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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 studiespertinent to managing the Santa Fe National Forest (SFNF) were assembled by Dr. DominickDellaSala and submitted on September 30, 2019. Unfortunately, our comments and these studieswere for the most part dismissed, ignored or misinterpreted without valid explanation in the FinalEnvironmental Impact Statement, Vol. 4, App. O, response to comments (FEIS, App. O).Examples include: 1) the statistical methodology in Baker (2017) for determining fire rotationson 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 O p. 60); 2)DellaSala and Hanson (2019) was dismissed in favor of unpublished data claiming high-severityfire patches have increased on the SFNF (FEIS, App. O pp. 60-61); 3) Hutto et al. (2016) wasmisinterpreted 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 conclusionregarding high severity fire in ponderosa pine forests (FEIS, App. O, p. 60); 4) ignored were theconceptual biases documented by Iftekhar and Pannell (2015) that were clearly evident in thisanalysis (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 withoutvalid explanation (FEIS, App. O p. 340-341 and pp. 39-40); and 6) Schoennagel et al. (2017) wasignored 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 tothe 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 availablescientific information to inform the planning process required by the 2012 Planning Rule 36C.F.R.[sect] 219.3. Supporting reasons are contained in the attached document by Dr. DominickDellaSala with separately attached studies and Web links.Second, the revised plan and FEIS fail to provide for the diversity of tree species as required bythe National Forest Management Act 16 U.S.C. [sect]1604(g)(3)(B). See section below on the failureto provide for the conservation of five-needle white pines on the SFNF and separately attachedstudies and Web links.Third, the FEIS violates the National Environmental Policy Act (NEPA) by failing to respond tosubstantive 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 attachedstudies and Web links.The revised plan and FEIS could be great improved by complying with applicable laws thatprotect 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 PineConservation on the Santa Fe National ForestIntroductionThe National Forest Management Act (NFMA) requires that the Forest Service adopt guidelinesfor the management of national forests that "provide for diversity of plant and animalcommunities." Trees are singled out in NFMA which directs that "steps to be taken to preservethe 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 orrestore "the diversity of native tree species similar to that existing in the plan area." 36 CFR219.9(a)(2)(iii). The Planning Rule also requires the use of the best available science to informthe planning process. 36 C.F.R. [sect] 219.3.In implementing NFMA's diversity mandate more generally "genetic diversity within species inecosystems" is given prominence as a key element in the adaptive capacity of ecosystems torespond to disturbances and stressors. Forest Service Land Management Planning Handbook1909.12.05.Despite the recommendations of expert Forest Service pathologists and researchers, the SantaFe National Forest Land Management Plan (revised plan) does not acknowledge the uniquediversity of the white pine complex, recognize multiple threats or propose binding measures toenhance and maintain their populations. As a result, fuel reduction targets are proposed thateliminate white pines from vast stretches of the landscape. Other threats include the recentappearance on the Santa Fe National Forest (SFNF) of a century-old exotic rust, potential barkbeetle outbreaks, a history of mismanaged fire and most significantly a rapidly warming anddrying climate. The revised plan does not take a hard look at these cumulative threats or, while itis still possible, propose proactive strategies to conserve a diverse germ plasm needed to confrontthe dual threats of climate disruption and exotic disease. This failure violates NFMA's mandateto 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 appropriatesteps to address the gravity of threats facing white pines on the SFNF. The revised plan and thefour volume Final Environmental Impact Statement (FEIS) makes only passing reference towhite pines or white pine blister rust. There is nothing about the impacts of widespread clearingand burning to white pine genetic diversity needed to adapt to the rapidly warming and dryingclimate.In response to our earlier comments, the revised plan added to its desired condition for nativebiota: "Habitats and refugia for rare, endemic, and culturally important species, are resilient tostressors and support species' persistence or recovery."A specific and measurable planning objective was not proposed to enforce this desire condition.Refugia is not defined or mentioned elsewhere in the revised plan. Absent is a criteria fordesignation and management of habitats and/or refugia for native biota. It is also unclear underwhat legal authority such protected zones could be established and whether habitats and/orrefugia have enforceable protected status. The desired condition by itself, while laudable, is but avague aspiration and clearly not a sufficient regulatory mechanism.Areas cannot achieve lasting protection without first providing basic information on the statusand threats to the white pine ecosystem. The lack of basic information in this case violates a keytenet of NEPA which requires "that environmental information is available to public officials andcitizens 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-sustainingsouthwestern white pine population be protected during on-going maintenanceactivities, including intentional burning (Margolis and Savage 2009). On December 21, 2018 wenotified the SFNF Supervisor that thousand of white pines were being cut and piled for burningon 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 theproactive strategy suggested by its own experts as the best available science to preserve theSFNF's white pines (see below). It is long past time to begin for such an effort.Natural History and BiologyThe 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 thesouthwestern white pine population (Andresen and Steinhoff 1971). In contrast, limber pinereaches its southern limit in northern New Mexico. These two closely related species interbreedon 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 Mountainbristlecone pine occurs on the Sangre de Cristo section of the SFNF.Both limber pine and Rocky Mountain bristlecone pine tolerate harsh, wind-swept sites attreeline and can be of great age. Limber pine is patchily distributed in western North Americaranging from 2,250 ft to 12,500 ft (Schoettle et al. 2019). At high elevation sites it often growswith Rocky Mountain bristlecone pine. The range of southwestern white pine extends into thehigh elevations but also occurs as tall and full-crowned old-growth trees on favorable sites in theSFNF.These five-needle white pine species and their hybrids provide vital ecosystem services on theSFNF. Occurring at treeline where other conifers are absent, their shade and shelter delays snowmelt thus protracting downstream flow (LaMarche and Mooney 1972; Arno and Hammerly1984; Bunn et al. 2005) and their root systems stabilize the loose, shallow, rocky substrates athigh elevation, reducing erosion (Arno and Hammerly 1984; Farnes 1990). Their nutritious seedsare eaten by a diversity of wildlife including squirrels, bears, birds and other rodents. Iconichigh-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'snutcrackers (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 specializedsublingual pouch. The seeds are cached in the ground with the birds returning to feed on theseeds for up to a year (Tomback 1982). Unretrieved seeds are the primary source of treeregeneration (Hutchins and Lanner 1982; Tomback 1982, 2001). After high-severity firenutcrackers will travel long distances to cache pine seeds in newly open terrain making themamong the first trees to stabilize disturbed sites.White Pine Blister RustThe accidental introduction of white pine blister rust Cronartium ribicola into Vancouver, BritishColumbia, on seedlings imported from Europe in 1910 initiated a catastrophe for western forestbiodiversity (Mielke 1943, Hummer 2000, McDonald and Hoff 2001). The magnificent westernwhite pines (Pinus monticola) in the Inland Northwest were the first to succumb. By the

late1960s, they were nearly gone, decimated by a combination of blister rust, commercial high-gradelogging, mountain pine beetle outbreaks and fire mismanagement. Today only 5 to 10 percent ofthe original 5 million acres still carries a significant component of western white pine (Kinloch2003). This despite spending $150 million over a period of 50 years unsuccessfully attempting toeliminate 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 diseasegrows into the trunk or starts in the trunk, it can girdle trees and kill them. Most infected treeslose their cone-producing capacity years before succumbing to blister rust, resulting indiminished natural regeneration.White pine blister rust is now well established on two other species of five-needle white pine, thelimber pine and Rocky Mountain bristlecone pine in nearby south-central Colorado (Blodgettand 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 40percent 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 ofmanagement interest on other Federal, State, and county lands (Burns et al. 2008). It is listed asendangered in Canada and Alberta. Limber pine in Wyoming, where it is more common than inany 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 andWildlife Service for listing as threatened under the Endangered Species Act. Infection levelsfrom blister rust can be as high as 100% in the northern part of its range. Rapidly warmingtemperatures are shrinking the white bark pine's high elevation habitat and making it unlikelythat this slow growing relatively immobile species can adapt and compete with the expandingrange of neighboring species.Rocky Mountain bristlecone pine occurs in disjunct mountain-top populations throughoutColorado and northern New Mexico. Little is known about the species' genetic structure orability to adapt to threats caused by the blister rust, climate change in high elevation systems andbark 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 atconsiderable risk (Schoettle et al 2010).
The imperiled state of white bark pine and some populations of limber pine are harbingers ofwhat 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 MexicoThe largest white pine populations in New Mexico are on the SFNF in the north and the Lincolnand 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) demonstratedhow this and other infestations in the Southwest and adjacent regions could have resulted fromlong-distance (>100s of km), aerial dispersal of spores from the Pacific Southwest. Surveysconducted 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 SFNFwhite 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 tosurrounding mountain ranges (Geils et al. 1999).Recent research has identified high levels of resistance to blister rust in Southwestern white pinesthat may prove useful in restoration and possible future reforestation efforts. Trees grown fromseed collected in the Lincoln, Cibola and Santa Fe National Forests were inoculated with blisterrust spores. After 7.5 years three population had a greater than 70% survival representing perhapsthe highest level of resistance documented to date in a North American white pine species(Johnson and Sniezko 2021 in press). These findings add urgency to the need to identify andprotect in the wild genetically unique five-needle white pine populations. Five-Needle White Pine ConservationMajor conservation programs are underway in the Rocky Mountains to promote self-sustainingfive-needle white pine ecosystems that have both resilience to disturbances and geneticresistance to white pine blister rust. A key strategy is to conserve the intact genetic diversity ofnative 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. Thiswould include ecosystems that provide habitat for southwestern white pine, limber pine, RockyMountain bristlecone pine and hybrid populations unique to the SFNF that may harbor rustresistant 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 andmoving north in response to climate disruption (Menon et al. 2019). This

expanding hybrid zonemay contain novel adaptive traits to more effectively resist blister rust infection and combinelimber pine's greater cold tolerance with southwestern white pine's ability to better withstanddrought (Menon et al. 2021). The revised plan should provide standards to facilitate thisnorthward expansion. These hybrid populations are an ideal source for germ plasm that may beneeded for assisted migration in the coming decades.The revised plan should highlight the need for a proactive strategy and facilitate itsimplementation. Keane and Schoettle 2011 provide a credible strategy for areas such as theSFNF that harbor intact and unique five-needle white pines populations. These measures include:
[bull] Educate and engage. Increase awareness of the threats to the High Elevation Five NeedlePine ecosystems and facilitate a shift from crisis management to managing for sustainedresilience.[bull] Gene conservation. Take advantage of the intact healthy ecosystems to assess and capturethe genetic diversity for gene conservation, research and future management activities.[bull] Research patterns, processes and responses. Gain information on natural disturbancesand 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 pineblister rust.[bull] Prepare the landscape for change. Develop and implement interventions to increaseadaptive capacity, mitigate ecosystem impacts of tree mortality, and accelerate theincrease in frequency of rust resistance.The creation of large and small openings should be avoided as it heightens the potential forblister rust damage (Schwandt et al. 1994; Fins et al. 2001). Increased sunlight reaching theforest floor often causes Ribes, the main alternative host, to proliferate leading to increasedopportunities for the spread of blister rust. Dense conditions limit not only Ribes, but alsodispersal of rust spores. Forest Service pathologists in the Southwest recommend carefulconsideration of the potential hazard of clearing and burning projects that may increase longtermdamage from blister rust (Conklin et al. 2009).Not being a desired timber species, five-needle white pines are often targeted in mixed stands forremoval in favor of ponderosa pine and Douglas fir. This practice is abetted by the mistakenbelief that white pines are less fire-resistant than other species. In fact, white pines areecologically well-adapted to fire. The discrimination against white pines is a misinformedlegacy from the past. The revised plan should establish standards that favor white pines insilvicultural 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 SFNFand thus preserving them does not greatly affect other management objectives. But lownumbers also mean unique genetic variants can be eliminated in landscape scale fuel reductionprojects 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 ofnative five-needle white pines threatened by an exotic disease, climate disruption and landscapelevel fuel reduction targets. Failing to act now, before significant loss of tree diversity, is not anapproach informed by the best available science (Tomback et al. 2001b2. The Revise Plan and FEIS Fail to Response to Substantive Comments onthe Impacts to Human Health of Polluted AirWe commented on the draft plan/DEIS concerning the failure to disclose and analyze the impactsto public health of intentional burning (prescribed fire) resulting in polluted air (FEIS, Vol. 4App. O, p. 16, letter 12685 with Appendix A)).The revised plan selectively quotes Wiedinmyer and Hurteau (2010), a modeling study focusedon West-wide carbon emission, to support the assumption that intentional burning will reducepublic health impacts over the long-term (FEIS, Vol. 4, App. O. p. 163). This study does notaddress cumulative emissions from repeated burning or the feasibility of implementing a widescaleprogram of intentional burning. As we noted in our earlier comments, landscape scaleburning over many years would very likely expose affected citizens to far more smokeparticulates 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 beingaffected 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 physicalreactions when exposed to even minute amounts of pollutants. This 31 page report that cites 59peer-review studies is clearly the best available science on the public health impacts ofintentional burning.An earlier version of Dr. McCampbell's report was ignored in violation of the agency's duty toresponse to all substantive comments in the FEIS. 40 C.F.R. 1503.4(a). The updated report isattached for review and consideration.(See Attached Objection for list of references and for footnotes)