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RE: 30-Day comments on the proposed Cooke City Fuels and Forest Health project.

Relevant background: From 1992 to 2006 I was a Research Scientist and Project Leader for the Forest Service, Rocky Mountain Research Station. During that time, my main research interest and expertise was the disturbance ecology of whitebark pine. I have published extensively in the peer-reviewed literature regarding whitebark decline in the Greater Yellowstone Ecosystem (GYE). Since retiring from Forest Service Research in 2006, I have remained active in advocacy for high-elevation forests of the GYE and have maintained familiarity with current whitebark research and literature.

My response to this proposal:
The Cooke City Fuels and Forest Health Project is so ambitious, and the potential negative impacts are so far-reaching that I hardly know where to begin. I have concerns about wildlife, public safety, inventoried roadless areas, and the list goes on. Although these concerns are real, because of educational and vocational background, I will restrict my comments to forest health issues, and in particular, those relating to the proposed whitebark pine enhancement treatments.

I. Healthiest climax whitebark forest in entire GYE
The climax whitebark forests in the Cooke City area are among the healthiest whitebark forests remaining in the entire Greater Yellowstone Ecosystem (GYE). Durning the recent major mountain pine beetle (MPB) outbreak that killed over 70% of cone bearing GYE whitebark (Thoma, et al. 2019), the Cooke City area was one of few that was largely unaffected (Macfarlane, et al. 2013, Fig. A.1). Although more recent work (Macfarlane et al. 2023) documents continuing post-outbreak MPB chronic mortality, the Beartooth Plateau and the climax whitebark forests surrounding Cooke City remain among the few areas with low cumulative mortality (Fig. A.2).

The proposed whitebark enhancement treatments (those that contain whitebark) are climax whitebark forests that have been on this landscape for centuries (my estimate based on past research experience is that they are at least 400 years old). The competing forest type that will be mechanically removed are primarily, if not entirely, subalpine fir. Subalpine fir and whitebark have co-existed for untold millennia in these subalpine habitats resulting in the current stable, healthy climax whitebark forests.

What is the justification for disturbing this co-evolved relationship that has resulted in stable, healthy forests? How can disruptive management intervention applied to an already healthy system meet the requirement of best science? At the very least, a thorough inventory needs to be made documenting the forest health status of the proposed treatment polygons, including characteristic stand age, and level and source of any existing mortality. In fact, a full EIS should be conducted.

II. Whitebark forests of today are not the whitebark forests of the future
Whitebark pine is supremely adapted for survival in climatic conditions too harsh for most other conifer species (McCaughey et al. 1990). The entire evolutionary strategy of whitebark has been to avoid competition from other conifers and depredation by insect pests by occupying these high elevation habitats (Logan and Powell 2001). The same adaptive traits that result in whitebark suitability for high elevation, harsh environments result in vulnerability to a warming climate (Igesias et all. 2008). The current distribution of whitebark in the Greater Yellowstone Ecosystem is largely restricted to subalpine habitats greater than 8,500 ft. to current treeline Maher (2018). With increasing temperatures, loss of conditions that maintain whitebark on these currently occupied

landscapes will occur within a 100 yr. planning framework regardless of management actions. A preponderance of peer-reviewed research supports this assertion.

The history of whitebark during the entire Holocene supports the progressive migration to higher/harsher habitats as climate warmed following retreat of the Yellowstone ice cap. With the retreat of ice, alpine tundra were the first plants to colonize this emerging habitat. Five needle pines, most likely whitebark, were next. Sediment analysis from Dailey Lake (elevation 5,500 ft.) indicates that at one-time whitebark occupied this site (Gennett and Baker 1986) while its current distribution is restricted to elevations greater than 8,500 ft. to current treeline (Macfarlane, et al. 2013), the distribution for the Cooke City Fuels Project are elevations above 8,700 ft. (Fig. A 3)

Climate envelope modeling (Chang et al. 2914) indicates an upward shift resulting in a 70% loss of suitable whitebark habitat by end of century. Other research projects whitebark range will be dramatically reduced (Rommie and Turner. 1991, Bartlein et al 1997, Schrag, et al. 2008, Sidder, et al. 2016, Hansen et. al 2016, Buotte et al 2017, Chavez et al. 2018). While these differ in their predictions depending primarily on which climate scenario is used, the consensus is that significant habitat will be lost through upward elevational migration by the end of the current century.

Recent research results from melting snowfields on the Beartooth Plateau found that whitebark has shifted its range upwards by at least 600 vertical feet above present treeline. during past warm periods, and downward to lower elevation during cold periods (Gregory et al. 2024). Other research documents the advance of competitively superior species into current whitebark habitat during previous warm climates (Fall, et al. 1995, Maher 2018, Lenoir et al. 2008). This combination indicates that whitebark was excluded in its current range by encroachment of other competitively super conifers during warm periods and that the adaptive strategy of whitebark was to migrate into habitats above current treeline during cold periods.

The lower elevation (less than 8,700 ft. in elevation) polygons scheduled for whitebark enhancement treatment (Figs. 3, 4 A, B) was aggressively colonized by lodgepole pine following the 1988 Storm Creek fire, which raises the question, what is the percentage of non-serotinous cones in this lodgepole regeneration forest? What is the chance that up-slope winds will wind dispersed lodgepole seeds into the proposed whitebark enhancement treatments in the Fisher and Miller Creek drainages where enhancement treatments will facilitate lodgepole seedling establishment (Maher 2018a, b).

The current whitebark distribution proposed for treatment includes important wildlife species sensitive to the proposed managements treatments. These species include lynx, wolverine, grizzly bears, and wolves as recognized in the Environmental Assessment. The long term (10 yr.) timeline for this project will result in significant, long lasting displacement of sensitive species.

III. Proposed whitebark enhancement treatments that contain no whitebark
Whitebark enhancement treatments are proposed in areas below 8,700' in elevation that contain no whitebark (Fig A.3, A.4 A and B). How can these be justified on any management criteria based in "best science?"

I have skied (or at least attempted to) through this area many times, and it is a dog-hair monoculture of 1988 post-fire regeneration lodgepole pine. Although I admit there could be whitebark understory that is covered by snow, local friends who visit this area during summer confirm lack of whitebark in the understory.

Even if occasional whitebark seedling/saplings occur in the understory of these treatment polygons, what is their chance of reaching cone-bearing age? Peer-reviewed science (see Section I above) indicates the climate driven trajectory of these forests is to early serial lodgepole regardless of management intervention This evidence is based on both documented evidence spanning the entire Holocene and best science model projections within a 100 year planning framework (see Section I).

IV. Daylighting has not been demonstrated to be effective

Daylight thinning treatments are designed to remove competing species, so called daylighting. The efficacy of such treatments is largely undocumented and unsubstantiated. While the peer-reviewed literature documents whitebark growth release following such treatments (Retalaff et al 2018, Kichas et al. 2024), there has typically been no follow up monitoring to evaluate long-term effects such as recruitment.

The supporting EA At Risk Effects Analysis is rife with vague references to expected results with no supporting documentation. In fact, the only peer-reviewed reference is Keane et al. (2022), In one of the few studies evaluating treatment effects, Maher et al. (2018) found variable growth response and that, "While some management goals were achieved, many were not, and there were some unintended consequences."

Treatments are designed to remove competing conifers, and in the designated polygons, that means almost exclusively removing subalpine fir. (Sec. I). Subalpine fir and whitebark have co-existed successfully in these forests for centuries. However, the major threats (FWS) of white pine blister rust (WPBR) and mountain pine beetles (FWS 2021) will not be affected by treatments, and in fact by increasing air movement through the stand may increase risk of infection by the aerial dispersed WPBR spors.

While the positive impacts of daylight treatments are speculative, the collateral damage of such treatments is unambiguous. These deleterious impacts include the direct effect of mechanical disturbance acknowledged in the EA At-Risk Effects Analysis, but also include the potential for treatments to accelerate the replacement of whitebark by other conifers, namely lodgepole pine and subalpine fir. Maher (2018) found strong evidence that treatments increased recruitment of competing conifers. An abundant seed source for the aerial dispersed lodgepole pine seeds is in close proximity to the proposed treatment blocks (Fig. A.3).

A recent (2011) whitebark treatment project was conducted in the Fisher Creek drainage. No efficacy evaluation of this project has been made, and yet, a larger, more ambitious whitebark enhancement project is proposed for the same area. At the very least, a full efficacy evaluation of results from this previous project needs to be made.

Inadequate treatment of a rapidly warming climate

Climate warming is the ultimate driving factor for elevational displacement of whitebark as conditions become more favorable for competing conifer species. Significant displacement of whitebark is projected to occur within a 100 year management framework, and in fact may be already occurring (Lenoir 2008, Greenwood and Jump 2014 and references therein). The major impact of climate warming is not so much the intolerance of whitebark to warm temperatures, but the release of constraining conditions for competing conifers (McCaughey et al. 2009). In other words, its distribution is determined not so much by where favorable conditions exist for whitebark, but where climate conditions are unfavorable for competing conifers.

In many circumstances, climate warming and increased favorability to outbreak populations of mountain pine beetle plays the dominant role in whitebark decline (Jules et al. 2016, Maher 2018 a, b) found that mountain pine beetle mortality vastly exceeded white pine blister rust mortality (86% to 14%, respectively) in his study plots located in Montana, Idaho, and Oregon. In the Greater Yellowstone Ecosystem, the recent outbreak resulted in 75% mortality of cone-bearing whitebark (Thom et al. 2019).

Expansion of mountain pine beetle outbreak populations into high elevation whitebark pine habitats is one of first examples of a modeled prediction of climate warming impacts that played out almost exactly as predicted (Logan and Powell 2001, Logan et al. 2010, Macfarlane et al. 2013). Once established, and with the amount of continued climate warming in the foreseeable future, continued episodic outbreaks of mountain pine beetles are projected to intensify, and to impact an increasing proportion of whitebark's current distribution. By mid-century, climate conditions over most of the current whitebark distribution will be as favorable for mountain pine beetles as during the catastrophic outbreaks of the early 2000s (Boutte et al. 2016, 2017).

Whitebark vulnerability to mountain pine beetle attack, at least in part results from mal-adaptive chemical defenses. The resin composition of whitebark is exactly backwards, high in those chemicals that the beetle uses to focus attack and lacking those that defend the tree from attack. (Logan et al. 2010, Raffa et al. 2013; 2017). Rather than evolve effective defensive defenses, whitebark's adaptive strategy has been avoiding competition and insect pests by occupying climatic regions too harsh for either (see section I. above).

Management actions that disregard the climate driven elevational plasticity of whitebark, accelerated by climate-released insect pests, cannot claim to be consistent with the requirement of best science.

Conclusions and Recommendations

Lack of adequately considering the negative impacts of the proposed whitebark enhancement treatments combined with the overly optimistic statement of their benefits has resulted in an egregiously flawed Environmental Assessment. The far-reaching implications of the proposed work warrants conducting a full Environmental Impact Statement that includes evaluation of the Fisher Creek treatments.

The stated purpose of enhancement treatments in this project is maintaining the current range of whitebark forests into the foreseeable future. Past historical evidence, recent research, and model predictions indicate a more likely trajectory regardless of treatment is displacement of whitebark from its current distribution by other, competitively superior conifers, and range expansion of whitebark into higher elevation habitats near or above current treeline. Alternative approaches to the proposed disruptive project should be considered. Foremost among these is aggressive planting (or seeding) blister rust resistant whitebark near or above current treeline. i.e. assisted migration (Palmer and Larson 2014, McLane and Atkins 2012).

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