Modeling the impacts of woody biomass harvests on wildlife species in the Sierran mixed conifer forest

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Introduction

Concerns about rising energy costs, global climate change, and catastrophic wildfires have resulted in a renewed interest in the removal of woody biomass from California's forest ecosystems for bioenergy generation. The potential impacts of increased utilization of fine and coarse woody debris on wildlife populations are not fully understood. Negative impacts are likely where the extraction of woody biomass results in the reduction/loss of essential habitat structures from the landscape.

The California Forest Practice Rules (CA FPR) require the use of the California Wildlife Habitat Relationship (CWHR) system when preparing timber harvest documents (e.g. timber harvest plan) to identify potential impacts of proposed harvest activity on wildlife habitats. In this study we used CWHR to model changes in species richness and habitat suitability resulting from woody biomass harvests in the Sierran mixed conifer forests of Shasta and Tehama counties.

Methods

In order to capture the potential impacts of biomass removal in even-aged and uneven-aged silvicultural systems, a pre-commercial thin, clearcut and single tree selection harvest were modeled. For each harvest type, two post-harvest conditions were modeled (with and without biomass harvest), in an attempt to assess the effects of the removal of additional biomass elements on habitat suitability.

Using the methods of Garrison and Standiford (1997), 42 evaluation species were selected to represent diverse habitat requirements for reproduction, feeding and cover habits. Habitat value comparison reports were generated for the six harvest scenarios. Average habitat suitability scores and changes in species richness were reported. CWHR bins habitat suitability scores into three categories: low (0-0.33), medium (0.34-0.66) and high (0.67-1). For each harvest type, we determined changes (positive/negative) in category assignment and species richness by comparing the CWHR output for model runs with and without biomass removal.

Harvest treatments:

Pre-commercial thin, canopy is opened but quadratic mean diameter remains unchanged.

Clearcut regeneration, canopy is removed and seedlings establish.

Single-tree selection, canopy remains closed but canopy layers are removed and the quadratic mean diameter is reduced.

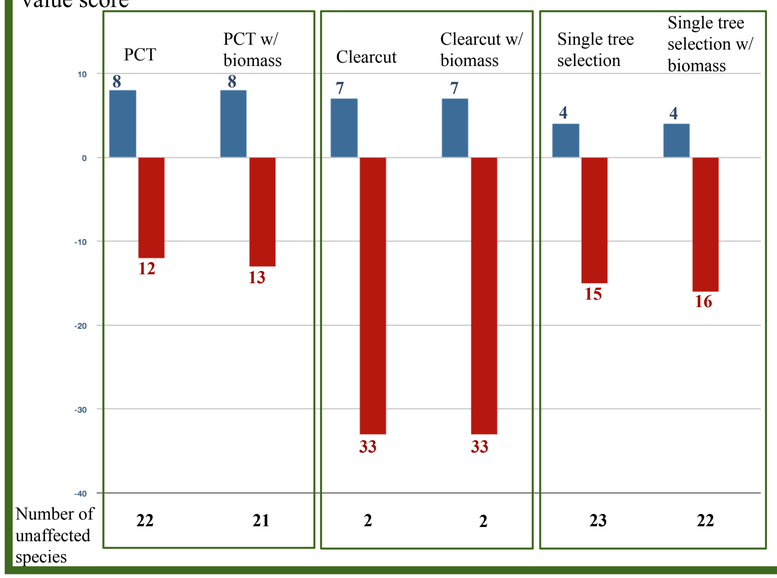
Additional biomass elements removed:

- fine/coarse woody debris
- logs
- snags
- trees with cavities, loose bark and broken tops

Study Area

The Northern Saw-whet Owl was the only evaluation species eliminated because of additional biomass removal

Figure 1: Number of species with positive (blue) or negative (red) change in habitat value score



An example of a biomass harvest done in association with a thinning operation in Northern California

Results

The 42 evaluation species showed varied responses to the six harvest scenarios (Figure 1). There was no difference in the number of positive species responses between harvest scenarios with and without additional biomass removal. The pre-commercial thin treatments produced the greatest number of positive changes in habitat suitability category (8). There was a slight difference in the number of negative changes in habitat suitability and species richness between post-harvest conditions with and without additional biomass removal. The clearcut treatments resulted in the greatest number of negative species responses (33 negative changes in category assignment). The only species eliminated because of the additional removal of woody biomass elements was the Northern Saw-whet Owl. The majority of the evaluation species showed no response to the additional harvest of woody biomass elements, indicating that these elements were not essential for their presence.

Discussion

The CWHR system produces lists of occurrence and average habitat suitability scores based on geographic location, vegetation type, stand structure and the presence of habitat elements. While vegetation type and stand structure are most influential in predicting habitat suitability scores, essential habitat elements must also be present in order for species to occur. According to CWHR generated lists of essential habitat elements, none of the 42 evaluation species require the presence of fine/coarse woody debris, snags and logs. In fact none of the 694 species in CWHR require these elements. Therefore, the majority of changes in habitat suitability values and species richness predicted by CWHR can be attributed to the primary harvest activity and not the removal of additional woody debris. The one exception to this was the Northern Saw-whet Owl which relies on trees with cavities and was therefore predicted to no longer occur when those trees were removed in biomass removal scenarios. Woody debris and snags are known to play important ecological roles in forests; providing cover, feeding and breeding substrates for many wildlife species (Harmon et al. 1986). The lack of predicted effects indicates that CWHR may not accurately model the potential impacts of harvesting dead and downed wood on California wildlife. The CA FPR require the use of CWHR to assess potential impacts on wildlife of proposed harvest activities. However, CWHR is unable to detect impacts on wildlife due to removing woody debris, snags and logs. This indicates an information gap in our habitat-relationship models that must be addressed.

References

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