

Data Submitted (UTC 11): 10/29/2021 6:00:00 AM

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Comments: We filed substantive and timely comments to the revised plan and DEIS on November 7, 2019. In support of these comments, a host of accurate, reliable and relevant peer-reviewed studies pertinent to managing the Santa Fe National Forest (SFNF) were assembled by Dr. Dominick DellaSala and submitted on September 30, 2019. Unfortunately, our comments and these studies were for the most part dismissed, ignored or misinterpreted without valid explanation in the Final Environmental Impact Statement, Vol. 4, App. O, response to comments (FEIS, App. O). Examples include: 1) the statistical methodology in Baker (2017) for determining fire rotation on the SFNF was dismissed as irrelevant without valid explanation (FEIS, App. O p. 60); 2) DellaSala and Hanson (2019) was dismissed in favor of unpublished data claiming high-severity fire patches have increased on the SFNF (FEIS, App. O pp. 60-61); 3) Hutto et al. (2016) was misinterpreted and then cited as relevant while DellaSala (2017) and DellaSala and Hanson (2019) were dismissed despite the fact that the three studies came to the same conclusion regarding high severity fire in ponderosa pine forests (FEIS, App. O, p. 60); 4) ignored were the conceptual biases documented by Iftikhar and Pannell (2015) that were clearly evident in this analysis (FEIS, App. O, p. 63); 5) wildfire emission studies by Mitchell (2015), Mitchell et al. (2009) and Jones et al. (2019) pertinent to analyzing climate impacts were dismissed without valid explanation (FEIS, App. O p. 340-341 and pp. 39-40); and 6) Schoennagel et al. (2017) was ignored possibly because it showed the ineffectiveness of thinning (not cited in the FEIS). The three main supporting reasons to this objection were first raised in substantive comments to the draft documents. First, the Santa Fe National Forest Land Management Plan (revised plan) and the four volume Final Environmental Impact Statement (FEIS) fails to use the best available scientific information to inform the planning process required by the 2012 Planning Rule 36 C.F.R. [sect] 219.3. Supporting reasons are contained in the attached document by Dr. Dominick DellaSala with separately attached studies and Web links. Second, the revised plan and FEIS fail to provide for the diversity of tree species as required by the National Forest Management Act 16 U.S.C. [sect] 1604(g)(3)(B). See section below on the failure to provide for the conservation of five-needle white pines on the SFNF and separately attached studies and Web links. Third, the FEIS violates the National Environmental Policy Act (NEPA) by failing to respond to substantive comments concerning the impacts of air pollution to public health 40 C.F.R. 1503.4(a). See below and attached report by Dr. Ann McCampbell with separately attached studies and Web links. The revised plan and FEIS could be greatly improved by complying with applicable laws that protect biologically diverse forests according to the wishes of most public owners of the SFNF.

1. The Revised Plan and FEIS Fail to Provide for Five-Needle White Pine Conservation on the Santa Fe National Forest

Introduction

The National Forest Management Act (NFMA) requires that the Forest Service adopt guidelines for the management of national forests that "provide for diversity of plant and animal communities." Trees are singled out in NFMA which directs that "steps to be taken to preserve the diversity of tree species." 16 U.S.C. [sect] 1604(g)(3)(B). Tree diversity is also emphasized in the 2012 Planning Rule by requiring that plans maintain or restore "the diversity of native tree species similar to that existing in the plan area." 36 CFR 219.9(a)(2)(iii). The Planning Rule also requires the use of the best available science to inform the planning process. 36 C.F.R. [sect] 219.3. In implementing NFMA's diversity mandate more generally "genetic diversity within species in ecosystems" is given prominence as a key element in the adaptive capacity of ecosystems to respond to disturbances and stressors. Forest Service Land Management Planning Handbook 1909.12.05. Despite the recommendations of expert Forest Service pathologists and researchers, the Santa Fe National Forest Land Management Plan (revised plan) does not acknowledge the unique diversity of the white pine complex, recognize multiple threats or propose binding measures to enhance and maintain their populations. As a result, fuel reduction targets are proposed that eliminate white pines from vast stretches of the landscape. Other threats include the recent appearance on the Santa Fe National Forest (SFNF) of a century-old exotic rust, potential bark beetle outbreaks, a history of mismanaged fire and most significantly a rapidly warming and drying climate. The revised plan does not take a hard look at these cumulative threats or, while it is still possible, propose proactive strategies to conserve a diverse germ plasm needed to confront the dual threats of climate disruption and exotic disease. This failure violates NFMA's mandate to preserve diversity in general and

tree diversity in particular. This objection to the revised plan is being filed because the agency has not taken the appropriate steps to address the gravity of threats facing white pines on the SFNF. The revised plan and the four volume Final Environmental Impact Statement (FEIS) makes only passing reference to white pines or white pine blister rust. There is nothing about the impacts of widespread clearing and burning to white pine genetic diversity needed to adapt to the rapidly warming and drying climate. In response to our earlier comments, the revised plan added to its desired condition for native biota: "Habitats and refugia for rare, endemic, and culturally important species, are resilient to stressors and support species' persistence or recovery." A specific and measurable planning objective was not proposed to enforce this desired condition. Refugia is not defined or mentioned elsewhere in the revised plan. Absent is a criteria for designation and management of habitats and/or refugia for native biota. It is also unclear under what legal authority such protected zones could be established and whether habitats and/or refugia have enforceable protected status. The desired condition by itself, while laudable, is but a vague aspiration and clearly not a sufficient regulatory mechanism. Areas cannot achieve lasting protection without first providing basic information on the status and threats to the white pine ecosystem. The lack of basic information in this case violates a key tenet of NEPA which requires "that environmental information is available to public officials and citizens before decisions are made and before actions are taken." 40 C.F.R. [sect] 1500.1(b). In 2009 the Santa Fe Municipal Watershed 20 Year Protection Plan recommended that the self-sustaining southwestern white pine population be protected during on-going maintenance activities, including intentional burning (Margolis and Savage 2009). On December 21, 2018 we notified the SFNF Supervisor that thousands of white pines were being cut and piled for burning on the hillsides above Black Canyon adjacent to the watershed. There was no response. As a bulwark against the perils that lay ahead, the revised plan should seriously consider the proactive strategy suggested by its own experts as the best available science to preserve the SFNF's white pines (see below). It is long past time to begin for such an effort.

**Natural History and Biology**

The three species of five-needle white pines found on the SFNF are limber pine (*Pinus flexilis*), southwestern white pine (*P. strobiformis*) and Rocky Mountain bristlecone pine (*P. aristata*). They uniquely commingle on the SFNF at or near the limits of their geographical ranges. Northern New Mexico and Arizona and southern Utah and Colorado are the northern limit of the southwestern white pine population (Andresen and Steinhoff 1971). In contrast, limber pine reaches its southern limit in northern New Mexico. These two closely related species interbreed on the SFNF to form a unique hybrid zone that extends into southern Colorado (Benkman et al. 1984; Samano and Tomback 2003). In addition, the southern limit of Rocky Mountain bristlecone pine occurs on the Sangre de Cristo section of the SFNF. Both limber pine and Rocky Mountain bristlecone pine tolerate harsh, wind-swept sites at treeline and can be of great age. Limber pine is patchily distributed in western North America ranging from 2,250 ft to 12,500 ft (Schoettle et al. 2019). At high elevation sites it often grows with Rocky Mountain bristlecone pine. The range of southwestern white pine extends into the high elevations but also occurs as tall and full-crowned old-growth trees on favorable sites in the SFNF. These five-needle white pine species and their hybrids provide vital ecosystem services on the SFNF. Occurring at treeline where other conifers are absent, their shade and shelter delays snowmelt thus protracting downstream flow (LaMarche and Mooney 1972; Arno and Hammerly 1984; Bunn et al. 2005) and their root systems stabilize the loose, shallow, rocky substrates at high elevation, reducing erosion (Arno and Hammerly 1984; Farnes 1990). Their nutritious seeds are eaten by a diversity of wildlife including squirrels, bears, birds and other rodents. In conifer high-elevation five-needle pines also provide aesthetic and spiritual values for skiers, hikers, backpackers, climbers and mountain visitors to these unique environments. Significantly, five-needle white pines have coevolved a mutualistic relationship with Clark's nutcrackers (*Nucifraga columbiana*) with the pines obligately dependent upon the bird for dispersal of its large, wingless seeds (Tomback 1982). In late summer and early fall, nutcrackers extract ripe seeds from cones, transporting them to open areas in a specialized sublingual pouch. The seeds are cached in the ground with the birds returning to feed on these seeds for up to a year (Tomback 1982). Unretrieved seeds are the primary source of tree regeneration (Hutchins and Lanner 1982; Tomback 1982, 2001). After high-severity fire nutcrackers will travel long distances to cache pine seeds in newly open terrain making them among the first trees to stabilize disturbed sites.

**White Pine Blister Rust**

The accidental introduction of white pine blister rust *Cronartium ribicola* into Vancouver, British Columbia, on seedlings imported from Europe in 1910 initiated a catastrophe for western forest biodiversity (Mielke 1943, Hummer 2000, McDonald and Hoff 2001). The magnificent western white pines (*Pinus monticola*) in the Inland Northwest were the first to succumb. By the

late 1960s, they were nearly gone, decimated by a combination of blister rust, commercial high-grade logging, mountain pine beetle outbreaks and fire mismanagement. Today only 5 to 10 percent of the original 5 million acres still carries a significant component of western white pine (Kinloch 2003). This despite spending \$150 million over a period of 50 years unsuccessfully attempting to eliminate plants in the genus *Ribes* that serve as its primary alternate host (Fins et al. 2002). At first tree branches are killed, reducing photosynthesis and cone production; if the disease grows into the trunk or starts in the trunk, it can girdle trees and kill them. Most infected trees lose their cone-producing capacity years before succumbing to blister rust, resulting in diminished natural regeneration. White pine blister rust is now well established on two other species of five-needle white pine, the limber pine and Rocky Mountain bristlecone pine in nearby south-central Colorado (Blodgett and Sullivan 2004). The incidence and severity of the disease are expected to increase over time, leading to negative impacts on bio-diversity and ecosystem processes (Schoettle et al. 2019). A 40 percent loss in basal area of limber pine is projected by 2030 (Krist et al. 2014). Limber pine is designated as a Species of Management Concern in Rocky Mountain National Park and is of management interest on other Federal, State, and county lands (Burns et al. 2008). It is listed as endangered in Canada and Alberta. Limber pine in Wyoming, where it is more common than in any other State, is on the Bureau of Land Management Wyoming's Special Status Species list. On December 2, 2020 white bark pine (*Pinus albicaulis*) was proposed by the U.S. Fish and Wildlife Service for listing as threatened under the Endangered Species Act. Infection levels from blister rust can be as high as 100% in the northern part of its range. Rapidly warming temperatures are shrinking the white bark pine's high elevation habitat and making it unlikely that this slow growing relatively immobile species can adapt and compete with the expanding range of neighboring species. Rocky Mountain bristlecone pine occurs in disjunct mountain-top populations throughout Colorado and northern New Mexico. Little is known about the species' genetic structure or ability to adapt to threats caused by the blister rust, climate change in high elevation systems and bark beetle outbreaks. However it is beyond doubt that the combination of low genetic diversity, high population isolation and long regeneration times puts the bristlecone population at considerable risk (Schoettle et al. 2010).

The imperiled state of white bark pine and some populations of limber pine are harbingers of what is to come if proactive action is not taken soon to conserve five-needle pines on the SFNF (Coop and Schoettle 2011). White Pine Blister Rust in New Mexico The largest white pine populations in New Mexico are on the SFNF in the north and the Lincoln and Gila National Forests in the south. The first white pine blister rust infection was detected in New Mexico on southwestern white pine near Cloudcroft in March 1990 (Hawkworth 1990) and was described as having "savage intensity" (Kinloch 2003). Frank et al. (2008) demonstrated how this and other infestations in the Southwest and adjacent regions could have resulted from long-distance (>100s of km), aerial dispersal of spores from the Pacific Southwest. Surveys conducted between 1990 and 2002 estimated the disease was increasing by an average of 2.6 % per year among white pines (Conklin 2004). Blister rust infections have been found on SFNF white pines on in the Jemez and near Las Vegas. The disease is also present on the Gila, Apache-Sitgreaves and Cibola national forests. There is a high risk of the infection spreading to surrounding mountain ranges (Geils et al. 1999). Recent research has identified high levels of resistance to blister rust in Southwestern white pines that may prove useful in restoration and possible future reforestation efforts. Trees grown from seed collected in the Lincoln, Cibola and Santa Fe National Forests were inoculated with blister rust spores. After 7.5 years three populations had a greater than 70% survival representing perhaps the highest level of resistance documented to date in a North American white pine species (Johnson and Snieszko 2021 in press). These findings add urgency to the need to identify and protect in the wild genetically unique five-needle white pine populations.

Five-Needle White Pine Conservation Major conservation programs are underway in the Rocky Mountains to promote self-sustaining five-needle white pine ecosystems that have both resilience to disturbances and genetic resistance to white pine blister rust. A key strategy is to conserve the intact genetic diversity of native populations in ecosystems such as those on the SFNF that have not yet been impacted by widespread infection. (Keane and Schoettle 2011) and encourage natural regeneration. This would include ecosystems that provide habitat for southwestern white pine, limber pine, Rocky Mountain bristlecone pine and hybrid populations unique to the SFNF that may harbor rust-resistant genes. All are in imminent danger from blister rust and other stressors (Tomback, 2011). Evidence suggests that southwestern white pine and limber pine on the SFNF are hybridizing and moving north in response to climate disruption (Menon et al. 2019). This

expanding hybrid zone may contain novel adaptive traits to more effectively resist blister rust infection and combine loblolly pine's greater cold tolerance with southwestern white pine's ability to better withstand drought (Menon et al. 2021). The revised plan should provide standards to facilitate this northward expansion. These hybrid populations are an ideal source for germ plasm that may be needed for assisted migration in the coming decades. The revised plan should highlight the need for a proactive strategy and facilitate its implementation. Keane and Schoettle 2011 provide a credible strategy for areas such as the SFNF that harbor intact and unique five-needle white pine populations. These measures include:

[bull] Educate and engage. Increase awareness of the threats to the High Elevation Five Needle Pine ecosystems and facilitate a shift from crisis management to managing for sustained resilience. [bull] Gene conservation. Take advantage of the intact healthy ecosystems to assess and capture the genetic diversity for gene conservation, research and future management activities. [bull] Research patterns, processes and responses. Gain information on natural disturbances and management responses to provide valuable process-level information to evaluate future impacts and treatment effectiveness as well as parameterize predictive models. Assess geographic patterns of natural frequencies of resistance mechanisms to white pine blister rust. [bull] Prepare the landscape for change. Develop and implement interventions to increase adaptive capacity, mitigate ecosystem impacts of tree mortality, and accelerate the increase in frequency of rust resistance. The creation of large and small openings should be avoided as it heightens the potential for blister rust damage (Schwandt et al. 1994; Fins et al. 2001). Increased sunlight reaching the forest floor often causes Ribes, the main alternative host, to proliferate leading to increased opportunities for the spread of blister rust. Dense conditions limit not only Ribes, but also dispersal of rust spores. Forest Service pathologists in the Southwest recommend careful consideration of the potential hazard of clearing and burning projects that may increase long-term damage from blister rust (Conklin et al. 2009). Not being a desired timber species, five-needle white pines are often targeted in mixed stands for removal in favor of ponderosa pine and Douglas fir. This practice is abetted by the mistaken belief that white pines are less fire-resistant than other species. In fact, white pines are ecologically well-adapted to fire. The discrimination against white pines is a misinformed legacy from the past. The revised plan should establish standards that favor white pines in silvicultural treatments as a simple and cost-effective conservation strategy. It should be noted that five-needle white pines are generally present in low numbers on the SFNF and thus preserving them does not greatly affect other management objectives. But low numbers also mean unique genetic variants can be eliminated in landscape scale fuel reduction projects which could swiftly lead to vortices of extinction (Conklin et al. 2009). In summary, the revised plan fails to establish proactive standards to protect populations of native five-needle white pines threatened by an exotic disease, climate disruption and landscape level fuel reduction targets. Failing to act now, before significant loss of tree diversity, is not an approach informed by the best available science (Tomback et al. 2001b2. The Revised Plan and FEIS Fail to Respond to Substantive Comments on the Impacts to Human Health of Polluted Air We commented on the draft plan/DEIS concerning the failure to disclose and analyze the impacts to public health of intentional burning (prescribed fire) resulting in polluted air (FEIS, Vol. 4 App. O, p. 16, letter 12685 with Appendix A)). The revised plan selectively quotes Wiedinmyer and Hurteau (2010), a modeling study focused on West-wide carbon emission, to support the assumption that intentional burning will reduce public health impacts over the long-term (FEIS, Vol. 4, App. O. p. 163). This study does not address cumulative emissions from repeated burning or the feasibility of implementing a wide-scale program of intentional burning. As we noted in our earlier comments, landscape scale burning over many years would very likely expose affected citizens to far more smoke particulates than emissions produced by an infrequent high intensity wildfire. The attached updated report by Dr. McCampbell [mdash] Human Health Effects of Wildland Smoke [mdash] cites data from the American Lung Association that nearly everyone in Santa Fe County is being affected by the cumulative effects of smoke from intentional burning and wildland fires (see p.6). The most at-risk are those with chemical sensitivities that experience serious physical reactions when exposed to even minute amounts of pollutants. This 31 page report that cites 59 peer-review studies is clearly the best available science on the public health impacts of intentional burning. An earlier version of Dr. McCampbell's report was ignored in violation of the agency's duty to respond to all substantive comments in the FEIS. 40 C.F.R. 1503.4(a). The updated report is attached for review and consideration. (See Attached Objection for list of references and for footnotes)