John P. O'Brien, Ph.D.
Climate Scientist
Webpage (CV linked within)
Email: jpobrien49@gmail.com

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Christopher Carlton
Forest Supervisor
159 Lawrence Street
Quincy, California 95971

RE: **Community Protection – Central and West Slope**

Please accept the comment/critique of the Plumas Community Protection Plan. First, so we are on the same page, it cannot be not debated that wildfires in California (the greater intermountain west, and globally for that matter) are increasing in size, and in some cases, intensity (increasing fire size necessarily means increasing area burned at high intensity, though the proportion of high intensity fire per wildfire-burned acre appears to be relatively stable over the past few decades (Parks and Abatzoglou, 2020). The physical drivers for this can also be little debated, there is little doubt that we are reaping what we have sowed and that,

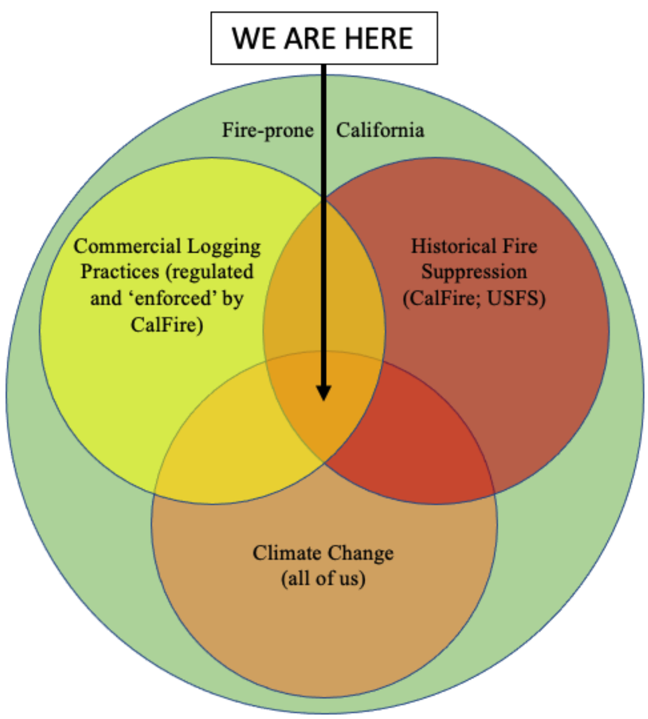


Figure 1: Conceptual Venn Diagram displaying roots of the current wildfire trends in California.

It is well-documented that past (and present) commercial/extractive management of our forests, much of what Plumas County has been subjected to, increases wildfire risk due to increased resultant surface fuel loads, the selective removal of large fire resilient trees, increased canopy openings which create hotter and drier understory conditions, which results in increased xeric understory shrub growth (native and invasive) and greater wind penetration into and through the all layers of the canopy. For example, Weatherspoon, 1996 writes:

> "*Thinnings, insect sanitation and salvage cuts, and other partial cuttings add slash, or activity-generated fuels, to the stand unless all parts of the tree above the stump are removed from the forest. Small trees damaged by harvest activities but not removed from the forest often add to the fuel load. To the extent that it is not treated adequately, this component of the total fuel complex tends to increase the probability of a more intense, more damaging, and perhaps more extensive wildfire. […] Thinning or otherwise opening a stand allows more solar radiation and wind to reach the forest floor. The net effect, at least during periods of significant fire danger, is usually reduced fuel moisture and increased flammability (Countryman 1955). The greater the stand opening, the more pronounced the change in microclimate is likely to be. [...] For example, removing most of the large trees from a stand, leaving most of the understory in place, and doing little or no slash treatment—a situation all too familiar in the past—will certainly increase the overall hazard and expected damage to the stand in the event of a wildfire. Everything points in the same direction: removing most of the fire-tolerant large trees; retaining most of the easily damaged small trees; increasing the loading (quantity) and depth of the surface fuel bed; and creating a warmer, drier, windier environment near the forest floor during times of significant fire danger*.

Russell et al. 2018 writes,

> "*As the forest was thinned, turbulence and wind speed near the surface (0.13 h) increased and became more connected with above the canopy (1.13 h). [...] Thinning the whole canopy reduced the overstory, leading to increased mixing and a better coupling between the canopy layers and the atmosphere as larger eddies could penetrate through the canopy*."

These factors largely explain why Stephens and Moghaddas 2005 found that for Sierra forests, old- and young-growth reserves and thin from below treatments (small diameter tree removal to reduce ladder fuels) were more effective at preventing tree mortality than overstory removal or individual tree selection in subsequent wildfire. Indeed, this is consistent with the findings of Nakamura 2004, as he writes,

> "*Forest surface fuels comprised of needles, leaves, branches, logging slash are the most important fuel to treat, as they drive overall fire behavior. Ladder fuels comprised of small trees, large brush, and lower branches of overstory trees will carry surface fires into the crowns of trees under some conditions. In California, crown fires are usually supported by the surface and ladder fuel complex, not crown fuel levels*."

In the same vein, Banerjee 2020 found that forest thinning uniformly increased in-forest wind speeds capable of carrying a wildfire through the crowns despite crown thinning and that fire moved fastest through thinned, dry forest.

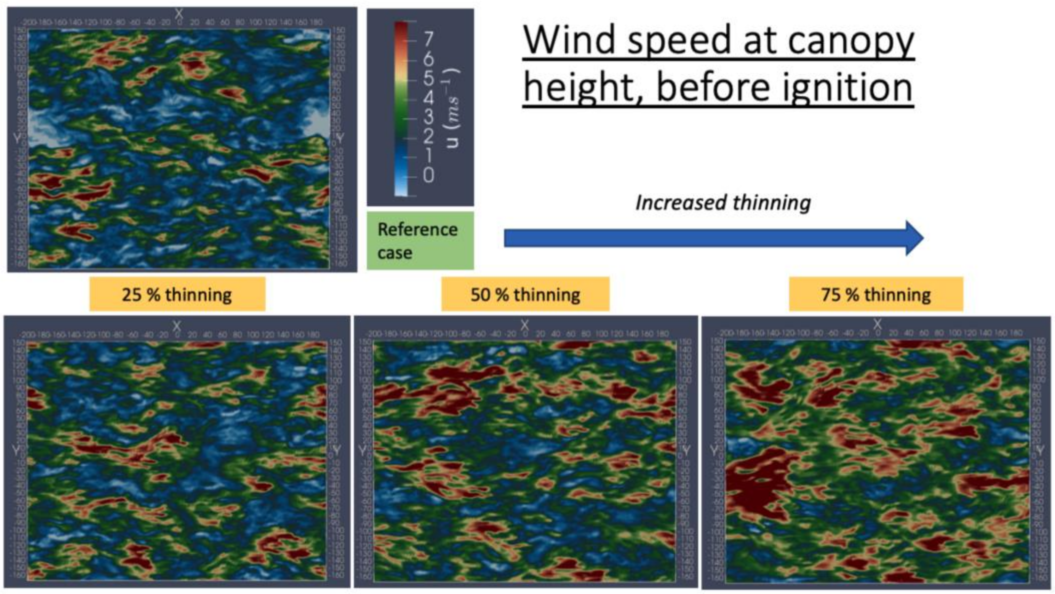
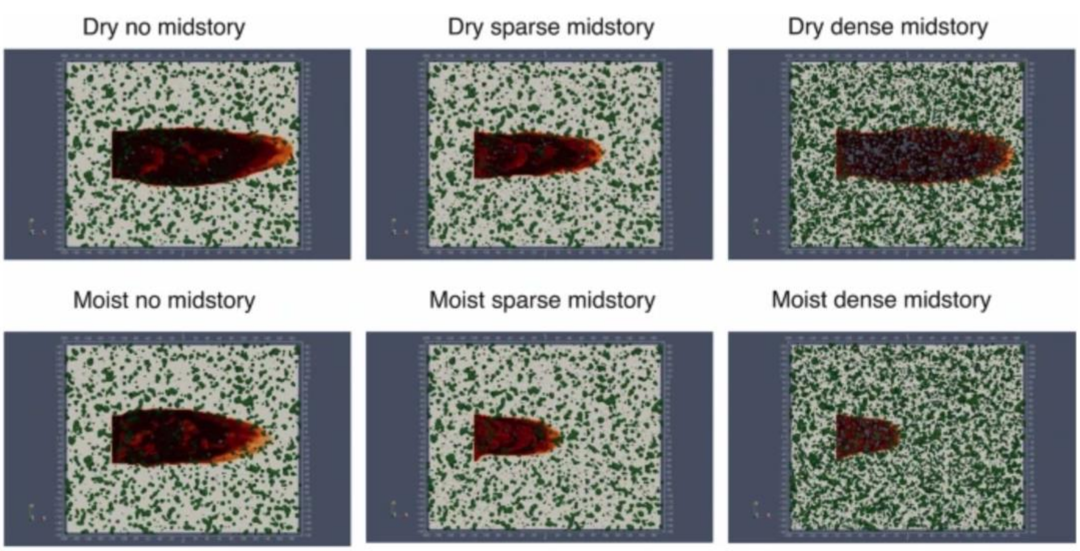


Figure 3. Wind speed at canopy height for the different simulation cases before ignition.

Figure 2: From Banerjee 2020.



Burnt area after 520 s for different cases. Green depicts midstory vegetation, the light yellow shade depicts the ground surface covered with grass and litter and the dark color depicts burned area.

Figure 3: From Banerjee et al. 2020

The modeling studies from Banerjee are consistent with the observational findings of Zald and Dunn 2018 who found that in the dry western forests, logging intensity is the second most important predictor of wildfire intensity, surpassed only by weather and drought conditions. This was also found by Bradley et al 2016 who reported that across the entire western U.S., fires burn with less intensity on lands that have the highest protections from logging.

It's clear to see that both past commercial logging and future "planned" commercial logging have detrimental impacts to our forests, both in terms of making them more vulnerable/conducive to wildfire, but also in terms of the direct loss of sequestered forest carbon, which is on average far higher annually than forest carbon losses from fire (Harris et al 2016; Williams et al 2016; Berner et al 2017; Bartowitz et al 2022). Indeed, Bartowitz et al 2022 state,

> "*In order to reduce fire impacts, management policies are being proposed in the western United States to lower fire risk that focus on harvesting trees, including large-diameter trees. Many policies already do not include diameter limits and some recent policies have proposed diameter increases in fuel reduction strategies. While the primary goal is fire risk reduction, these policies have been interpreted as strategies that can be used to save trees from being killed by fire, thus preventing carbon emissions and feedbacks to climate warming. This interpretation has already resulted in cutting down trees that likely would have survived fire, resulting in forest carbon losses that are greater than if a wildfire had occurred. […] While wildfire occurrence and area burned have increased over the last three decades, per area fire emissions for extreme fire events are relatively constant. In contrast, harvest of mature trees releases a higher density of carbon emissions (e.g., per unit area) relative to wildfire (150–800%) because harvest causes a higher rate of tree mortality than wildfire. Our results show that increasing harvest of mature trees to save them from fire increases emissions rather than preventing them.*"

This is in line and consistent with what Ingalsbee 2005 reported:

> "*While commercial timber extraction is often seen as the primary economic driver behind management projects, managers attempt to avoid public controversy by framing project proposals around more laudable pursuits, such as hazardous fuels reduction. For example, the purpose and need governing several recent fuelbreak timber sales has been canopy fuel reduction in order to reduce crown fire hazard. Not coincidentally, reducing canopy fuels involves cutting down overstory trees. Typically the first order of business in these projects is to remove the large-diameter boles— the least flammable but most commercially valuable portion of a tree. This in turn involves moving the most flammable components—the small-diameter limbs and foliage—from the canopy layer directly onto the ground surface. In such cases, one could argue that the net result is not fuels reduction, but rather, fuels relocation, essentially shifting the location of hazardous fuels from the crown to the ground where they become immediately available for surface fires. If these activity fuels are left untreated or are ineffectively treated, fire intensity and severity can actually increase compared to untreated sites (Graham et al 1999, Weatherspoon 1996).*"

All the preceding taken together, a project that focuses on mechanical thinning and overstory removal (crown density thinning) is very likely to exacerbate wildfire behavior rather than suppress it. The Plumas Community protection project has an upper limit of **30 inches DBH on trees to be removed**. These trees are certainly those that make up the overstory of the forest and also among the most fire resistant and ecologically valuable, not to mention also the most commercially valuable. Project managers might respond that the removal of these trees will be a minimum, but the project documentation provides no assurance or guarantees of this. There is exactly zero analysis on the pre-harvest distribution of trees in this diameter class or how many will be taken. In fact, there is no pre-harvest information on the tree diameter distribution nor is there any post-harvest target distribution given.

The project relies heavily on the rSDI metric, however, the EA provides no spatially explicit information on initial rSDI within the project area. The only rSDI target given for the project is a broad statement of something like reducing the pre-project rSDI to something like ~25%. However, rSDI is effectively composed of two distinct components, Trees per Acre (TPA) and Quadratic Mean Diameter (QMD; which by the way is a logging industry metric that inflates tree diameters higher than the mean diameters to better reflect board-foot volumes delivered to mills). Thus, to reduce rSDI one can reduce the trees per acre or reduce the QMD of the forest. As such, the largest reductions in QMD come from cutting down the biggest, fire resistant, overstory trees first, which as the literature shows, would actually worsen wildfire risk. The Project documentation states,

> "*Research indicates tree density across California has increased nearly 40 percent since the 1930's, while the number of large trees has decreased. The result is more homogenous landscapes characterized by tightly packed small and medium-sized trees, increased canopy cover, and fewer large-diameter trees (Forest Service 2023).*"

This statement is broadly true, however it fails to mention that the loss of large trees, the exact ones we need in our forests, is primarily a result of past and present logging practices and that the loss of those big old trees is exactly what allowed more light to penetrate to the forest floor allowing a proliferation of small tightly packed trees that have a high propensity to burn at high intensity in wildfire.

The Project documentation is vague and unclear on which trees will be slated for removal thus as proposed the Project will have vague and uncertain outcomes. Focusing on reducing rSDI by reducing TPA from a smallest to "largest" framework (though for the record, 30in DBH is far too large of a tree to be felled in the name of "fire risk reduction") would likely have positive outcomes for wildfire risk mitigation. However, focusing on reducing rSDI by reducing the QMD of the forest by cutting down the largest trees in the forest first would like exacerbate future wildfire behavior. It is imperative that this be clarified before the project proceeds or is approved. The science is abundantly clear, surface fuels treatment, the reduction of ladder fuels through small understory tree thinning, followed by or coupled with prescribed fire offers the greatest benefit to the forest in terms of protection from wildfire. Crown fuel levels are of secondary or tertiary importance at best. Agee et al 2000 report that,

> *"Fuel fragmentation does not have to be associated with structural fragmentation or overstory removal, but must be associated with declines in at least one of the factors affecting fire behavior discussed earlier: reduction of surface fuels and increases in height to*

> *live crown as a first priority, and decreases in crown closure as a second priority. On most landscapes these treatments should be prioritized in that order, but economic issues tend to reverse the order and focus on thinning only that directly affects crown closure. Thinning must be linked with surface fuel reduction and increases in height to live crown to be an effective fuel treatment."*

Case in point from Agee et al 2005. On the upper left, untreated forest and on the lower right forest treated by reducing surface and ladder fuels. Note that in the treated forest, the overstory (crown bulk density) was left intact. Despite high crown fuel levels and horizonal continuity, when the fire hit the understory treated forest the fire dropped from a detrimental crown fire to a beneficial ground fire. No overstory thinning (large tree removal) necessary.

Figure 4: From Agee et al 2005.

Accordingly, Agee et al summarize the basic principles of fuel reduction:

> "*We summarize a set of simple principles important to address in fuel reduction treatments: reduction of surface fuels, increasing the height to live crown, decreasing crown density, and retaining large trees of fire-resistant species. Thinning and prescribed fire can be useful tools to achieve these objectives.* ***Low thinning will be more effective than crown or selection thinning, and management of surface fuels will increase the likelihood that the stand will survive a wildfire*** (emphasis added)."

And again, to reiterate, reducing crown bulk density does not in and of itself mean removal of the largest overstory trees, removing small diameter, but tall spindly trees reaching up into the canopy is sufficient for achieving that purpose, albeit not being near as important as treating surface fuels and ladder fuels.

It should also be explicitly stated that if the purpose of this project is community protection (ie the protection of homes and businesses) then these type of treatments should be focused in and around the community. It is well documented that fuel reduction work has little to no effect on home survival when done more than 100 feet away from structures and that within the 100ft defensible space perimeter firefighter presence is of key importance (Syphard et al 2014; Syphard and Keeley 2019). If the purpose of this project is "community protection" then it should be primarily focused on the community and areas immediately adjacent (Gibbons et al 2012). In addition, it is also widely recognized that even in the presence of properly maintained defensible space, it is more often than not the home itself that is the "fuel" as opposed to any surrounding vegetation present. Increasingly we are seeing that "home hardening" has the best bang for the buck when it comes to investment for home survival in wildfire prone areas (Cohen and Stratton 2008; Cohen 2019; Cohen and Strohmaier 2020).

Logging trees up to 30in DBH and calling it fuel reduction is effectively doubling down on the same principles of past forest management in the area. It has not worked and more homes will surely be lost in the next fire when, not if, it comes. It is stated in the EA (pg. 52) how detrimental past management was, however, from the Project description it is not possible to tell how different the proposed management is from past management and exactly how future forest structure will be meaningfully different from past forest structure. It is imperative that this is explicitly clarified.

I applaud the proposed use prescribed fire, however much more is needed. Along with a reduction in the maximum diameter of trees to be removed. Something like 20in DBH seems more appropriate, but it is not possible to tell without a pre-project stem inventory- that is TPA by DBH class. Without this beforehand it is not clear what work needs to be done and what should be done to effectively reduce fire danger. A spatially explicit tree distribution within and around the project area could easily be accomplished using the available FIA plots in and around the area; as well as potentially using data from private industrial landowners. Further, the available USGS lidar in the area should also be leveraged for understanding canopy heights and correlating/calibrating that to FIA plots in the area.

The vague nature of the planned treatments and the "hand-wavy fuels reduction for fire management" stinks ulterior motives, especially with the large diameters of trees to be cut. Moreover, both fire science and ecology extol the benefits of prescribed fire, yet despite being the cheapest to implement at $500/acre, it is the least used method in this vast 200,000+ acre project. Its notable also that you have chosen to provide the costs associated with the different treatments, mechanical being the most expensive, however, you have not provided estimates of expected revenue associated with the project from timber sale. It is surely factored in as a means to offset costs. How many board-feet does this project plan to deliver to the mill and what is the expected revenue associated with that? If you provide the costs associated treatment you need to also provide the revenue associated with it as well.

Finally, the scope of herbicide use in this project is staggering. Most studies on the environmental effects of herbicide use are small in geographic area. Proposing to use it on 200,000 acres surrounding communities is tantamount to an experiment on the people and environment of Plumas County. Especially with toxic substances like Glyphosate and Imazapyr which are known to cause cancer and is banned in Europe, respectively. These compounds are regularly used by logging companies and again it makes this project stink of commercial/industrial forest management, not community protection from wildfire.

The extensive logging and herbicide use associated with this project brings about the very real prospect of unanticipated cumulative impacts, to both plant, animal, and human life. This conjures the metaphor that by using commercial forest management and herbicides to "move forward" here, we are just taking out a loan to pay back the interest on the loan we took out when commercially managed the forest in the decades prior as described on page 52 of the EA. And where will we be in 10, 20 years from now… even deeper in debt.

Community and forest protection can be done through management, but commercial management is not the way. It needs to be made abundantly clear to the community, the real stakeholders here, that this project is not more of the same, which is partially responsible for getting us in this wildfire mess in first place (Figure 1).

In addition fire modeling should also be conducted in the project area under less extreme conditions for example 80th percentile as in any given year, most acres burned do not burn under the most extreme conditions. Yes the worst fires burn under the worst conditions, hence weather and climate being the leading factor, but most acres do not necessary burn under the worst case conditions. Trying to manage to adapt to extremes is a fools errand- it cannot and should not be done. Adaption is about responding to changes in average conditions, mitigation is about responding to changes in variability, or the extremes in the tails of the distribution. This management perspective underpins the statement of Bartowitz et al 2022,

> *"While the primary goal is fire risk reduction, these policies have been interpreted as strategies that can be used to save trees from being killed by fire, thus preventing carbon emissions and feedbacks to climate warming. This interpretation has already resulted in cutting down trees that likely would have survived fire, resulting in forest carbon losses that are greater than if a wildfire had occurred. […] Our results show that increasing harvest of mature trees to save them from fire increases emissions rather than preventing them."*

The increase in area burned every year is primarily a climate related phenomena and its not something that we will be able to log our way out of (Williams et al 2019; Goss et al 2020; Abatzoglou et al 2020; Higuera and Abatzoglou, 2021; Zhuang et al 2021; Turko et al 2023). Intentional management focused on TPA reduction starting first with surface and ladder fuels can help mitigate some wildfire impacts, but under an increasingly extreme climate, long-term reductions in anthropogenic CO_2 will be the only real solution to our wildfire woes.

At a time when the federal government is actively calling for increased protections for mature and old growth forests, here is a federal project threatening to log mature trees in the name of "fire risk reduction and community protection" when it is scenically unsupported that these same mature trees in any way contribute to increased wildfire risk… And it is in fact the opposite: its exactly these large diameter trees that help our forests be resilient to and withstand fire (Bartowitz et al 2022), make up the bulk of above ground carbon storage (Mildrexler et al 2020), and provide the bulk of ecological services (Lutz et al 2018).

In a recent review, Prichard et al. 2021 address several common questions that come up in relation to forest management, some key points from their review as are follows:

1. *While "thin the forest to reduce wildfire threat" is commonly cited in the popular media, the capacity for thinning alone to mitigate wildfire hazard and severity is not well supported in the scientific literature. Thinning treatments require strategic selection of trees to target fuel ladders and fire-susceptible trees, along with a subsequent fuel reduction treatment. When thinning is conducted without accompanied surface fuel reduction, short and long-term goals may not be realized.*

2. *Thinning from below reduces ladder fuels and canopy bulk density concurrently, which can reduce the potential for both passive and active crown fire behavior.*

3. *Large-diameter trees and snags that provide essential wildlife habitat and other ecosystem values can be retained and fuels can be deliberately removed around these structures using this approach.*

4. *On most sites, thinning alone achieves a reduction of canopy fuels but contributes to higher surface fuel loads. If burned in a wildfire, these fuels can contribute to high-intensity surface fires and elevated levels of associated tree mortality.*

5. *When trees are felled and limbed, fine fuels from tree tops and branches (termed activity fuels) are re-distributed over the treatment area, thereby increasing surface fuel loads.*

6. *Other unintended consequences of thinning without concomitant reduction in surface fuels can occur. For instance, decreasing canopy bulk density can change site climatic conditions. Wildfire ignition potential is largely driven by fuel moisture, which can decrease on drier sites when canopy bulk density is reduced through commercial thinning.*

7. *Reduced canopy bulk density can lead to increased surface wind speed and fuel heating, which allows for increased rates of fire spread in thinned forests.*

Please be clear about *exactly* which diameter class and number of trees in each class you intend to fell for "community protection". It matters.

Finally, a 30-day comment period on a ~1000 page project document(s) covering over 200,000 acres is wholly inadequate. Given the scope and scale of the project 30-days is far too little time to read, absorb, and write. I assume that was done intentionally to limit informed public participation.

Sincerely and with concern,
John P. O’Brien, Ph.D.