[redacted]

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Annette Fredette
4FRI Planning Coordinator
Coconino National Forest
1824 S. Thompson St.
Flagstaff, AZ 86001

Dear Ms. Fredette,

I am writing to provide scoping comments on the 4FRI Rim Country Project, dated June 2016. These are my personal comments, not those of my former employers.

Purpose and Need

I suggest some modifications to the purpose and need:

First, the document describes the purpose as to "restore forest structure and pattern...to conditions within the natural range of variation, thus moving the project area toward the desired conditions," but then explains that the desired conditions are "in the land and resource management plans." The document also says that research, science, and landscape restoration criteria in the Omnibus Public Land Management Act also went into developing the purpose and need. All of these seem fine except using the land and resource management plans to define desired conditions, since the plans do not have the same focus as this project. Instead, I suggest you use all these sources except the land and resource management plans, then amend the plans as needed after the EIS for this project is finalized. I think this could be the intention, since Appendix A lists proposed amendments. However, the "Desired Conditions" section does repeat the idea that the proposed treatments come from the land and resource management plans. I hope this is not true, and I suggest rephrasing the purpose and need to make it clear that the purpose and need does not come from desired conditions in the land and resource management plans.

I support the bullet "increase forest resiliency and sustainability" but "sustainability" should be defined and limited to the forest ecosystem itself, to make it clear that we are not talking about sustaining products from the forest ecosystem, which are already in the last bullet. This can be accomplished by clarifying this bullet as "forest resiliency and forest ecosystem sustainability."

I do not support the bullet "reduce risk of undesirable fire effects." That implies that people will define what is desirable to them, but that is not necessarily congruent with restoring "to conditions within the natural range of variation" and also is not congruent with the Omnibus Act, which uses the phrase "reestablishing natural fire regimes."This can be resolved by changing the bullet to "Restore the natural fire regime." I think this is needed, because much of the funding comes from the Omnibus Act, and because restoring to conditions within the natural range of variability also means restoring the natural fire regime.

I support the bullets about terrestrial and aquatic habitat, streams and springs, riparian vegetation, and cultural resources.

I might support the bullet: "Support sustainable forest products industries" but the project generates products only for 10 years, so it is impossible for these industries to demonstrate sustainability beyond the 10-year period, and at the end of this period the resources that are available under this project also end. I suggest changing this bullet to read "Support forest products industries that use sustainable practices and have the potential to remain sustainable using other resources after the project period ends."

<u>The Proposed Action needs to revise the historical fire regime and forest structure</u>

The document indicates "There is a need to restore the frequent low-severity fire regimes in which the forest in the Rim Country project area evolved" and later (p. 11): "Desired conditions are for no more than 15% of the ponderosa pine (under conditions modeled) in the treatment area to be prone to crown fire or high-severity fire, with areas of potential high severity spatially distributed." The scientific basis for these numbers and this proposal of course are not provided in the document, but it is difficult to see how they can be supported by the available science.

The draft EIS should comprehensively review and take a hard look at the available scientific evidence about historical fire regimes in the project area and in comparable areas nearby, including our publication. It documents that very substantial amounts of high-severity fire historically shaped both ponderosa pine and dry mixed-conifer forests inside the project area:

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 21:1042-1052.

Of course, it is appropriate to review the critique of this publication by Fulé et al. (2014), but if you do this, you should of course also review and report the specific rebuttals we made to their critiques in Williams and Baker (2014). Here are the two citations:

Fulé, P. F., 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. Sieg, C. Skinner, S. L. Stephens, and A. Taylor. 2014. Unsupported inferences of high severity fire in historical western United States dry forests: Response to Williams and Baker. Global Ecology and Biogeography 23:825-830.

Williams, M. A. and W. L. Baker. 2014. High-severity fire corroborated in historical dry forests of the western United States: response to Fulé *et al.* Global Ecology and Biogeography 23:831-835.

The description of the fire regime as "frequent low-severity" is not supported by the findings of Williams and Baker (2012), which is the only reconstruction of fire severity across a very large land area that includes much of the project area. Be careful with other available literature as there

is very little tree-ring research on the historical fire regime in the project area that includes actual reconstruction of fire severity using forest age structure. Most tree-ring research assumed that fire severity was low in these forests and did not collect information to determine fire severity. That is not scientific evidence that the historical fire regime was "frequent low severity" as described in the Proposed Action.

I hope that when you present the draft EIS you will have revised the historical fire regime description so it is "mixed severity" or "variable severity" and you will have accepted that this historical fire regime at times included substantial high-severity fire, so that the proposed goals of no more than 15% high severity in ponderosa and no more than 20% high severity fire in dry mixed conifer will not be used. Those numbers are too low relative to the evidence we presented (Williams and Baker 2012), and there is limited evidence about historical fire severity in other sources for the project area.

Do not overpromise what can be accomplished regarding large, severe fires

It would be a significant matter to not reveal to the public the evidence in Williams and Baker (2012) and treat this evidence seriously, as it shows the historical fire regime to have been mixed-severity, not low severity. If you indicate in the draft EIS that you are going to restore a fire regime that included no more than 15% high-severity fire, and subsequent fires have much more high-severity fire than this, then you will have lost public faith in these large restoration programs.

If, instead, you indicate that you expect restoration to reduce fire severity somewhat, because fuels will have been reduced, but also make it clear that severe fires were part of the natural range of variability and could still occur, you will not be over-promising. I think it is also important to make it clear that fuels are only part of the fire equation and you cannot control the weather and climate parts of this equation. This, too, is an important part of not over-promising.

Also, I do not know which model you used to estimate the reduction in fire severity expected from treatments. However, all the common models (e.g., FlamMap), have known errors that mean they significantly underpredict the probability of crown-fire initiation. Those errors have not been fixed. Here is the peer-reviewed scientific publication that shows this, and proposes using an alternative validated model that can be downloaded and used instead. These two authors are the world authorities on fire-behavior and fire modeling and are collaborating with USFS researchers on fire modeling:

Cruz, M.G., Alexander, M.E., 2010. Assessing crown fire potential in coniferous forests of western North America: a critique of current approaches and recent simulation studies. International Journal of Wildland Fire 19, 377-398.

Use their model, CFIS, not the standard models used by USFS, and you will again avoid overpromising, in this case because of a documented modeling flaw, what can be accomplished via this restoration program. Here is a recent publication, that includes a USFS researcher, that mentions this flaw, then avoids it by using CFIS, and shows how to do it. I suspect Tinkham or

Battaglia at the Rocky Mt. Res. Station and Martin Alexander in Canada would help with CFIS:

Tinkham, W. T., C. M. Hoffman, S. A. Ex, M. A. Battaglia, and J. D. Saralecos. 2016. Ponderosa pine forest restoration treatment longevity: implications of regeneration on fire hazard. Forests 7, 137. This journal is online: http://www.mdpi.com/journal/forests

Propose to take action to reduce human-set fires in the project area

Please also review and present the evidence in Baker (2015), which shows that high-severity fires are not generally increasing across dry forests in most of the western USA, but are in the larger analysis area that includes the project area:

Baker, W. L. 2015. Are high-severity fires burning at much higher rates recently than historically in dry-forest landscapes of the western United States? PLOS One 10(9), e0136147. This journal is also online: http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0136147

Please explain that, although there is an upward trend in ponderosa, high-severity fire is still operating within its historical range and has a recent fire rotation of 686 years in ponderosa and 592 years in dry mixed conifer. Those fire rotations are quite long and provide ample time for dry forests to fully regenerate and grow back to old-growth forests. Also, there is no upward trend in the fraction of fires that are burning at high severity.

Please also explain that many of the large, severe fires that have contributed to the trend in ponderosa are human-set fires. There are quite a few things that the project could propose to help reduce the possibility of human-set fires. Certainly, reducing tree density and fuels will have some effect, but also you can take action to close access to certain areas during severe droughts, you can redirect camping and other activities into less vulnerable locations and treat/redesign those locations to reduce fire spread, you can make it difficult for people to stop along roads in vulnerable locations and instead channel stops into moister areas or locations where fire spread is less likely. Of course it would be good to increase fines for leaving campfires burning etc. There are other suggestions in Fire ecology in Rocky Mountain landscapes. There is a copy at NAU.

The Proposed Action needs to review and base a landscape plan on historical landscape data

The Proposed Action does mention, under Forest Resiliency and Sustainability, the idea that the natural range of variation included “a mix of open, moderately closed, and closed canopy conditions at the fine (group) to landscape...scales.” This is good, and is in agreement with the tree-density reconstructions of Williams and Baker (2012 Figure 2) and other published sources. Please cite and use this document as one of your cited sources as supporting that historical landscapes had a large range in tree densities.

This mix cannot have been produced by a frequent-fire regime, as this regime is consistently linked only to low-density forests with large trees. You have described the historical landscape as a mix of densities. Please abandon that unsupported notion, and embrace the mixed-severity fire regime evidence, which is the primary source of this mix of open to closed conditions. Of course, you are correct to review evidence of effects on historical forests from droughts, disease, and

insect outbreaks as well. The Plummer report, discussed below, has unique, comprehensive data on drought effects across the project area that I hope you will report and use.

The Proposed Action, as it is in Tables 2 and 7 is too vague at this point, as I'm sure you know, with large ranges of basal area and tree density (e.g., 11-124 trees/acre). You will need, and perhaps already have, some scientific basis for determining the details of the mix of densities, basal areas, and other aspects of historical forest structure across the landscape, so that there is a well-supported scientific basis for the landscape restoration plan.

As far as I know, there are only two widely available sources that provide spatially comprehensive information about the historical landscapes of the project area. Here they are:

1. Plummer, F. G. 1904. Forest conditions in the Black Mesa Forest Reserve, Arizona. U.S. Geological Survey Professional Paper No. 23, U.S. Government Printing Office, Washington, D.C.

2. 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 21:1042-1052.

What you need, in my scientific opinion, is some way to estimate proportions of the project area that historically had various levels of tree density, basal area, perhaps timber volume, and forest composition, or at least indicators of variability in forest structure. Not all of this is available, but enough is to craft a reasonable plan. Calculating some actual distributions of various parameters of historical forest structure is possible from Plummer, and I recommend it be used directly:

Plummer (1904) provides township-by-township descriptions for about A.D. 1900 for most of the townships in the project area, including the following for each township:
a. verbal description of the quality and location of the ponderosa pine timber, including what percentage was "good quality" and whether it was "heavy" meaning dense
b. estimate of timber volume for ponderosa in feet B.M. These estimates are difficult to translate into modern estimates of volume since they cruised it differently, but this is very good indicator to use in a relative way to estimate how variable forests were historically across the project area.
c. composition - some estimates of volume for associated tree species, that could also be used in a relative way, and some verbal explanations of associated trees.
d. average height - tells something about how variable the forest was, although height is not as important as other variables
e. average diameter - of obvious value directly and also can compare across the townships to estimate the variability of mean tree diameter
f. average age - this is important and also can be used to show variability across the landscape. This appears to show that a lot of the landscape was not very old, often between about 125-175 years on average.
g. dead and diseased - these are useful to understand the state of the historical forest, which had just experienced a significant drought period (p. 18). But, these estimates should also be useful in

understanding that significant amounts of dead and diseased trees were historically normal.
h. Map in Plate VI. This shows some of the variability in the historical forest and how it was arrayed across the landscape. Look at the patches of timber in the three volume classes to see that there were large blocks and patches of forest with differing levels of timber volume. And, those volume levels were generally pretty low, likely because of fires and other disturbances. The restored forest should not be uniform or entirely old-growth forests.

I would like to respectfully remind USFS that after quite a bit of discussion over objections to Phase 1 of 4FRI, it was determined by USFS that Phase 1 would be restoring tree densities and leaving dense-forest areas that are congruent with the reconstructions of Williams and Baker (2012). That was good news, and I hope that similar congruence will be possible with Phase 2.

Patterns in Williams and Baker's maps of tree density and fire severity (2012) correspond reasonably well with patterns in the Plummer map of timber volumes, which was done about 10-20 years after the surveys. The western part of the Rim Country Project area corresponds with the southeastern part of the Mogollon Plateau panel in Figures 2 and 3 in Williams and Baker (2012), which shows moderate to high tree density (Fig. 2) and high-severity and mixed-severity fire (Fig. 3). These fires likely occurred early in the reconstruction period (which was about 1760-1880) and post-fire forests would have been about 100-120 years old at the time of the surveys in the late-1800s. This area was reconstructed to have evidence of high-severity fire because it had high tree density, few trees larger than 16" diameter, spatial contiguity, and some sharp borders with mature forest. This same area is highlighted in Plummer on p. 18, where he says "In Tps. 12 and 13 N., R 12 E, exceptionally heavy stands of young timber were noticed. These trees average about 10 or 12 inches in diameter..." Trees 10-12 inches diameter would likely have been 100-120 years old, agreeing with the Williams and Baker reconstruction for this area. This agreement is strong corroboration that both sources provide valid information about historical landscapes and corroborating evidence that this area likely burned at high severity.

The Black Mesa panel in Figure 2 and 3 of Williams and Baker (2012) corresponds with the eastern half of the Rim Country Project area but extends beyond it. Similarly, the area of reconstructed high-severity fire west of Show Low in William and Baker's Fig. 3 shows up on the Plummer map (Plate VI) in the lowest timber-volume class, reflecting a young forest, and the description of the township says: "The timber is generally small and rough, the best yellow pine being along the creek" (p. 39) consistent with a forest recovering from a high-severity fire in the late-1700s to early 1800s, that left surviving trees in moister areas along the creek.

What you see in the Williams and Baker (2012) reconstructions and in the Plummer (1904) report and maps is similar coarse spatial heterogeneity in tree density (W&B) and timber volume (Plummer), produced by the same mixed-severity fires, that included some large patches of high-severity fire. Patches are similar, although mapping detail differs, and they are in similar places. I hope you will use these two sources as a guide to formulate a landscape plan that will lead to a landscape, after restoration, that was guided by this historical landscape heterogeneity.

The Proposed Action needs to show how the restored landscape will look and how fire will be managed to restore the fire regime, as required by the Omnibus Public Land Management Act

The proposed action should lay out what the restored landscape will look like and how fire will ultimately be managed in the restored landscape, as without this vision, the Proposed Action appears to lead to nothing, when in fact it is clear that there is a very big vision to this project. Please explain these two missing and essential matters in detail, with accompanying maps, graphs, and tables giving the details.

To meet the mandate of the Omnibus Act to restore the historical fire regime, I suggest an obvious goal for fire would be to maximize the area within which fire managers are able, after the project is done, to manage wildfire for resource benefit. I hope you agree, and agree that this should be clearly laid out in the Proposed Action, along with an explanation of the steps that will be taken to meet this goal. Also needed are explicit maps of where these areas will be or will not be. Where managed wildfire is not feasible, it is important to provide clarity about how fires will be managed to effectively restore the natural fire regime even in these areas. The EIS does need to propose explicit policy actions and locations to restore the historical fire regime.

The Proposed Action should clearly demonstrate that the project is worthwhile and will achieve the goals required by the Omnibus Act, which is to restore the forest and restore the fire regime. The plan itself and the extent of expected success in achieving these goals, along with the environmental impacts, should be on display in the draft EIS for every alternative.

Use more fire to accomplish restoration itself

The Kaibab National Forest is a national leader in wildland fire use and managing fire for resource benefits, yet this Proposed Action does not even mention using wildland fire to accomplish restoration, instead just mechanical/prescribed fire or prescribed fire alone. Please include use of wildland fire for resource benefit whenever and wherever it is possible to use it during the 10-year project period. Over the course of ten years, a great deal of restoration could likely be accomplished with this technique. Based on the Kaibab's achievement of 98% of wildfires managed for resource benefit, over about 25,000 acres in one year, it would not be surprising if 10-20% of the project area could be restored this way, reducing costs and achieving better ecological results.

Use the final agreement about how to treat and monitor MSO habitat

Phase 1 of 4FRI, regarding the MSO, met with objections from Wild Earth Guardians and John Muir Project and an agreement was forged that phased in actions in MSO habitat, combined with monitoring and re-evaluation. Nothing about that agreement is in this new Proposed Action. Please go back to that agreement, explain it in detail in the draft EIS, along with whatever data have been collected, and put it back in as the preferred alternative. That could help avoid another round of objections, which would be a waste of everyone's time and energy.

Too much area for "Facilitative operations" (p. 14) is proposed

It should not take 157,270 acres of area to facilitate adjoining actions–that is a huge area to prescribe burn just to allow mechanical/prescribed burned next door. This need should just

require a small area and most of this can be right within the actual treatment area by blackening the margins first.

Don't plant the 69,360 acres of burned forests that you are calling "understocked"

Both the Williams and Baker (2012) reconstruction and the Plummer (1904) report show treeless areas and grasslands. These were likely created or maintained historically in part by high-severity fires, as they were historically closely intermixed with high-severity fire areas (W&B Fig. 3). Early successional habitat is very rare in western dry forests because it is typically planted to meet forestry goals, as indicated here by the use of the term "understocked" in this case. However, this is an ecological restoration project where the habitats that are created by fire should be left to slowly return to forest, rather than being planted to expedite forestry goals.

It especially makes no sense to remove trees in existing grasslands to restore grasslands but plant trees in other grasslands (those created by fire). It is particularly important to not plant these fire-created grasslands, especially since restoring grasslands is a high priority for the Arizona Partners in Flight bird conservation plan.

Lots of other good things in the Proposed Action too

Decommissioning roads, relocating roads having adverse impacts, restoring hydrologic function in meadews and springs, restoring riparian areas are all wonderful to see in the restoration program.

I appreciate your attention to the concerns I raise in this letter. I know that the task you have is very large already.

Sincerely,

William L. Baker, Ph.D.
Emeritus Professor of Ecology, University of Wyoming