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Center for Biological Diversity

May 15, 2018

Re: EA comments on "Chetco Bar Fire Salvage Project"
Submitted via: comments-pacificnorthwest-siskiyou-goldbeach@fs.fed.us

Please enter these comments into the record for the Chetco post-fire logging project EA. We appreciate the decision by the Forest Service to prohibit post-fire logging and related activities within late-successional reserves (LSRs) and inventoried roadless areas (IRAs), and the recognition of complex early seral forests as biodiverse. However, we have several concerns related to project activities that are not based on best available science nor provide sufficient mitigation for impacts to the human environment, as follows:

- High severity fire estimates derived from RAVG grossly over-estimate the actual amount of high severity in the project area and consequently the Forest Service will unnecessarily log large legacy trees, many of which may be misclassified as likely to die especially using low canopy scorch levels for tree marking.
- Fire regimes and condition classes used are dated, based on a very limited/ biased reporting of the literature, and there are unsupported conclusions about fuel loadings attributed to large dead trees.
- PDC retentions are grossly inadequate and arbitrarily determined for snag densities in logging units – e.g., only 2 snags per acre >20 in dbh.
- 70-acre patch retentions for Northern Spotted Owls (NSO) are grossly inadequate and do not represent enough of owl home ranges to avoid incidental take (see Bond et al. 2016).
- Logging will impact coho habitat, damage fragile soils from roads and burning of slash piles, and destroy habitat for extraordinary botanical resources, many of which are globally rare, fire adapted, and likely present in the project area.
- Roadside hazard tree removal is not reported as a cumulative impact even though over 100 miles in the project area will be impacted (a separate Categorical Exclusion is not sufficient for dismissing cumulative impacts).

Therefore, in sum, we request that you revise the draft EA as follows:

(1) Replace RAVG estimates with MTBS fire severity estimates that are comparable to other regional studies (as it stands, you cannot compare RAVG estimates for the project with studies of severity based on MTBS – this is apples to oranges);
(2) Retain more of the large (>20 in dbh) legacy trees by implementing treatments that do not rely solely on logging (see Pacific Southwest Hazard Tree Marking Guidelines, below) especially in spotted owl habitat and Riparian Reserves;

(3) Conduct botanical surveys and provide the public with results of spotted owl surveys in relation to areas slated for logging;
(4) Exclude steep slopes (>30%), fragile soils (ultramafic, granitics), and hydrological areas containing *Darlingtonia* fens (no helicopter logging);
(5) Drop undeveloped areas (826 acres,1.5 miles of temporary roads) and unmanaged (2,222 acres) stands from project logging activities, as logging will forever change their character; and
(6) Reduce log hauling distances (e.g., up to ~104 miles) that otherwise pose a significant impact to endangered coho salmon by further impairing water quality limited streams in the project area (mitigation is inadequate).
(7) Redo the cumulative effects section to take into account the substantial roadside logging and options for maintaining large trees as requested in our comments below.

Notably, the project area has several regionally recognized climate refugia properties not mentioned in the EA (e.g., intact watersheds; roadless areas; elevation and latitudinal gradients; riparian areas; mature forests; Olson et al. 2012). Post-fire logging and road building (13.5 miles of "temporary roads") would degrade these features, particularly the pulse of large legacy trees that can sustain an area (in terms of snags and other legacies) for decades (until the next fire). Further, we see no ecological need for post-fire logging and tree planting in the project area for the following reasons:

- Prior studies of the Biscuit burn area showed: (1) rapid conifer establishment from natural seed sources that exceeded those of planted areas (e.g., Donato et al., 2006, Campbell et al. 2010); and (2) post-fire logging killed most of the natural regeneration by removing biological legacies during Biscuit logging (Donato et al. 2006);
- Complex early seral forests represent the stage prior to conifer crown closure that can last 10-20 years depending on site conditions and which is as biodiverse as old growth when not logged (Swanson et al. 2011, DellaSala et. al 2014) (thus just because conifers have not quickly re-established does not mean the area is not biologically important);
- Sparse conifer establishment is not unexpected at least on some soil types (ultramafics) in this region – a rush to plant will truncate the most biodiverse early seral stage prior to conifer establishment as discussed (additionally, the EA provides no time frame on when natural conifer seedling establishment will be assessed – this is important, as there could be an initial delay followed by a pulse of natural seedling establishment that you will miss if seedling surveys are conducted immediately after the fire).

Thank you for the time to review our comments and the attached supporting pdfs. We request that you add this to our scoping comments, along with the pdfs provided.

Sincerely,

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FIRE REGIME CONDITION CLASS AND HIGH SEVERITY FIRE EFFECTS ARE NOT BASED ON BEST AVAILABLE SCIENCE

The EA incorrectly assumes fire regimes in the project area are predominately low mixed severity and therefore claims there is significant departure from historic conditions

The EA claims that there are spatially large and contiguous high severity patches greater than what would be expected under a "more typical fire regime." However, no data on high severity patch sizes are provided or any citations to back this assertion. Additionally, the EA claims, without data, that most of the project area (except riparian and low-lying areas) is in Fire Regime 1, but again provides no data or citations. The EA then contradicts itself by stating "high severity fire effects are within the natural range of variability for the Chetco Bar fire…"

Notably, fire regimes in the Klamath-Siskiyou are highly variable and include both small and large patches of high severity fire (Donato et al. 2009a,b, Perry et al. 2011, Halofsky et al. 2011, Odion et al. 2014 – see Supplemental). Large high severity patches occurred historically, including patch sizes likely equivalent to those currently in the project area (see Odion et al. 2014: Supplemental).

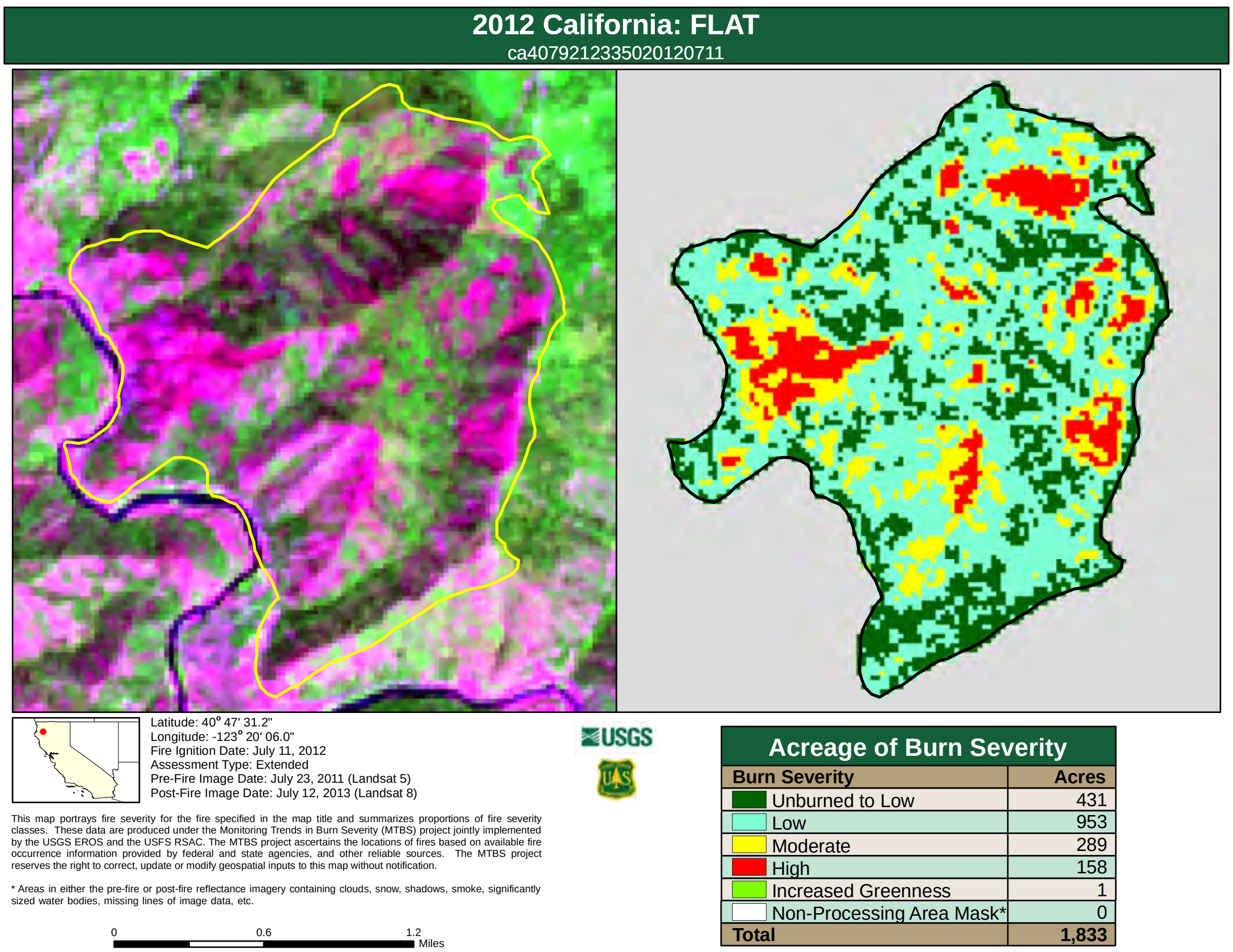
Additionally, Odion et al. (2004) showed that as time since fire increased in this region, fire severity actually declined presumably because as the overstory canopy closes, flammable shrubs are shaded out. Thus, the EA cannot claim that there is a departure from historic conditions in the project area without data nor that fire severity will increase as forests age (i.e., missed fire cycles) given the opposite has been reported (Odion et al. 2004).

We note that there are at least two inappropriate citations used in the EA to back claims not relevant to the study area or for high severity comparisons using different estimators. For instance, Miller (2012) (cited in the EA) actually used MTBS to estimate high severity fire effects while the EA uses RAVG that is notorious for over estimating high severity (apples to oranges comparison). Use of MTBS by Miller (2012) may account for why their 10% figure for high severity is much lower than the RAVG derived 39% estimate for the project area and this difference may have nothing to do with whether the area is outside historic conditions. Additionally, Miller and Safford (2012, cited in the EA but not in the literature section so I assume you mean this one – "Trends in wildfire severity: 1984 to 2010 in the Sierra Nevada, Modoc Plateau, and southern Cascades, California USA") cannot be used to claim the project area is outside historic range of variability since that study was for a different region.

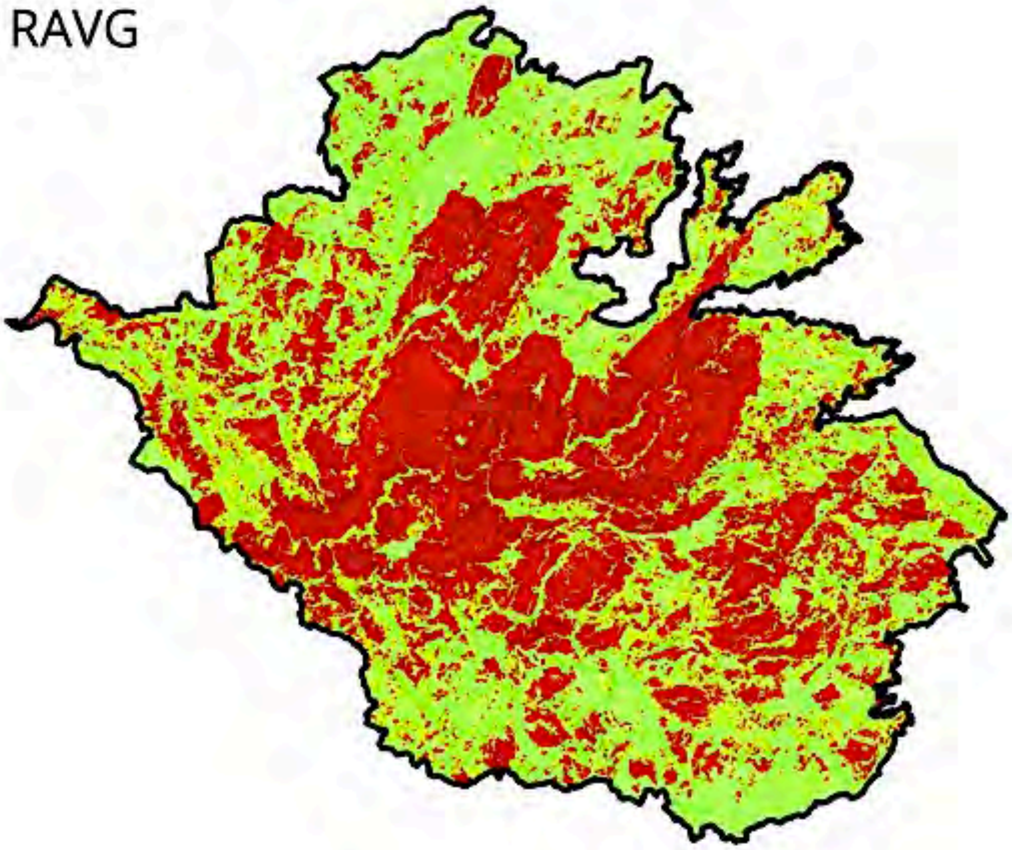
In our scoping comments, we stated that the actual percent tree mortality from severe fire in the project area is over estimated given that in a rush to log the project area the RRSNF uses RAVG instead of the more reliable MTBS (see Figure 1 comparisons). The difference between RAVG and MTBS, for any given RdNBR value, is likely substantially larger than even reported in

Miller and Quayle (2015) who demonstrated RAVG over estimates tree mortality relative to MTBS. Additionally, given how broadly USFS field crews expect trees to die post-fire, the broad definition of high severity (50-100% basal area loss) to be logged almost certainly will lead to greater than necessary project area logging. Moreover, the EA does not include any explicit protocol to account for pine flushing of conifers with high amounts of canopy scorch. Douglas-fir also is capable of epicormic branching post disturbance. Thus, at a minimum, Table 8 estimates of vegetation mortality in the EA may be grossly inaccurate especially for the mixed and high mortality classes.

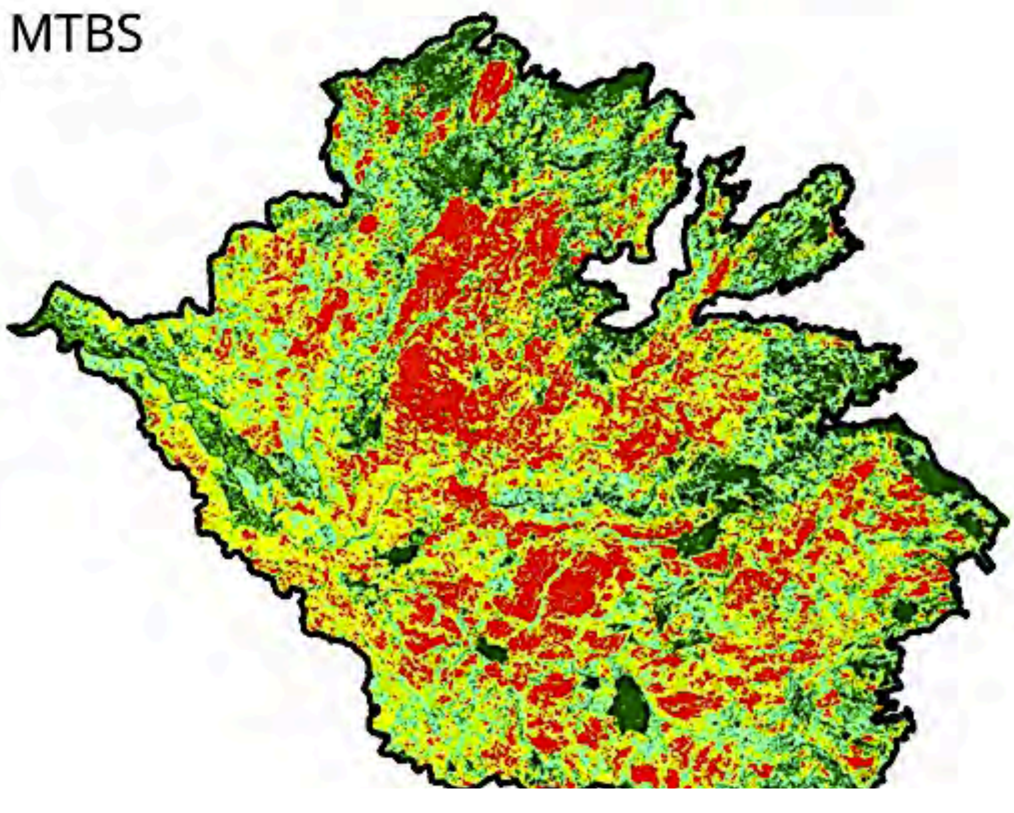
Figure 1. Two examples (top: Flat Fire 2012, bottom: Rim Fire 2013, n. California) of how RAVG overestimates high severity fire effects.



RAVG



MTBS



The RRSFN also lumped moderate (50%) with high (>75%) severity fire effects ostensibly to increase the area to be logged. This lumping is inappropriate for two reasons: (1) high severity is mainly characterized by RdNBR values that correspond to >75% (some authors use >90%) overstory tree mortality (see Odion et al. 2014); and (2) high severity patches are exceptionally diverse and typically do not need planting, which can impair development of complex early seral forests (DellaSala et al. 2014). Note – the EA shows several photos of canopy scorch that apparently were taken from tree plantations. Those photos do not accurately portray the ecological importance of high severity burn patches that are structurally complex and where post-fire flushing and epicormic branching may be occurring. Therefore, the proportion of high severity fire actually may be much lower than RAVG, meaning you can retain even more large biological legacies and reduce the overall impact to complex early seral forests, particularly within NSO PFF1 and PFF2 habitat (high and low RHS).

The EA does not include appropriate regional studies of abundant post-fire natural conifer establishment even in large high severity patches nor does it specify when natural conifer seedling sampling will occur

Donato et al. (2009b) found abundant conifer regen in short-interval (<15 years) high severity overlapping fires in the Klamath Mountains (i.e., "Conifer regeneration densities were high in both the SI [short interval] and LI [long interval] burns (range = 298–6086 and 406–2349 trees ha-^{1}, respectively), reflecting similar availability of seed source and germination substrates").

"*Synthesis. SI [short interval] severe fires are typically expected to be deleterious to forest flora and development; however, these results indicate that in systems characterized by highly variable natural disturbances (e.g. mixed-severity fire regime), native biota possess functional traits lending resilience to recurrent severe fire. Compound disturbance resulted in a distinct early seral assemblage (i.e. interval dependent fire effects), thus contributing to the landscape heterogeneity inherent to mixed-severity fire regimes. Process-oriented ecosystem management incorporating variable natural disturbances, including 'extreme' events such as SI severe fires, would likely perpetuate a diversity of habitats and successional pathways on the landscape.*"

Halofsky et al. (2011) note "*both conifer and hardwood regeneration were also abundant in riparian areas four years after the Biscuit Fire; mean tree seedling density was 1600/ha and mean sprout density was 8200/ha.*"

Further, a *USFS report* (emphasis added) by Brown (2008) noted abundant post-fire conifer establishment for the Klamath-Siskiyou following severe fires:

"…. researchers found that the mixed-severity fire regime of the region, which includes patches of repeated severe fire, supports abundant, natural postfire conifer regeneration and regionally significant biodiversity. Salvage logging aimed at reducing risk of severe reburn appeared to make little difference in reducing surface fuels or potential fire behavior. Allowing the postfire early seral shrub phase to run its natural course has the potential to bolster the success and efficiency of several diverse management goals."

Brown (2008) further notes (emphasis – this is a USFS publication):

- *"There was no reduction in surface fuels or re-burn potential from salvage logging. Managed and unmanaged stands exhibited the same surface fuel loads 17–18 years after fire, when re-burn potential is high.*
- *The potential for severe re-burn was driven by the inherent structure of young vegetation, and much less by residual woody material from the previous fire.*
- *Natural conifer regeneration typically exceeded prescribed densities without additional planting or intervention in areas within 400 yards of live forest edges.*
- *Extended periods of early seral shrub dominance and short interval, high-severity fires appear to be important for conservation of avian biodiversity.*
- *Short-term fire effects on small mammal communities were more significant than those of postfire salvage logging."*

Brown (2008) also states:

"By mapping and measuring the distance from live tree seed sources, managers can confidently eliminate the need for artificial conifer regeneration in highly burned patches less than 0.25 miles from a seed source—even after the most extreme fire events."

Based on Brown (2008), we request that you map the location of seed trees/sources within high severity burn patches to determine if there are sufficient seed sources nearby before you conclude a lack of conifer regeneration in these patches.

Shatford et al. (2007) report *abundant post-fire conifer establishment* in severe burn patches -

In contrast to expectations, generally, we found natural conifer regeneration abundant across a variety of settings. Management plans can benefit greatly from using natural conifer regeneration but managers must face the challenge of long regeneration periods and be able to accommodate high levels of variation across the landscape of a fire.

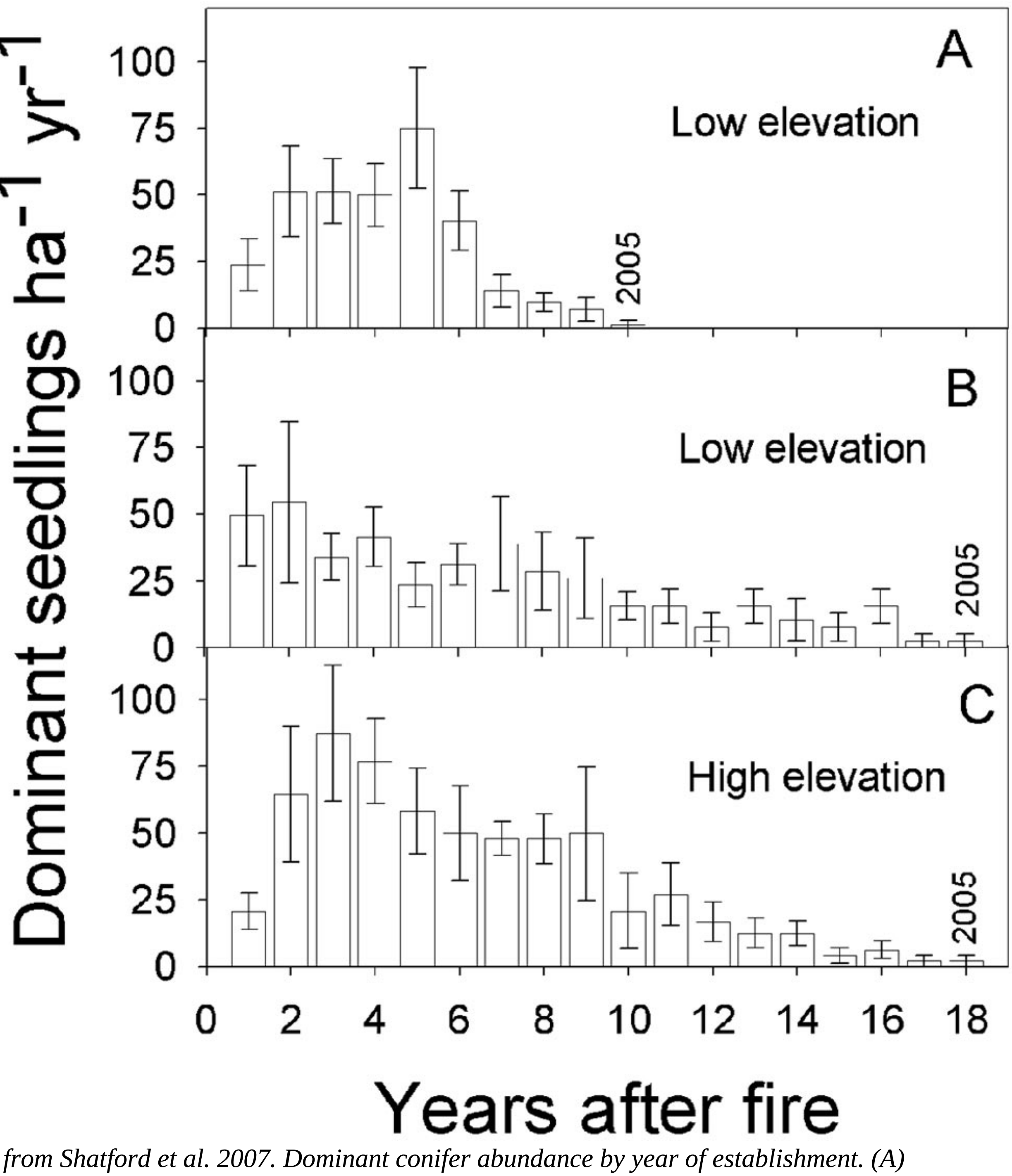


Figure 5 from Shatford et al. 2007. Dominant conifer abundance by year of establishment. (A) Establishment after fires of 1992–1996 on low-elevation sites; (B) establishment after fires of 1987 on low elevation sites (Douglas-fir and Douglas-fir/tanoak series); (C) establishment after fires of 1987 on high-elevation sites (white fir series) in the Klamath-Siskiyous region.

Based on the above regionally specific literature, you cannot claim that “the longer reforestation is delayed after the fire, the less chance the trees, either planted or seeded naturally, have of out-competing the shrub component.” This argument is based old-school forestry that has very little basis in contemporary ecological sciences.

While hardwoods and shrubs undoubtedly compete to some degree with conifer seedlings, accumulating evidence shows that conifers also benefit – both directly or indirectly – from their association with hardwoods and shrubs in recently burned areas. Because sprouting hardwood and shrub species recover quickly after fire, they help minimize loss of soil carbon and nutrients that facilitate reestablishment of later-arriving plants, maintain critical elements of soil structure, and provide critical habitats for soil organisms that depend on plants for their continued survival (Amaranthus & Perry 1989, Borchers & Perry 1990, Perry et al. 1989). The following is a brief summary of some of this research.

Resprouting hardwoods and shrubs growing from buried seeds often become foci for the recovery of other plants in burned areas, including conifer seedlings. There can be various reasons, but whether providing shelter, perches for birds that disseminate seeds, or food for mycorrhizal fungi, pioneers that sprout from roots or buried seed constitute important legacies that assist in post-fire re-establishment of other species within the system (Perry 1994). For example, nitrogen-fixing *Ceanothus*, which regenerates rapidly in burned areas, plays an important role in post-fire recovery by replenishing nitrogen losses resulting from the fire.

Although improved growth may not appear for several decades, *Ceanothus* actually enhances the growth of associated trees (Conrad et al. 1985). Shrubs and hardwoods directly facilitate the re-establishment of conifer seedlings by providing access to mycorrhizal fungi, nitrogen-fixing bacteria and bacteria that stimulate root-tip production (summarized in Perry 1994). Research in the Siskiyous has shown that survival and growth of tree seedlings established in disturbed areas depends on their ability to quickly establish links with their below-ground microbial symbionts, especially on infertile soils or in climatically stressed environments (Amaranthus et al. 1987, Perry et al. 1987). Nutrients also cycle faster in soils near hardwoods than in the open, a reflection of greater biological activity.

Both controlled and field studies have shown that Douglas-fir survive and grow better in proximity to shrubs and hardwoods than in the open (Horton & Parker 1994, Amaranthus & Perry 1989a,b; Amaranthus et al. 1990; Borchers & Perry 1990). Perry (1994) also reports that the relative inflammability of Pacific madrone and several other hardwoods may actually protect small conifers from fire.

In summary, instead of viewing standing dead trees and regenerating vegetation as undesirable competitors with crop trees, these important structural elements should be viewed as enablers of post-fire ecosystem processes. Unfortunately, the EA presents post-fire logging and control of post-fire regeneration as solely beneficial, without any reference to the wealth of research suggesting that these activities may actually delay ecological processes and diminish resiliency.

To quote noted ecologist David Perry (1994): "We have to think in ecosystem terms when we try to judge the impacts of management operations on burned forests." In light of this information, proposed recommendations for post-fire salvage, site preparation and replanting should be seriously reconsidered. Additionally, just because conifer establishment in high severity patches is not immediate (or within 3-5 years), does not mean the stand won't come back. In fact, this delayed period of conifer establishment is actually associated with high levels of biodiversity in complex early seral forests with delayed canopy closure (Swanson et al. 2012). These researchers actually recommend extending the period before canopy closure for ecosystem benefits rather than accelerating it.

Large Legacy Tree Removal Is Not Based on Best Available Science

Table 3 of the EA presents diameter distributions and scorch standards used to log legacy trees in the project area. There are several problems with this table.

First, there are inconsistencies among species in terms of the relationship between tree size to be removed based and scorching amounts. For instance, lower scorching levels are inexplicably used for sugar pine (large trees are regionally rare due to past high grading), ponderosa pine, and white fir to justify large tree removals. This is problematic as large trees are the most ecologically valuable legacies and lower scorch levels mean you are logging live trees likely to survive the burn.

Second, the Forest Service does not indicate how scorch levels were assessed but instead vaguely refers to Marking guidelines for fire-injured trees in California. The EA does not disclose whether PM rates were based on multi-factor hazard rating scores or a single marking factor. For instance, the most reliable method for PM scores assesses three factor ratings: crown injury, cambium injury, and red turpentine beetle (RTB). Leaving anyone of these out can result in over or underestimating PM values (see marking guidelines). This needs to be fully disclosed instead of vaguely referencing that you are following the California marking guidelines as managers have flexibility in choosing which guidelines to follow.

Third, hazard tree management includes much more than just logging the trees that have moderate to high PM values. In fact, according to the PSW guidelines for hazard trees, five types of actions are available to managers to reduce tree hazard potential:

- Target removal (i.e., remove that target area such as picnic tables)
- Tree removal (the only one considered in the EA)
- Topping
- Pruning
- Specialized Actions (e.g. brace the tree)

The EA therefore inappropriately choses a single action - logging – when five actions are available based on hazard tree guidelines. Thus, we request that you include non-tree removal actions to minimize impacts to NSO, Riparian Reserves, and other high conservation value areas where hazard trees are a concern.

The EA falsely concludes that large dead trees with needles need to be logged to reduce fine fuels from needle castings

The EA targets dead and dying trees as a presumed fire risk reduction but then states that this risk (needle cast) lasts only "approximately 1-2 years." It is highly unlikely that a fire ignition will occur in the project area in the next 1-2 years (or even 15 years or so) when the red phase of needles in dead trees is present. It is much more likely that the project will contribute far more fine fuels from logging slash that will persist over a much longer time frame than the short time frame of the red phase of needle cast. Thus, the problem is not dead and dying trees per se, but the logging slash left behind by logging operations, particularly in areas with little or no access (helicopter logging sites, undeveloped areas) where slash treatments are prohibitive.

NORTHERN SPOTTED OWLS

The NWFP "salvage" guidelines state that, "the scale of salvage and other treatments should not generally result in degeneration of currently suitable owl habitat or other late-successional conditions" (see NWFP salvage guideline C-13). Thus, by removing numerous large legacy trees on 4,091 acres of the matrix, EA project activities will degrade owl habitat, including possibly destroying occupied and unoccupied (historical) nest sites and owl core areas.

Notably, according to Franklin et al. (2000), biological legacies include organisms, organic materials, and organically generated environmental patterns that persist through a disturbance and are incorporated into the recovering ecosystem. These are perennating parts (some roots, rhizomes, and hyphae), propagules (seeds, spores, eggs), organically derived structures (snags, logs and other coarse wood), large soil aggregates, physical/chemical/microbial soil properties, root pits and mound, and understory communities. Large dead and dying trees are legacies (Lindenmayer et al. 2008). Baker (2015) and A.B. Franklin et al. (2000) identified habitat components of NSO in dry forests of Oregon's eastern Cascades and the Klamath province to include large older firs (>20 in dbh) in high densities (also see Buchanan et al. 1995). Forest stands used by spotted owls in southwest Oregon tend to have mature and old trees, diverse structural composition, large amounts of down woody debris and abundant snags (Clark et al. 2013). Trees >20 in dbh are generally in short supply in dry forests of the Oregon and Washington Cascades (Henjum et al. 1994, Buchanan et al. 1995, Spies et al. 2006) and therefore large trees (>20 in dbh) when killed by intense fire are biological legacies important to owls and to late-seral development. The EA proposes substantial removal of large trees >20 in dbh using much larger diameter thresholds for site retention based on whether such trees are scorched (including very low scorching of white firs and pines). This will impact spotted owl habitat and may lead to incidental take.

Additionally, because spotted owls forage in high severity burn patches where owl prey species are abundant (Bond 2016), project activities will impact owl foraging sites and prey species, in both PFF1 and PFF2 (low and high RHS). We request that you disclose:

- Will shrubs be reduced by logging within owl cores, and if so how will this affect owl prey species and densities?
- Will post-fire logging exacerbate interspecific competition with Barred Owls, especially given that spotted owls are more vulnerable to territory extinction events in low-quality spotted owl habitat (Dugger et al. 2016)?

In addition, we request that you analyze project-related impacts to large (>20 in dbh) trees, live or dead and other biological legacies based on their importance to spotted owls, complex early seral forests (Swanson et al. 2011, DellaSala et al. 2014), and late-successional development (Donato et al. 2012).

The NSO Critical Habitat Rule (USFWS 2011b) does NOT recommend active management in quality owl habitat (which in this case includes PFF1 high RHS) or occupied sites and instead states,

"We encourage management actions that will maintain and restore ecological function where appropriate."

USFWS (2011b) recommends that within NSO Designated Critical Habitat (to avoid incidental take), managers should:

- "Focus active management in *younger forest* (emphasis added), lower quality owl habitat, or where ecological conditions are most departed from the natural or desired range of variability;
- Avoid or minimize activities in active NSO territories or high-quality habitat within territories; and
- Ensure transparency of process so the public can see what is being done, where it is done, what the goal of the action is, and how well the action leads to the desired goal."

In general, post-fire logging is incompatible with Recovery Action 12, and new information (e.g., Hanson et al. 2018) that adds to a growing list of post-fire logging impacts to owls and ecosystems. Thus, the proposed project, especially when added to nearby post-fire logging (e.g., Westside salvage and private lands) will cumulatively degrade owl habitat.

Recovery Action 12: *In lands where management is focused on development of spotted owl habitat, post-fire silvicultural activities should concentrate on conserving and restoring habitat elements that take a long time to develop (e.g., large trees, medium and large snags, downed wood).* Also – see discussion of owl prey habitat and fire importance in III-49.

Based on Recovery Action 10 (below), the EA does not contribute to restoring habitat elements that take a long time to develop (e.g., large live and dead trees). While we appreciate dropping 260 acres of PFF habitat, this seems arbitrary and instead we request that you drop all units within PFF habitat in order to contribute to Recovery Action 10, 12, 30, and 32.

Recovery Action 10 – conserve spotted owl sites and high value spotted owl habitat to provide *demographic support* (emphasis added) to the spotted owl population.

Recovery Action 30 – manage to reduce the negative effects of Barred Owls on spotted owls…..

Recovery Action 32 – …..land managers should work with the Service as described below to maintain and restore such habitat [structurally complex] while allowing other threats, such as fire and insects, to be addressed by restoration management actions. These high-quality spotted owl habitat stands are characterized as having large diameter trees, high amounts of canopy cover, and decadence components such as broken-topped live trees, mistletoe, *cavities, large snags, and fallen tree*s (emphasis added).

Thus, project activities within NSO cores, owl home ranges, and critical habitat will degrade owl habitat within the matrix. As noted, mitigation measures proposed are inadequate (i.e., large snag retention densities, and 70-acre owl circles).

Owl information is dated, not based on best available science, and retentions in NRF are arbitrary

The reference to juvenile owl dispersal habitat as being the 50:11:40 rule is dated. Sovern et al. (2015) documented juvenile owls using dispersal habitat equivalent to NRF habitat. Thus, we request you re-evaluate impacts to juvenile owls using the latest published study (Sovern et al. 2015) and not the 50:11:40 rule.

Additionally, the retention standards used in the EA that are based on 500-foot distance from existing NRF is arbitrary and not based on any published studies or data. Carey et al. (1990) (Spotted Owl Home Range and Habitat Use in Southern Oregon Coast Ranges) found mean year-round home range was 2121 ha (true mean size likely higher because some owls were only tracked 6 months. SD = 641 ha), meaning minimum year-round home range is a circle around nest with radius 2.6 km (diameter 5.2 km), conservative estimate would be 2762 ha (mean + 1SD) for radius = 2.9 km. Home ranges were 20%-75% old growth. Carey et al. 1992 (Northern Spotted Owls: Influence of Prey Base and Landscape Character) found owls needed their large year-round home range because the prey base close around the nest is depleted by intensive foraging during the breeding season. Zabel et al 1995 (Influence of primary prey on home-range size and habitat-use patterns of northern spotted owls (*Strix occidentalis caurina*) tracked 10 owls from summer 1988 until fall 1989 at the Chetco study area located 10 km east of Brookings, Curry County, Oregon (Chetco Ranger District, Siskiyou National Forest). They found mean year-round home ranges in the Chetco area of 814 ha (circle around nest with radius

1.6 km). Home range SD = 214 ha, so conservative estimate to recover most habitat necessary (mean + 1SD) is a radius of 1.8 km. Home ranges were 33%-66% old growth. They also found owl locations inside 'unsuitable' habitat up to 400-m from an edge (in the Chetco area).

Ganey et al. 2014 (RELATIVE ABUNDANCE OF SMALL MAMMALS IN NEST CORE AREAS AND BURNED WINTERING AREAS OF MEXICAN SPOTTED OWLS IN THE SACRAMENTO MOUNTAINS, NEW MEXICO) found spotted owls moved to burned forest overwinter and that there was much more prey in burned versus unburned areas. Bond et al 2010 (WINTER MOVEMENTS BY CALIFORNIA SPOTTED OWLS IN A BURNED LANDSCAPE) found 3 of 5 radioed owls roosted in burned landscapes during the nonbreeding season, and 30% of all roost locations were within the fire's perimeter. Bond et al 2009 (Habitat Use and Selection by California Spotted Owls in a Postfire Landscape) found a significant preference for high-severity burned forest for foraging, and all burn severities were used more than unburned forest. Bond et al. 2016 (Foraging Habitat Selection by California Spotted Owls After Fire) found low-, moderate-, and high-severity burned forests were generally used in proportion to availability, with the exception of significant selection for moderate-severity burned forests farther from territory centers at the largest available habitat

Based on the above citations, the 500-foot distance around NRF is clearly inadequate and arbitrarily determined. The EA therefore is not based on best available science nor will it contribute to owl recovery as noted.

CLIMATE CHANGE

The EA uses an inappropriate spatial scale from which to assess climate impacts particularly from logging-related emissions. While logging 4,090 acres may not contribute to the overall pool of regional or global emissions, that's the wrong scale. By inference, that would mean no single action has any significance to the global climate and therefore why bother? Instead, the Forest Service should examine a range of alternatives and chose the one with the least emissions. Additionally, the social cost of carbon is the correct scale to assess emissions as it converts CO2 equivalents to estimated costs from those emissions to the human environment, human health, and regional climate impacts. Therefore, we request that you calculate a social cost of carbon as the appropriate analysis scale and compare that with the estimated project benefits to provide a level economic playing field that considers the true costs of logging, rather than discounting those costs by claiming they are negligible on a global scale.

Regarding life cycle analysis, the EA provides a very limited and biased assessment of wood stores and compares stores to concrete (we could not find the Hennigar et al. 2010 or the Perez-Garcia et al. 2005 in the literature cited). A more recent regional analysis by carbon experts (Law et al. 2018) questions long-term wood stores in buildings as being grossly overstated. We request that you use these estimates as they are regionally specific and conduct a life cycle analysis of emissions rather than dismiss them as negligible because you are using the wrong analysis scale.

From Law et al. 2018

Our LCA showed that in 2001–2005, Oregon's net wood product emissions were 32.61 million tCO2e (Table S3), and 3.7-fold wildfire emissions in the period that included the record fire year (15) (Fig. 2). In 2011–2015, net wood product emissions were 34.45 million tCO2e and almost 10-fold fire emissions, mostly due to lower fire emissions. **The net wood product emissions are higher than fire emissions despite carbon benefits of storage in wood products and substitution for more fossil fuel-intensive products (emphasis added).**

Harvest-related emissions had a large impact on recent forest NECB, reducing it by an average of 34% from 2001 to 2015. By comparison, fire emissions were relatively small and reduced NECB by 12% in the Biscuit Fire year, but only reduced NECB 5–9% from 2006 to 2015. Thus, **altered forest management has the potential to enhance the forest carbon balance and reduce emissions (emphasis added – they are referring to extending harvest rotations on private lands and protecting federal forests).**

State-level reporting of GHG emissions includes the agriculture sector, but does not appear to include forest sector emissions, except for industrial fuel (i.e., utility fuel in Table S3) and, potentially, fire emissions. Harvest-related emissions should be quantified, as they are much larger than fire emissions in the western United States. **Full accounting of forest sector emissions is necessary to meet climate mitigation goals (emphasis added).**

Increased long-term storage in buildings and via product substitution has been suggested as a potential climate mitigation option.

Pacific temperate forests can store carbon for many hundreds of years, which is much longer than is expected for buildings that are generally assumed to outlive their usefulness or be replaced within several decades (7). By 2035, about 75% of buildings in the United States will be replaced or renovated, based on new construction, demolition, and renovation trends (31, 32). Recent analysis suggests substitution benefits of using wood versus more fossil fuel-intensive materials **have been overestimated by at least an order of magnitude (33) (emphasis added).**

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BOTANICAL RESOURCES (Prepared for Geos Institute by Evan Frost, Wildwood Consultant Biologist)

The potential for adverse impacts of proposed action alternatives on special status / sensitive plant species are not adequately evaluated because the Forest Service failed to conduct post-fire botanical surveys.

The CBF Salvage Project draft EA claims that post-fire botanical surveys for sensitive plants, a standard requirement for proposed logging projects of this magnitude on national forest land, "*were not completed because of the low potential for detection* [of sensitive plants] *due to the severity of the fire in relation to the quality of the habitat*." [EA p. 3-133]. Yet the EA provides no supporting documentation whatsoever that burned areas are no longer capable of supporting populations of sensitive plant species. In fact, sensitive plant populations are commonly documented in recently burned areas on federal forest lands throughout southwest Oregon (R. Brock, pers. comm. 2018). While high-intensity fire may reduce or possibly extirpate populations of some species that have no fire resistance, most native species, including sensitive/special-status (hereafter abbreviated as SS) taxa, are adapted to fire to varying degrees (USDA Forest Service 2018, Owen 2003, Hessl & Spackman 1995). The fact that the Chetco Bar project area has experienced fire is no excuse for abrogating the Forest Service's legal responsibility to fully evaluate and disclose potential impacts to SS plant species, which can only be reasonably completed when post-fire botanical surveys have been conducted.

Without any substantiating evidence, the EA falsely claims that the project area no longer supports suitable habitat for SS plants.

The EA identifies six SS plant species with known occurrences inside or in very close proximity (i.e., within 100 feet) to the Chetco Bar project area, four of which are known to be disturbance-adapted and therefore more likely to benefit rather than be extirpated by fire as asserted by the EA. The Gasquet manzanita (*Arctostaphylos hispidula;* 10 occurrences) is recognized as a "fire-dependent species;" goldenfleece (*Ericameria arborescens*; 4 occurrences) "is known to occur in openings...disturbance and fire are necessary for germination," and California globe-mallow (*Iliamna latibracteata*) is found "almost exclusively within openings in recently burned forests" (EA at p. 3-134).

As with the previous three species, the Siskiyou or Coast checkerbloom (*Sidalcea malviflora* ssp. *patula*) is also known to be disturbance-adapted, generally occurring in open areas with bare soil such as clearings along roadsides (CNPS 2018). According to Gold Beach District Botanist Clint Emerson, Siskiyou checkerbloom "has an affinity for recently burned areas where canopy cover and competition from shrubs has been reduced to low levels" (Emerson 2015). Three occurrences of this species are located within only 100 feet of the project area. Given the close proximity of known sites together with the dramatic increase in suitable post-fire habitat, there is high probability that all four of these species may occur within the project footprint. There is no scientifically justifiable reason to conclude, as the EA does, that fire effects have eliminated all possibility of locating new occurrences for these SS species (and therefore that post-fire surveys are not required), and therefore that the proposed action alternatives will have “no adverse impacts.”

In direct contradiction to such erroneous claims, the Forest Service must consider as evidence what transpired in the aftermath of the 2002 Biscuit Fire. In this case, post-fire botanical surveys were completed in 2003, one outcome of which was discovery of many new populations of California globe-mallow (*Iliamna latibracteata*) on recently burned areas within the Gold Beach Ranger District (see RRSNF Biscuit Fire, project records). Propagules of this species had likely remained dormant in the soil and were stimulated/recruited by the Biscuit Fire. Without post-fire surveys, these populations would have (erroneously and illegally) remained unrecognized and potentially lost due to ground-disturbing activities. Similar situations very likely exist in the Chetco Bar Fire project area, either with this same *Iliamna* or the three other taxa listed above that are known to positively respond in the aftermath of fire.

Even for SS species that are not strongly fire-adapted, it cannot be assumed -- as the EA erroneously does -- that the Chetco Bar Fire has eliminated all suitable habitat in the project area. Many SS plants occupy specific microhabitats -- such as rock outcrops, meadow openings, canopy gaps, small springs/wetlands -- that generally support low fuels and are much less likely to burn or burn at high intensity than adjacent upland forests. Oregon bensonia (*Bensoniella oregana*) is one such example. This SS species inhabits "seeps, springs, moist meadows and wet ditches" (EA p. 3-134), microhabitats that are more likely to have remained relatively unaffected or even unburned. Despite the fact that four populations of this taxon are known within 100' of the project area, the EA simply dismisses the possibility that this species may exist in the project area, without any substantive analysis or field review of habitat conditions on the ground.

The EA does not present sufficient information to accurately evaluate the potential for adverse effects on SS plants.

The EA discusses the potential impacts of proposed post-fire logging only on a single botanical occurrence of *Arctostaphylos hispidula* that was documented in the project footprint before the fire. However, in order to appropriately evaluate the potential for adverse impacts, reviewers need to know the extent to which the entire project area has had botanical surveys completed in the past, when those surveys occurred and whether they were conducted in a manner that satisfies the primary requirements of NEPA analysis. Based on the above concerns, we assert that draft EA is in violation of legal statutes to protect botanical resources, because the Chetco Bar EA has falsely dismissed or "written off" the potential for any SS plant populations that likely exist within the project footprint without adequate justification. We have presented ample reasons why the Forest Service cannot claim that the potential impacts of project activities -- including many miles of new road construction, thousands of acres of post-fire logging and associated ground disturbance, creation of new landings, etc. -- will have no impact on SS plants because "there is no suitable habitat in the project area due to fire effects"[EA at 3-133].

According to the National Forest Foundation, the non-profit partner to the Forest Service, "the Rogue River-Siskiyou National Forest represents a treasure of world-class botanical diversity" and is "the most floristically diverse National Forest in the country with some extraordinary botanical resources." (National Forest Foundation 2018). Unfortunately, the Chetco Bar Fire Salvage Project draft EA fails in its legal obligations to sustain these outstanding botanical values, by: 1) not conducting the necessary standard field surveys, 2) erroneously dismissing the potential occurrence of SS plants, including fire-adapted SS species, within the project area, and 3) failing to present sufficient information to evaluate the full range of potential impacts of proposed actions on SS plants and fungi. **In order to comply with various legal statutes designed to protect botanical resources, the Forest Service must conduct post-fire botanical surveys in areas that will be disturbed by proposed actions, as is the normal standard for projects of this nature, and to share the results of these surveys as part of a more thorough effects analysis.**

SOIL RESOURCES

Soils deserve particular attention and analysis in post-fire land management because soils and soil productivity are irreplaceable within human time frames, and are crucial to forest regeneration, ecosystem productivity, and hydrologic processes. Available scientific evidence is also overwhelmingly clear that post-fire logging generally results in numerous adverse impacts to soil resources, including soil compaction, reduced site productivity, altered soil food web relationships, reduced water infiltration, and increased surface erosion (see citations throughout this section and pdfs provided). In fact, there is no scientific body of knowledge to support the scale and magnitude of post-fire logging as proposed in action alternatives of the Chetco Bar EA, which as we summarize below, will cause significant adverse impacts to soils.

Our review finds that the Chetco Bar EA downplays or excludes important scientific evidence relating to post-fire logging impacts on soils and the soil biota, and appears to rely on anecdotal evidence, unsubstantiated claims, and generic mitigation measures to support its findings of no significant direct, indirect, or cumulative impacts. As described in these comments, the EA's analysis of soils and soil impacts from proposed actions is often vague, incomplete and generally inadequate to satisfy legal standards and requirements to ensure protection of soil resources. This cursory level of analysis is not sufficient to allow a reasoned determination that the Chetco Bar post-fire project will protect soils and long-term productivity, because it fails to provide scientific support for its assumptions and predictions, or disclose evidence that might introduce significant controversy or conflict with the agency's underlying goals to generate timber volume from burned areas.

Available scientific evidence is overwhelmingly clear that post-fire logging results in numerous significant and adverse impacts on soil resources. In order to comply with its legal and statutory requirements, the Forest Service needs to develop and consider alternative ways to avoid these impacts.

It is well established that post-fire logging has significant, adverse impacts on forest soil, over and above the effects of wildfires alone (Peterson et al. 2009, Lindenmayer & Noss 2006, Donato et al. 2006, Karr et al. 2004). Wildfire-affected soils are especially vulnerable to any additional disturbance, partly as a result of changes in soil processes caused by recent burning (Beschta et al. 2004). Moreover, post-fire logging is known to damage soils by compacting them, removing vital organic material, and increasing the amount and duration of surface erosion and runoff (Slesak et al. 2015, Lindenmayer et al. 2008, Silins et al. 2009). Increased erosion and sedimentation, and the accompanying loss of soil nutrients, are typical outcomes and almost inevitable impacts associated with post-fire logging operations (Lindenmayer et al. 2008, Karr et al. 2004, Beschta et al. 1995/2004, Marton & Haire 1990, Klock 1975). The loss of nutrients via increased erosion is essentially permanent (Beschta et al. 1995) and is the most severe source of reductions in long-term soil productivity (USDA FS and USDI BLM 1997a, b). Soil compaction persists for at least 50-80 years and is already a major concern across national forest lands throughout the western U.S. (USDA FS and USDI BLM 1997a, CWWR 1996).

Although any form of logging can cause harm to soil resources regardless of what system is used and how carefully it is implemented, the potential for soil damage is highest with ground-based machinery (DeMirtas et al. 2016, Wagenbrenner et al. 2015, 2016, McIver & Starr 2001). Skidding logs across bare ground disturbs and compacts soil, thereby reducing infiltration and increasing runoff (Maruxa et al. 2017, Wagenbrenner et al. 2015, 2016, Slesak et al. 2015, McIver & McNeil 2006). Any activity that disturbs vulnerable post-fire litter layers and surface soil horizons is likely to accelerate soil erosion, and these increased erosion rates can persist for many years (Peterson et al. 2015, Peterson et al. 2009, Lindenmayer et al. 2008, Karr et al. 2004, Beschta et al. 2004). Road construction (including temporary roads) also significantly contributes to post-fire logging impacts on soil, especially when the land surface has been denuded by wildfire (Robichaud et al. 2000, Reid & Dunne 1984). Post-fire logging also reduces soil productivity by removing trees, which are major sources of the coarse woody debris and organic matter critical to soil productivity (USDA FS and USDI BLM. 1997a). Even the removal of slash consisting of tops and branches negatively affects soil productivity by reducing nutrient and organic matter levels (Peterson et al. 2015, Brown et al. 2003, Klock 1975).

USDA FS and USDI BLM (1997a) and Kattleman (1996) state that the prevention of soil damage and loss of productivity is easier and more effective than attempts to restore it after damage has occurred. A primary approach to restoring soil productivity is to restore organic matter and coarse woody debris levels by leaving areas undisturbed until organic matter levels have recovered (USDA FS and USDI BLM 1997a, emphasis added). Avoidance of increased erosion is key to restoring soil productivity (Karr et al. 2004, Beschta et al. 2004, 1995; USDA FS and USDI BLM 1997a). The most effective means of controlling erosion is to avoid activities that disrupt or damage soils and vegetation recovery, as is exceedingly well-documented in the literature (Karr et al. 2004, Lindenmayer et al. 2008). Due to the manifold negative effects of post-fire logging on soil productivity, erosion, and sedimentation, USDA FS and USDI BLM (1997b) concluded that logging had greater negative effects on ecosystem functions than the exposure of soils by fire.

The USDA FS and USDI BLM (1997b) notes that although fire may reduce soil productivity, it typically does not reduce it as much as from soil compaction and whole tree removal (e.g., logging), except in the rare cases where fire consumes all organic material:

"Because of the mosaic pattern that wildfire produces, and the residual wood that is left on site...wildfire usually has fewer implications for loss of soil productivity and function than disturbances which remove oil organic matter and [increase] bulk density as well. Logging effects on soil properties are usually more severe and more persistent than those of fire" (USDA FS and USDI BLM 1997b).

Similarly, Kattleman (1996) noted that "If post-fire treatments of salvage logging and site preparation prevent rapid reestablishment of low vegetation, resulting erosion can be greater than that directly produced by the fire." Helvey (1980, 1985) and Potts et al. (1985) also found that sedimentation increases after a large fire, but also increases significantly more after post-fire logging. The resulting loss of future soil organic matter is likely to translate into soils that are less able to hold moisture (Jenny 1980), with significant negative consequences for the soil biota, plant growth and other ecosystem processes (Lindenmayer & Noss 2006, Rose et al. 2001, Brown et al. 2003). These multiple impacts on soil productivity are probably why post-fire logging retards post-fire vegetative recovery.

Based on all of these well recognized and significant impacts, it has been strongly recommended by a large number of forest and natural resource scientists that post-fire logging be prohibited in sensitive areas, including areas such as the Chetco Bar project area, or in any site where accelerated erosion is possible (Beschta et al. 2004, 1995). More specifically, Karr et al. (2004) and Beschta et al. (1995) advanced a number of pointed recommendations regarding post-fire forest management, including the following:

- Protect soils from further damage, especially in ecologically sensitive areas
- No tractors and skidders in burned areas because of the exacerbated soil compaction and erosion problems they create;
- No road building (including "temporary" roads) or landings in the burned landscape;
- Retain old and large trees;
- Limit reseeding and replanting, and;
- General recommendation to allow natural recovery to occur on its own or intervene only in ways that promote natural recovery.

Essentially all of these science-based recommendations related to soils in burned forests are in direct opposition to various aspects of the proposed action alternatives in the Chetco Bar EA. Despite the volume of scoping comments that highlighted many of these concerns, the EA has failed to take a "hard look" at these recommendations, as well as the wealth of available science upon which they are based and explain specifically why they are not appropriate in this case. As required by NEPA, the Forest Service must rely on this science and not solely on its professional opinion, in assessing the potential adverse impacts of proposed actions. Unfortunately, the Chetco Bar EA completely fails in this regard.

The Chetco Bar EA fails to adequately analyze the direct, indirect and cumulative impacts of proposed actions on soils and soil productivity in the project area.

Statutory, Regulatory and Legal Background

The National Forest Management Act (NFMA) prohibits the Forest Service from carrying out management activities that cause permanent impairment of the soil.[1] The NFMA is most relevant to timber harvest planning and dictates that the Forest Service perform inventories, plan in accordance with the National Environmental Policy Act (NEPA), consider the physical and economic suitability of the lands, provide for diversity of plant and animal communities and follow certain harvesting guidelines and practices.[2]

The NFMA requires the Forest Service to "insure that timber will be harvested from National Forest System lands only where—soil, slope, or other watershed conditions will not be irreversibly damaged."[3] Finally the NFMA directs that timber will be harvested only where "protection is provided for streams, stream-banks, shorelines, lakes, wetlands, and other bodies of water from detrimental changes in water temperatures, blockages of water courses, and deposits of sediment, where harvests are likely to seriously and adversely affect water conditions or fish habitat."[4] The statute's implementing regulations require that "[all] vegetative manipulation [must] [a]void permanent impairment of site productivity and ensure conservation of soil and water resources.[5] Also that "all management prescriptions shall… Conserve soil and water resources and not allow significant or permanent impairment of the productivity of the land."[6]

Again, the Forest Service has legal mandates to do far more than they have for protecting soils. Section 6 of the Forest and Rangeland Renewable Resources Planning Act of 1974, as amended, states:

"(g) As soon as practicable, but not later than two years after enactment of this subsection, the Secretary shall in accordance with the procedures set forth in section 553 of title 5, United States

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[1] National Forest Management Act of 1976, 16 U.S.C. §§ 472a, 512b, 1600, 1611-1614 (1194) (amending Forest and Rangelands Renewable Resources Planning Act of 1974, Pub. L. No. 93-178, 88 Stat. 476).
[2] Lacy, Peter M. 2001. *Our sedimentation boxes runneth over: Public lands soil law as the missing link in holistic natural resource protection*. 31 Envtl. L. 433 (2001).
[3] 16 U.S.C. 1604(g)(3)(E)(i).
[4] 16 U.S.C. 1604(g)(3)(E)(iii).
[5] 36 CFR §219.27(b)(5) (2000).
[6] 36 CFR §219.27(a)(1) (2000).

Code, promulgate regulations, under the principles of the Multiple-Use, Sustained-Yield Act of 1960, that set out the process for the development and revision of the land management plans, and the guidelines and standards prescribed by this subsection. The regulations shall include, but not be limited to-

"(3) specifying guidelines for land management plans developed to achieve the goals of the Program which-

> "(E) insure that timber will be harvested from National Forest System lands only where-
>
> "(i) soil, slope, or other watershed conditions will not be irreversibly damaged; NFMA implementing regulations of the Act states, at 36 C.F.R. § 219.27:
> (a) Resource protection. All management prescriptions shall--
>
> (1) Conserve soil and water resources and not allow significant or permanent impairment of the productivity of the land;
>
> (b) Vegetative manipulation. Management prescriptions that involve vegetative manipulation of tree cover for any purpose shall--
>
> (5) Avoid permanent impairment of site productivity and ensure conservation of soil and water resources…

<u>The Forest Service Manual and Handbook</u>

Outside of the individual forest plans, the most comprehensive definitions of soil quality standards are found in the Forest Service Manual (FSM) and in the Forest Service Soil Management Handbook (FSH). Title 2500 of the FSM specifies standards and guidelines for watershed management, a category that includes soil quality. The two objectives of Title 2500 are "to protect and, where appropriate, enhance soil productivity, water quality and quantity, and the timing of waterflows" and "to maintain favorable conditions of streamflow and a continuous protection of resources from the National Forest System watersheds."[7]

The Forest Service's policy on watershed management is to "implement watershed management activities on the National Forests in accordance with the general objectives of multiple-use and the specific objectives of in the Forest land management plan for the area involved," and to "design all management activities of other resources to minimize short-term impacts on the soil and water resources and to maintain or enhance long term productivity, water quantity, and water quality."[8]

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[7] FSM 2502.
[8] FSM 2503.

Both policies are significant, the first because it directs the Forest Service to engage in land management practices that are consistent with the land resource management plans for specific forests, and the second because it directs the Forest Service to avoid developing land management practices that will result in a degradation of long-term soil productivity. Chapter 2550 of the FSM deals specifically with soil management. The Forest Service's stated policy on soil management is to "manage forest and rangelands in a manner that will improve soil productivity. Use appropriate soils information systems in support of all management activities affecting, or influenced by, the soil resource."[9]

The requirement that soil productivity be improved by management practices is more restrictive than the general policy stated in FSM 2503, for the general policy of maintaining soil quality and preventing long-term impairment of soil productivity has been interpreted by the Forest Service to mean that no more than fifteen percent of the soil area or soil productivity may be impaired, and that fifteen percent impairment will not have significant long-term effects on soil productivity. The improvement of soil resources is further discussed in FSM 2553.02, which states as one of its objectives "to rehabilitate soils that are in an unsatisfactory condition."

The Forest Service Handbook sets out the agency's internal requirements for soil resource inventories and soil quality monitoring. The FSH 2509.18 is the Soil Management Handbook, and within are found many of the relevant definitions for soil quality standards on a Service-wide basis. Chapter 1 sets the standards for soil resource inventories, which are intended to "provide information about the use, production capabilities, management opportunities, and limitations of soils."[10] The Soil Management handbook refers to the National Soils Handbook, the USDA Soil Conservation Service's Soil Taxonomy (Agricultural Handbook 436), and the Soil Survey Manual as providing mandatory and essential guidelines for all Forest Service soil resource inventories.[11]

Chapter 2 of the Soil Management Handbook, entitled Soil Quality Monitoring, restates the policy to "design and implement management practices to maintain or improve the long-term inherent productive capabilities of the soil resource" and to "plan and conduct soil quality monitoring to determine if soil management goals, objectives, and standards as outlined in Forest plans are being achieved." Chapter 2.05 defines the relevant terms as follows:

- Soil productivity is the inherent capacity of a soil to support the growth of specified plants, plant communities, or a sequence of plant communities. Soil productivity may be expressed

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[9] FSM 2550.3.
[10] FSH 2509.18, Ch. 1.
[11] Available online at http://www.statlab.iastate.edu/soils/nssh, http://www.statlab.iastate.edu/soils/soiltax/, and http://www.statlab.iastate.edu/soils/ssm/gen_cont.html, respectively.

in terms of volume or weight/unit area/year, percent plant cover, or other measure of biomass accumulation.

- Significant changes in productivity of the land are indicated by changes in soil properties that are expected to result in a reduced reproductive capacity over the planning horizon. Based on the available research and current technology, a guideline of 15 percent reduction in inherent soil productivity potential will be used as the basis for setting threshold values for measurable or observable soil properties or conditions. The threshold values, along with aerial extent limits, will serve as an early warning signal of reduced productive capability. The allowable aerial extent of significantly changed soil is to be established as part of soil quality standards.
- Significant impairment of the productivity of the land includes changes in soil properties which would result in significant changes in the inherent productive capacity that last beyond the planning horizon.
- Soil compaction is a physical change in soil properties that results in a decrease in porosity and an increase in soil bulk density and soil strength.
- Soil puddling is a physical change in soil properties due to shearing forces that alter soil structure and porosity. Puddling occurs when the soil is at or near liquid limit.
- Soil displacement is the movement of the forest floor (litter, duff and humus layers) and surface soil from one place to another by mechanical forces such as a blade used in piling or windrowing. Mixing of surface soil layers by disking, chopping, or bedding operation, are not considered displacement.
- Severely burned soil is a condition where most woody debris and the entire forest floor is consumed down to bare mineral soil. Soil may have turned red due to extreme heat. Also, fine roots and organic matter are charred in the upper one-half inch of mineral soil.
- Surface erosion is the detachment and transport of individual soil particles by wind, water, or gravity.
- Detrimental Soil Disturbance. The condition where established threshold values for soil properties are exceeded and result in significant change. See definition number 2.

Chapter 2.2 describes the standards to be followed in the development of soil quality standards. The Forest Service is directed to "establish threshold values where soil disturbances become detrimental, that is, result in significant change." The Forest Service should also use "compaction, erosion, puddling, protective plant cover and burning, as applicable, to categorize soil disturbances," and to "define the aerial extent that detrimental soil conditions, which reflect significant change in productivity, may occur."

Regional Supplements to the FSM and Soil Management Handbook provide further insight into the application of soil quality standards. R-1 Supplement 2509.18-94-1 also provides a number of useful definitions that incorporate the concept of "detrimental." For example, the definition for "Detrimental Compaction" states that "soil compaction that adversely affects hydrologic function and site productivity is detrimental." 2.05. Similarly, "Detrimental Puddling" and "Detrimental Displacement" are defined by adverse effects on hydrologic function and/or site productivity. "Hydrologic Function" is defined as "the ability of the soil to absorb, store and transmit water, both vertically and horizontally," and "Soil Productivity" is "the inherent capacity of a soil to support the growth of specified plants, plant communities, and soil biota… often expressed by some measure of biomass accumulation." The Supplement defines "Severely Burned Soil" as "all surface litter is consumed and the mineral soil has been blackened more than 1 inch deep. Oxidized soil (reddish color) is also indicative of severely burned soil."

<u>Failure to Comply with the NFMA and its Implementing Regulations and Directives</u>.

In order for the Forest Service to make informed decisions that comply with the statutory language of the NFMA and it various implementing regulations and directives, the Responsible Official must be provided with soil resource information "that is of sufficient quality and detail." The Forest Service has failed to provide such information in recent years and yet continues to plan and propose to implement the landscape-scale Chetco Bar post-fire logging project. However, the USDA Office of Inspector General found that the "Forest Service's administrative controls over the preparation of environmental documents and implementation of mitigation measures applicable to timber sales have not been effective."[12] The finding that mitigation measures were not always implemented or incorrectly implemented led the OIG to conclude that soils can be adversely affected and evidence that deterioration of the environment had occurred was present.

In addition, the OIG found that the "Forest Service used common standards and guidelines contained in the Forest Land and Resource Management Plans…instead of site specific analysis and mitigation measures… and [that] all relevant data was not collected and presented to the public"[13] The report specifically mentions soils as a resource area where deficiencies and omissions were involved. The OIG concludes: "based on our reviews, we concluded that the environmental assessments did not identify or discuss some severely erosive and/or sensitive soils occurring in the timber sale areas."[14]
The Forest Service failed to implement many different mitigation measures in part, because of failure to monitor whether or not "actual implementation" occurred. Because "districts had not always properly implemented mitigation measures designed to prevent soil erosion…some excessive soil erosion was occurring."[15] Further, a 1999 Government Accounting Office (GAO) report found that: "the Forest Service continues to approve projects that do not provide adequately for monitoring. Moreover, the agency generally does not monitor implementation of its plans as its regulations require."[16]

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[12] USDA Office of Inspector General, 1999. *Forest Service timber sale environmental analysis requirements Washington, D.C.* Evaluation Report No. 08801-10-At. January 1999. p. 1
[13] Id. p. 9 & 14
[14] Id. p. 16
[15] Id. p. 36
[16] General Accounting Office, 1997.

To remedy these defects and meet the intent of the NFMA, the Forest Service in Region 6 has recommended that the agency must be capable of demonstrating through "the prescription development and environmental analysis process" that it:

- Has knowledge of and understands characteristics of the various kinds of soils found within planned project areas;
- Has knowledge of how those soils have been affected by past management activities;
- Can logically predict and display effects of any proposed activity;
- Has the knowledge and ability to prescribe effective restoration and/or mitigation measures as part of an overall management plan; and,
- Can respond to soil resource questions and display information in a professional and understandable manner.[17]

In order for the Forest Service to demonstrate its knowledge of the various site-specific soils and their properties it is recommended that the environmental documentation include a description of baseline soil conditions including: documented field visits and soil inventory information (e.g. Terrestrial Ecological Unit Inventory, Landtype, Landtype phase, Landtype Association, Soil Inventory Resource Inventory, etc.).[18] Site specific management objectives have also been recommended that are based on an analysis if the baseline soil conditions, evaluation of risk, and assessment of impacts of past management activities.[19] It is critical that blanket application of threshold values not be applied:

"Blanket application of threshold values contained in Regional or Forest Plan standards and guidelines for soil resource protection is no longer acceptable…These threshold values are to be considered as minimum standards and should be used to evaluate performance in general terms…They should not be considered as a substitute for conducting proper field investigations, synthesis of information, and establishment of appropriate soil management objectives and prescriptions."[20]

For example, Forest Service must disclose, for the planning area, the percentage of existing detrimental soil disturbance from past timber harvest, fire suppression activities, livestock grazing, off-road vehicle use, firewood cutting, and other human disturbances. It cannot only provide percentages of "Severely Burned" conditions in the cutting units following the fire. The Forest Service then must display, for the planning area, the anticipated percentage of total detrimental soil disturbance that would exist in these same cutting units *after* salvage logging activities. The Forest Service should disclose the reduced soil productivity associated with

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[17] USDA Forest Service. *Draft: Preparing Soil Resource Analyses for Inclusion in NEPA Documents.* p. 4
[18] Id. p. 6-8
[19] Id. p. 12
[20] Id. p.12

proposed actions within the Chetco Bar project area, and also site-specifically discuss the soil productivity implications for the cumulative effects of the fire plus proposed salvage logging activities. This information has not been presented in sufficient detail in the EA or project records to adequately assess the environmental impacts of proposed actions on soil and soil productivity.

The criteria for assessing areas of detrimental burning are defined in Forest Service Handbook, FSH 2509.13, Chapter 20 – Burned-area Survey, Section 23.32a. Section 23.32a lists five site indicators to use in identifying fire intensity. These five indicators are: 1) depth and color of ashes; 2) size and amount of live fuels consumed; 3) litter consumption; 4) plant root crowns damaged; and 5) soil crusting, or baking of the soil surface. Because many of the Standards are at least in part numerical, failure to disclose numerical values for erosion, compaction and soil productivity results in a failure to demonstrate consistency with the NFMA. If the FS uses the 15% Standard, then the meaning of "soil productivity" in the terminology of NFMA is largely ignored. The Forest Service claims that "soil quality is maintained when erosion, compaction, displacement, rutting, burning, and loss of organic matter are maintained within defined soil quality standards."[21] But even if the Forest Service were to meet the 15% standard in all Activity Areas, and even if the soil conditions of land outside Activity Areas could reasonably be ignored, the Forest Service still cannot assume that there has been no "significant or permanent impairment of the productivity of the land" as NFMA requires.

Soil productivity can only be assumed to be maintained if it turns out that the soil standards work. To determine if they work, the Forest Service would have to undertake objective, scientifically sound measurements of what the soil produces (grows) following management activities. It is reasonable to expect that in order for the Forest Service to assure that soil productivity is not being significantly impaired, to assure that the forest is producing a sustained yield of timber, for one example, tree growth must not be significantly reduced by soil-disturbing management activities. Grier et al. (1989) adopted as a measure of soil productivity: "the total amount of plant material produced by a forest per unit area per year." And they cite a study where "a 43-percent reduction in seedling height growth in the Pacific Northwest on primary skid trails relative to uncompacted areas" for example. And in another Forest Service report, Adams and Froehlich (1981) state:

"Measurements of reduced tree and seedling growth on compacted soils show that significant impacts can and do occur. Seedling height growth has been most often studied, with reported growth reductions on compacted soils from throughout the U.S. ranging from about 5 to 50 per cent."

Adams & Froehlich (1981) also provide reasons why impacts beyond the directly compacted 15% of an area must be considered in any reasonable definition of soil productivity:

[21] FSM 2500-99-1. Region 1 Supplement.

"Since tree roots extend not only in depth but also in area, the potential for growth impact also becomes greater as compaction affects more of the rooting area. In a thinned stand, for example, you can expect the greatest growth impacts in residual trees that closely border major skid trails or that have been subject to traffic on more than one side of the stem."

In other words, when an Activity Area reaches 15% detrimentally impacted soils via compaction, tree growth **outside the skid trail,** or beyond the 15% compacted area, is affected.

To recognize that these standards must be validated, Forest Supervisors must: 1) assess whether (soil quality standards) are effective in maintaining or improving soil quality; 2) evaluate the effectiveness of soil quality standards and recommend adjustments to the Regional Forester; and 3) consult with soil scientists to evaluate the need to adjust management practices or apply rehabilitation measures.

All of this implies that rigorous soils monitoring must be undertaken. The Forest Management Handbook at FSH 2509.18 directs the Forest Service to do validation monitoring to "Determine if coefficients, S&Gs, and requirements meet regulations, goals and policy" (2.1 – Exhibit 01). Furthermore, recognizing that loss of soil productivity is defined not merely in terms of the absence of meeting the 15% standard. "Soil Function" is defined thus:

Primary soil functions are: (1) the sustenance of biological activity, diversity, and productivity, (2) soil hydrologic function, (3) filtering, buffering, immobilizing, and detoxifying organic and inorganic materials, and (4) storing and cycling nutrients and other materials.

And "Soil Quality" is defined as:

"The capacity of a specific soil to function within its surroundings, support plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation."

Page-Dumroese et al. (2006) emphasize the importance of validating soil quality standards using the results of monitoring: "Research information from short- or long-term research studies supporting the applicability of disturbance criteria is often lacking or is available from a limited number of sites which have relative narrow climatic and soil ranges. …Application of selected USDA Forest Service standards indicate that blanket threshold variables applied over disparate soils do not adequately account for nutrient distribution within the profile or forest floor depth. These types of guidelines should be continually refined to reflect pre-disturbance conditions and site-specific information." (Abstract). Furthermore, even if it were reasonable to assume that the Forest Service need only maintain soil conditions so that no more than 15% of Activity Areas be in a detrimentally disturbed condition, the Forest Service has not actually included measures of all the kinds of soil disturbance that meet the definition of "detrimentally disturbed."

Adams & Froehlich (1981) state: "While general field observations can be useful in recognizing severe compaction problems, measurement of actual changes in soil density permits the detection of less obvious levels of compaction." It is these “less obvious levels of compaction” that are missed by the lack of monitoring in the Chetco Bar project area and the Rogue River-Siskiyou National Forest in general. There is simply no way that the RRSNF has enough soil bulk density and other compaction monitoring data collected at the adequate soil depths and in enough sites to be able to assure that the logging activities will not significantly or permanently impair the productivity of the soil.

Another problem with the Forest Service’s lack of soil monitoring is that there has been no measure of soil productivity reductions due to loss of soil nutrients from logging activities, including removal of boles, branches, and from site preparation methods such as broadcast burning. From Grier and others (1989):

“The potential productivity of a site can be raised or lowered by management activities causing a permanent or long-term increase or decrease in the availability of nutrients essential for plant growth.

…Any time organic matter is removed from a site, a net loss of nutrients from that site also occurs. In timber harvesting or thinning, nutrient losses tend to be proportional to the volume removed.

…Slash burning is a common site preparation method that can affect soil chemical properties tremendously. A great deal of controversy is often associated with using fire because of the wide variety of effects, some of which are definitely detrimental to site quality and some of which are beneficial.”

Without sufficient soils monitoring and field verification in the Chetco Bar project area, the Forest Service cannot make unsubstantiated predictions that the project will comply with Forest Plan Standards. Courts have held that sufficient monitoring and inventorying of forest resources is vital to making sound, forest management decisions and ultimately protecting the forest resources. NEPA analysis must present a "reasonably complete discussion of possible mitigation measures." *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 351 (1989).

The Chetco Bar EA's reliance on generic Best Management Practices (BMPs) is not scientifically or legally sufficient to demonstrate that significant adverse impacts to soil resources will be avoided.

The Chetco Bar EA proposes to avoid the numerous adverse impacts of post-fire logging under action alternatives by following Best Management Practices (BMPs), such as "designing and minimizing the number of skid trails used; by requiring equipment to use only those roads and skid trails created during past harvest where feasible; using equipment and/or techniques shown effective to prevent or minimize compaction; and allowing operations only during conditions when soils are unlikely to be detrimentally compacted beyond the 15% LRMP allowances" (EA at 3-78). The EA asserts that these generic design criteria "have been proven successful" and "are highly effective at minimizing erosion and the movement of sediment from proposed activities" (EA at 3-83) but provides no substantiating evidence in support of this claim. Despite the fact that the preferred alternative proposes to log thousands of acres from high severity burn areas, where vulnerable, erosion- and compaction-prone soils are most prevalent, the EA's soils analysis cursorily concludes that "any potential effects are expected to be localized and short-term in duration" (EA at 3-83).

While proposed BMPs as set forth in the Chetco Bar EA may mitigate expected adverse impacts to some degree, there is considerable evidence that they do not eliminate the persistent erosional impacts of post-fire logging (Megahan et al. 1992). USDA FS and USDI BLM (1997c) concluded that although BMPs can reduce surface erosion compared to more damaging historical practices, increased risks of adverse soil impacts remain with post-fire logging even if BMPs are followed. Ziemer & Lisle (1993) stated that there are no reliable data indicating that BMPs have proven effective in protecting soil and aquatic resources from the adverse effects of post-fire logging. Consistent with this finding, Espinosa et al. (1997) provided evidence from watershed case histories that BMPs thoroughly failed to cumulatively protect salmonid habitats and streams from severe damage associated with roads and logging.

Such over-reliance on BMPs and generic mitigation measures has been found to be inconsistent with NEPA by the federal court system. The Neighbors of Cuddy Mountain case provides clarification with respect to the Forest Service's duty to properly formulate and discuss mitigation measures:

"The Forest Service's perfunctory description of mitigating measures is inconsistent with the "hard look" it is required to render under NEPA . . . A mere listing of mitigation measures is insufficient to qualify as the reasoned discussion required by NEPA."[22]

While the use of BMPs is to be encouraged in post-fire logging projects, the courts have found that the use of these measures is not in and of themselves sufficient to ensure compliance with the law. Again Neighbors of Cuddy Mountain,

"The Forest Service's broad generalizations and vague references to mitigation measures in relation to the streams affected. do not constitute the detail as to mitigation measures that would be undertaken, and their effectiveness, that the Forest Service is required to provide."[23]

[22] 137 F.3d at 1380 (quoting Carmel-by-the-Sea v. U.S. Dep't of Transp., 123 F.3d 1142. 1154 (9th Cir. 1997 and Northwest Indian Cemetery Protective Ass'n v. Peterson, 795 F.2d 688, 697 (9th Cir. 1986), rev'd on other grounds, 485 U.S. 439 (1988).
[23] Id. at 1381.

The Chetco Bar EA's reliance on BMPs and other generic mitigation measures to summarily dismiss any adverse impacts on soil compaction and erosion, and uncertainty regarding their actual implementation, simply does not meet the "hard look" requirements of NEPA.

The Chetco Bar EA fails to adequately evaluate the adverse impacts to soils and site productivity associated with construction of temporary roads and landings.

According to the Chetco Bar EA, approximately 12.2 miles of temporary road would be constructed for Alternative 2 and 9.4 miles for Alternative 3 in order to conduct proposed post-fire logging (EA at 3-84). In addition, an undisclosed (but likely significant) amount of existing system roads will receive new maintenance or upgrading -- which may include resurfacing, blading/reshaping, roadside tree removal, brushing, culvert and ditch cleaning -- "to make them suitable for treatment access". While acknowledging that some (undisclosed) degree of erosion and other soil impacts will likely result from these actions, the EA essentially dismisses these impacts by claiming that new roads would be temporary, and "following use, would be returned to the highest degree of productivity reasonably achievable". These statements do not constitute sufficient analysis of this issue and fail to consider available scientific evidence about the numerous insidious and long-term impacts of roads on soils and other important resource values.

The proposed construction and reconstruction of roads and landings are likely to cause tremendous and enduring increases in soil erosion and sedimentation in the Chetco Bar project area and on adjacent lands, likely affecting this watershed for decades. Road construction and increased use associated with post-fire logging is known to dramatically increase rates of erosion and sedimentation (Reid & Dunne 1984, Roni et al. 2001). For example, Swank et al. (1989) demonstrate that logging roads and landings caused 100 times more erosion than undisturbed sites, and logging caused 7 times more erosion than undisturbed sites in southwest Oregon.

The Forest Service essentially claims in the EA that proposed new roads will have no long-term adverse impacts because they are "temporary", but the agency has presented no scientific evidence in support of this statement. In fact, available research on this issue has found exactly the opposite. For example, Luce (1996) found that soil erosion, compaction and water infiltration rates remained dramatically altered for a number of years following recontouring of a forest road. “Reported changes do not represent “recovery” for the treated areas, and an increased risk of erosion and reduced soil productivity remains” (Luce 1996). Even if "rehabilitated" temporary roads may exhibit some improvement in conditions over untreated roads, the EA fails to ensure or detail how temporary roads will in fact be treated, what specific actions will be taken and when, and whether such actions are guaranteed to occur as part of project implementation.

The EA also fails to adequately evaluate impacts associated with the construction of numerous landings throughout the Chetco Bar project area as part of proposed logging. Even helicopter logging often creates significant soil damage through extra-large landings needed for large volumes of logs (Megahan 1987). How many new landings does the Forest Service expect to be construct and of what size and type? How many acres of soil will be adversely impacted, and how will these cleared and compacted areas be distributed across the project area in relation to streams and other sensitive features? These impacts have not been estimated or disclosed in the EA, so the agency cannot say with any factual basis whether forest plan standards will be met. All proposed soil impacts must be estimated and fully presented so that the public can comment and an adequate cumulative effects analysis can be prepared.

The EA fails to discuss and analyze likely adverse impacts of proposed actions on the soil biotic community, including soil food webs, which are known to strongly influence nutrient dynamics, plant succession, and other important ecosystem processes.

In undisturbed ecosystems, the soil food web is a tightly coupled below-ground ecosystem that directly affects many above ground processes such as succession, plant establishment and growth, and erosion and water quality. In a forest, this below-ground ecosystem is fed primarily by photosynthates exuded from the fine roots of trees. These photosynthates feed a plethora of bacteria and fungi species which feed thousands of arthropod and nematode species and so on. Each species fills an important niche and represents both a sink and a source and of nutrients for other organisms. Logging will remove trees and alter the soil environment which forms the basis of this food web, so the tightly coupled nutrient retention systems will be disrupted, allowing nutrients to “leak” from the system. After a fire all the living (and dying trees) play an essential role in feeding the below ground ecosystem until more of the above ground ecosystem recovers. The Chetco Bar EA fails to consider these significant effects.

The structure and function of the soil food web has been suggested as a prime indicator of ecosystem health (Coleman, et al. 1992; Klopatek, et al. 1993). Measurement of disrupted soil processes, decreased bacterial or fungal activity, decreased fungal or bacterial biomass, changes in the ratio of fungal to bacterial biomass relative to expected ratios for particular ecosystems, decreases in the number or diversity of protozoa, and a change in nematode numbers, nematode community structure or maturity index, can serve to indicate a problem long before the natural vegetation is lost or human health problems occur (Bongers, 1990; Klopatek et al. 1993).

Soil ecology has begun to identify the importance of understanding soil food web structure and how it can control plant vegetation, and how, in turn, plant community structure affects soil organic matter quality and soil food web structure. Regardless, some relationships between ecosystem productivity, soil organisms, soil food web structure and plant community structure and dynamics are known and can be extremely important determinants of ecosystem processes (Ingham and Thies 1995). Alteration of the soil food web structure can result in sites which cannot be regenerated to conifers, even with 20 years of regeneration efforts (Perry 1988; Colinas et al. 1993). Work in intensely disturbed forest ecosystems suggests that alteration of soil food web structure can alter the direction of vegetation development. By managing food web structure appropriately, early stages of succession can be prolonged, or deleted (Allen & Allen 1993). Initial data indicates that replacement of grassland with forest in normal successional sequences requires alteration of soil food web structure from a bacterial-dominated food web in grasslands to a fungal-dominated food web in forests (Ingham et al. 1986a, 1986b, 1991; Ingham & Thies 1996).

Soil processes are important for maintaining normal nutrient cycling in all ecosystems (Coleman 1985; Dindal 1990; Ingham et al. 1986a, 1986b). Plant growth is dependent on the microbial immobilization and soil food web interactions to mineralize nutrients. In undisturbed ecosystems, the processes of immobilization and mineralization are tightly coupled to plant growth but following disturbance, this coupling may be lost or reduced. Nutrients may be no longer retained within the system, causing problems for systems into which nutrients move (Ingham & Coleman 1984, Hendrix et al. 1986, Nannipieri et al. 1990). Measurement of disrupted processes may allow determination of a problem long before normal cycling processes are altered, before the natural vegetation is lost, or human health problems occur. By monitoring soil organism dynamics, we can perhaps detect detrimental ecosystem changes and possibly prevent further degradation.

Immobilization of nutrients in soil, i.e., retention of carbon, nitrogen, phosphorus, and many micronutrients in the horizons of soil from which plants obtain their nutrients, is a process performed by bacteria and fungi. Without these organisms present and functioning, nutrients are not retained by soil, and the ecosystem undergoes degradation. Thus, to assess the ability of an ecosystem to retain nutrients, the decomposed portion of the ecosystem, i.e., active and total fungal biomass, and active bacterial biomass must be assessed.

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