X. Agency Memo

Memorandum For: Matt Dias, CAL FIRE
From: Caitlin Swalec, Courtney Schatzman, Emma Mendonsa, Laura Gray, and Lauren Krohmer - Master's students at the Bren School of Environmental Science & Management
Date: May 2019
Re: Findings from a master's thesis: Approaches for and limitations to implementing the recent addition of the Wildfire Risk & Hazard Resource Subject to Cumulative Impacts Assessment for Timber Harvest Plans

Over the past year, our University of California, Santa Barbara (UCSB) Bren School master's thesis project team (Group) worked with you to develop a standardized methodology for the newly adopted Timber Harvest Plan (THP) resource subject *Wildfire Risk and Hazard* within the Cumulative Impact Section. The intent of this memo is to outline the accomplishments of our project and discuss in depth the opportunities to reduce hurdles for Registered Professional Foresters (RPFs) and CAL FIRE officials during THP development and evaluation stages. Our final recommendations emerged from (1) a review of the best available science on wildfire hazard and risk assessment from both peer-reviewed and grey literature and (2) insight gleaned from interviews and surveys of Registered Professional Foresters and additional scientists and practitioners in the field of fire science and management. This approach ensures methods which are both scientifically rigorous and technically and logistically feasible.

Our project results include the following: a) clear definitions for wildfire risk and wildfire hazard, b) a baseline knowledge set necessary for evaluating wildfire hazard, c) a baseline checklist for initial wildfire hazard assessment, and d) a decision tree to reach a scientifically credible conclusion about expected wildfire risk in a watershed following a timber harvest. Throughout the project, our Group encountered several hurdles linked to limited site-specific data availability and limited long-term timber harvest research studies. Our Group hopes that providing information about limitations encountered will assist CAL FIRE as it prioritizes funds and efforts towards resources for the new *Wildfire Risk and Hazard* resource section. The following <u>Recommendations</u> section provides suggestions for various stakeholder groups to take as they prepare to interact with the *Wildfire Risk and Hazard* resource section, while the <u>Barriers</u> section speaks to the knowledge gaps and limitations that challenged our research and method development.

Additionally, attached to this memo is a Guidance Document, developed by our Group to provide a recommended approach to assess expected wildfire risk and hazard impacts following a timber harvest. Our Group considered CAL FIRE and Registered Professional Foresters as the primary users of these results, which informed our choice of methodology with respect to time demand and modeling access.

Recommendations

Recommendation 1*: Provide substantiated and consistent definitions of wildfire risk and wildfire hazard that should set the standard in the THP CIA process.*

In support of the addition of Wildfire *Risk and Hazard* to Cumulative Impacts Assessment, CAL FIRE should work to create detailed and cohesive definitions of both risk and hazard as they pertain to wildfire, with specific emphasis on metrics by which RPFs should measure these. This is critical because the variety of definitions for hazard and risk used in the literature around wildfire decrease the likelihood of defensible or standardized assessments of this new Resource Subject. These definitions should either be used within the Forest Practices Rules or THP documentation to ensure standardization of all assessments by RPFs. This will assist in the need that CAL FIRE has expressed for more consistent applications. While the current definitions provided by CAL FIRE were used by our Group, these should be expanded to include metrics and regionally-specific information.

Recommendation 2: *Provide additional resources towards studying the effects of timber harvest actions on forest structure that can change wildfire risk and hazard within the scope of the Cumulative Impacts checklist.*

There is a serious lack of scientific literature reviewing the specific effects of timber harvest actions on a forest and the potential short- and long-term consequences on wildfire risk and hazard. It is recommended that within their capacity to assist in these types of studies, CAL FIRE encourage and support research in the unique ways that timber harvest actions can affect a forest. This will provide more substantive evidence for trends of hazard and risk in California's forests. Additionally, there are limited long-term studies of any type of management action on forest structure. This is also an important endeavor for CAL FIRE to support to better satisfy projections into the future required by Cumulative Impacts Assessments. This need also extends to studying the effects of forest management in different forest types, as the literature currently focuses primarily on mixed-conifer forests in the Sierra Nevada, leaving certain forest types significant to the California timber harvesting industry under-represented.

Recommendation 3: *Support efforts to increase the availability and update frequency of necessary data at the state level to be able to apply wildfire risk and hazard assessments to timber harvest plots.*

More data should either be collected on or disseminated from privately held timberlands, especially the data already collected from pre and post timber harvest assessments.

The spatial data used in this case study were limited to those available from LANDFIRE, the most recent of which were from 2014. This can severely limit the time-series analysis that we recommend, by reducing the quality and/or feasibility of assessing some immediate or longer term trends. LANDFIRE provides data in a consistent format easily used as an input for a landscape file needed for FlamMap 5.0. It is recommended that CAL FIRE support continued efforts to increase the availability of similar raster data for the state of California to encourage use of models that require this type of data that can assist in estimating wildfire risk and hazard.

Updated data considerations should also be extended to the California Fire and Resource Assessment Program's Fire Threat to Wildland Urban Interface resources. These resources are vital towards determining Wildfire Risk yet these inputs have often not been revised since 2001.

Recommendation 4: Provide incentives for further research and understanding of burn probability and the likelihood of wildfires in and near timber harvest plots.

Our project did not focus on the likelihood of a fire starting, and instead worked under the assumption of conditions conducive to wildfire ignition. We do recommend that CAL FIRE support research into the causes of wildfire, and, importantly, whether timber harvest actions may increase the likelihood of ignition. There is currently limited research on this subject, despite relevant legal cases.

Recommendation 5: Encourage the use of flame length as a metric for crown fire potential to increase consistency in assessments of wildfire hazard.

Flame length was chosen as the metric for measuring wildfire hazard in this evaluation. This metric is valuable as it can be modeled using a number of different software programs available, and is directly linked to the likelihood of crown fire. Crown fires are of particular interest as they are characteristic of very hazardous wildfire scenarios that can be very difficult to suppress. Flame length was also chosen as a metric because of its preexisting use within CAL FIRE's model for calculating fire hazard severity zones. We recommend that CAL FIRE continue to encourage the use of this metric for RPFs to use when assessing wildfire hazard in their timber harvest documentation. This will work to increase consistency in THPs that are submitted for review and RPF understanding of wildfire risk and hazard.

Recommendation 6: Determine relevant thresholds for significant adverse changes in wildfire hazard and risk as a result of a timber harvest action.

While available literature outlines many of the interconnected effects that alterations to forest structure have on wildfire behavior, the thresholds for *significant* changes in wildfire hazard or risk are less clear. In order for RPFs to determine whether a proposed timber harvest action will significantly impact wildfire risk or hazard across the Planning Watershed unit, these thresholds should be well defined. One possible way to do this is to create a rating system by which different types of actions would have different weight on the total hazard rank. Currently, the literature does not provide sufficient quantitative values for different actions that may be part of a timber harvest plan to rank such actions. Further research and evaluation of such timber harvest-specific actions and their impact on wildfire hazard can inform such thresholds.

Barriers
Our group discovered the following knowledge gaps, which presented barriers to our research:

Barrier 1: Forest Management Actions

Over centuries, timber is harvested in multi-decadal cycles that likely alter wildfire risk and hazard, yet there is limited literature on this process in different forest types, across varying temporal and spatial scales, and across management practices such as piling and burning, broadcast burning, lop and scatter, mastication, or yarding methods. Likewise, there is limited documentation on restocking methods and regrowth periods following harvest, as well as the compounding effects of climate change and timber harvest actions on forested ecosystems.

Barrier 2: Wildfire Behavior

The predictability of fire varies across spatial and temporal scales and predictions are complicated by weather patterns and the prospect of future disturbances other than fire. Understanding how variations in wildfire behavior (e.g. by crown height, flame length, fire line intensity) cause structural alterations in a range of forest types (species composition), and vice-versa, remains enigmatic. We highlight species composition, here, because few forest types are represented in wildfire behavior literature at present-- mostly limited to mixed-conifers--and are therefore not representative of all California forests significant to the timber harvest industry.

Barrier 3: Research

Substantial research needs to be conducted on timber harvest activities, including: 1) longevity studies (> 7 years) that utilize historic management or disturbance data; 2) cumulative impact studies on timber harvest action across harvest categories (e.g. clear cutting, selective harvesting) and restocking approaches; 3) wildfire behavior studies across harvest categories and bioregions which capture a variety of spatial and temporal patterns; 4) evaluations of the compounded effects of coincident disturbance events such as extreme weather events, wildfires, climate change, and timber harvests.

Conclusion

Considering these recommendations and barriers will help guide CAL FIRE in taking the steps needed for effective implementation of the new *Wildfire Risk and Hazard* section of the Cumulative Impacts Assessment. Our recommendations emphasize the need to encourage research and improve data availability for wildfire and forest modelling programs. While tools and methodologies exist for estimating the effects of forest management actions on wildfire behavior, specific applications of this relationship to timber harvesting activities have yet to be documented in Timber Harvest Plans.