrass contributes to its post-fire dominance.

SOILS

The EIS should identify soil types on which mechanical treatments, piling and pile burning should be prohibited owing to vulnerability to soil disturbance. It should also include mandatory procedures for preventing soil erosion during mechanical treatments. We are not at all convinced that best management practices will prevent unacceptably detrimental soil conditions where ground-based log skidding occurs. The EIS should relate slope steepness to soil erosion hazard or soil structure throughout the project area; it should disclose exactly where ground-based skidding and mechanical treatments may and should not occur. The Forest Service should evaluate soil erosion hazard at multiple scales, using watersheds and sub-watersheds to delineate between those scales.

We have seen extensive soil damage occur within the Flagstaff Watershed Protection Project area, resulting from operations occurring during wet and muddy conditions. Every effort should be taken to stop operations during wet conditions to prevent rutting and gullying.

MISTLETOE TREATMENTS

Because this project is intended to improve and restore forest and ecosystem health, structure, functioning, and resilience, and not for timber production, mistletoe treatments are unwarranted and counterproductive, especially if they focus on removing the largest trees as a treatment method. Research repeatedly shows that mistletoe is an important component of healthy forest habitats, and large trees with mistletoe brooms provide essential food and occupancy needs to wildlife.

Worldwide, species in 97 vertebrate families consume mistletoe and species in 50 vertebrate families use mistletoe for nesting; therefore mistletoe can be considered a keystone species in forest ecosystems[57]. Mistletoe brooms provide essential wildlife nesting, foraging, caching, resting, and roosting habitat for sites for Abert squirrel, porcupine, and passerine birds; managers should retain some broomed trees as wildlife habitat[58][59]. Bird species richness in southwestern ponderosa pine forest positively correlates with level of dwarf mistletoe, and no bird species appear to have a negative correlation with dwarf mistletoe[60]. Mistletoe provides a

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[51] Young, J. A., Evans, R. A., & Eckert Jr, R. E. (1969). Population dynamics of downy brome. *Weed Science*, 20-26.
[52] Melgoza et al. 1990.
[53] Hull, A. C. (1963). Competition and water requirements of cheatgrass and wheatgrasses in the greenhouse. *Journal of Range Management*, *16*(4), 199-204.
[54] Harris, G. A. (1977). Root phenology as a factor of competition among grass seedlings. *Journal of Range Management*, 172-177.
[55] Harris, G. A., & Wilson, A. M. (1970). Competition for moisture among seedlings of annual and perennial grasses as influenced by root elongation at low temperature. *Ecology*, *51*(3), 530-534.
[56] Melgoza et al. 1990.
[57] Watson, D.M. 2001. Mistletoe – A keystone resource in forests and woodlands worldwide. Annual Review of Ecology, Evolution, and Systematics 32:219-249.
[58] Parks, C.G., E.L. Bull, R.O. Tinnin, J.F. Shepherd, and A.K. Blumton. 1999. Wildlife use of dwarf mistletoe brooms in Douglas-fir in northeast Oregon. Western Journal of Applied Forestry. 14:100-105.
[59] Mathiasen, R.L., G.N. Garnett, and C.L. Chambers. 2004. A Comparison of Wildlife Use in Broomed and Unbroomed Ponderosa Pine Trees in Northern Arizona. Western Journal of Applied Forestry 19:42-46.
[60] Bennetts, R.E., G.C. White, F.G. Hawksworth, and S.E. Severs. 1996. The influence of dwarf mistletoe on bird communities in Colorado ponderosa pine forests. Ecological Applications 6:899-909.

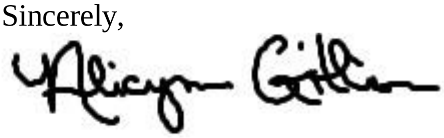
consistent food-based moisture source for squirrels[61]. Deer use was significantly higher in tree clusters with dwarf mistletoe in the Wet Beaver Creek watershed[62]. Mistletoes provide a climatically stable food resource for avian frugivores, even when other tree-based foods are unavailable due to drought. Plants that rely on birds to disperse seeds benefit from mistletoe, which correlates with bird presence through a range of climatic conditions[63]. Red squirrels rely on specific types of mistletoe brooms for nesting in mixed-conifer forests in northern Arizona and New Mexico[64]).

Mistletoe provides inclement weather protection to porcupines in Douglas-fir[65] and pine-juniper forests[66]. Number of branches within a mistletoe broom and tree height correlate with probability of Abert squirrel caching, foraging, and nesting. Taller trees with mistletoe are most important. Forest managers should keep trees $\geq$ 18 m and with brooms having > 7 branches[67].

Besides, since fire causes more scorch and there is higher fire mortality in medium scorch classes with mistletoe, if these areas are expected to burn in the future, mistletoe populations exposed to managed fire will be kept in check without intervention[68].

Thank you for considering our comments on the Rim Country 4FRI PA.

Sincerely,



Alicyn Gitlin
Sierra Club Grand Canyon Chapter

[61] Pederson, J.; Farentinos, R.; Littlefield, V. 1987. Effects of logging on habitat quality and feeding patterns of Abert squirrels. Western North American Naturalist, North America, 4730 04 1987.
[62] Clary, W.P., and Larson, F.R. 1971. Elk and deer use are related to food sources in Arizona ponderosa pine. USDA Forest Service Research Note RM 202, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.
[63] van Ommeren, R.J., T.G. Whitham. 2002. Changes in interactions between juniper and mistletoe mediated by shared avian frugivores: parasitism to potential mutualism. Oecologia 130:281-288.
[64] Hedwall, S.J., C.L. Chambers, and S.S. Rosenstock. 2006. Red squirrel use of dwarf mistletoe-induced witches' brooms in Douglas-fir. Journal of Wildlife Management 70:1142-1147.
[65] Smith, G.W. 1975. An ecological study of the porcupine (*Erethizon dorsatum*) in the Umatilla National Forest, Northeastern Oregon. Washington State University M.S. thesis.
[66] Hoffer, M.C. 1967. Radio-telemetry: a key tool in porcupine control-methods research. Trans. California-Nevada Section of the Wildlife Society.
[67] Garnett, G.N., C.L. Chambers, R.L. Mathiasen. 2006. Use of Witches' Brooms by Abert Squirrels in Ponderosa Pine Forests. Wildlife Society Bulletin 34:467-472.

[68] Harrington, M.G. and F.G. Hawksworth. 1990. Interactions of fire and dwarf mistletoe on mortality of southwestern ponderosa pine. Poster paper presented at the conference, Effects of Fire in Management of Southwestern Natural Resources (Tucson, Al., November 14-17, 1988). U.S. Forest Service publication, Available at http://www.fs.fed.us/rm/pubs_rm/rm_gtr191/rm_gtr191_234_240.pdf, accessed 6/1/12.