Research on Post-fire Intervention

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Introduction

Thank you for the opportunity to speak today. I am a graduate student in the Forest Science Department at Oregon State University, and have a Bachelor of Science degree in forestry and about a decade of experience in forest and fire ecology.

For the past three years our team has been conducting an extensive field study of vegetation and fuel dynamics following the Biscuit Fire. Our study employs a replicated and statistically rigorous design to assess the effects of individual management treatments across the broad portion of the burn targeted for salvage.

Paucity of studies

The recent publication of a paper[1] from our study has generated intense discussion in the public and scientific communities. The very fact that a one-page paper has generated this discussion underscores the paucity of direct scientific information that exists on the effects of management intervention following natural disturbance events[2].

By way of example, consider two important works germane to this topic. The first is considered the bible of fire ecology in the Pacific Northwest, containing much of what we know about fire in forests of the region[3]. The second exemplifies a vast body of knowledge regarding reforestation after timber harvest in the region of our study[4]. Salvage logging and post-fire management are arguably where these two bodies of knowledge meet. Yet neither text has a chapter on salvage.

Before moving on to the specifics of our paper, I want to note that decisions regarding intervention after disturbance are driven by management objectives. The relevance of science is to provide information within this context.

Results and implications of the recent *Science* paper[1]

What this study contributes

Previous to our research, very few published studies existed on the effects of salvage logging with respect to forest regeneration and fire hazard. Of the very limited number of studies, most have been retrospective and confounded—they could not disentangle the effects of logging from those of slash treatments or tree planting[5]. Moreover, none of these prior studies implemented an experimental design including pre-treatment data, replication, and controls. Pre-treatment measurements and short-term data provide critical reference points for understanding long-term processes. This study contributes all of these aspects.

Limitations

In our paper we presented data on the immediate effects of salvage logging two to three years after the Biscuit Fire in southwestern Oregon. Strictly speaking, the scope of inference of this study is limited to that timeframe and set of conditions. Like all fire studies, it is a case study in time and space. The long-term effects of salvage logging on the Biscuit Fire remain unknown.

Rather than characterizing the entire Biscuit Fire, we conducted our research in mature forest stands that were identified as potential logging units following the fire. Similarly, we did not set out to measure all different logging methods, but measured representative and commonly employed practices (helicopter and cable yarding).

Conifer Regeneration

In this study we sampled the Biscuit Fire on portions that were expected to be the most problematic for conifer establishment in the critical first years following the burn. One source of that problem was thought to be a lack of seed source in large burned areas with no surviving trees[6]. However, we found substantial conifer establishment 2 and 3 years after the fire and that seedlings were surviving multiple years. The wildfire area is a mosaic of live and dead trees. Mature trees distributed throughout the burn that were not killed by the fire probably acted as seed sources, underscoring the importance of surviving trees to forest regeneration[7]. The seedling densities observed thus far exceed what would be planted under current management plans. Other factors in addition to density are important in determining whether regeneration is “adequate,” but this too depends on management directives.

These findings suggest a need for caution in extrapolating knowledge gained from post-timber harvest studies to post-disturbance ecology. Much of what we have learned indicates that ecosystem response to harvest and disturbance differs in fundamental ways[8]. Examples of post-fire conditions that may differ from post-harvest conditions include the following:

- Abundant on-site seed from stress cone crops, canopy seed banks, and surviving trees dispersed throughout the disturbed area[7,9,10,11]
- Favorable soil seedbed conditions (exposed mineral soil)
- Temporary reduction in competing ground vegetation
- Increases in nutrient availability
- Differences in microclimate afforded by the dead trees

Salvage Effects

We conducted our measurements after logging and prior to subsequent fuel treatments. The regeneration we observed was reduced by 71% as a result of the salvage logging operations. This was due to soil disturbance and burial by woody materials. We also, to the best of our knowledge, published the first study quantifying the effect of logging fire-killed trees on surface fuel loads. We saw an increase in the amount of surface fuels of a magnitude that may well be significant with respect to fire potentials. This underscores the importance of subsequent fuel treatments if mitigation of short-term fire risk is an objective.

While the results are not necessarily surprising, they raise important questions. For example:

1. Does the increase in fire hazard associated with salvage slash exceed acceptable levels?

2. How will fuel loads and fire hazard compare between logged and unlogged stands over time?

3. What are the specific effects of subsequent slash treatments in post-fire ecosystems?

4. What role might natural processes play in attaining management objectives?

A mechanistic understanding of the effects of post-fire management activities will emerge from studies that isolate the effects of each step, followed by re-integration of the knowledge gained to form a complete picture. This approach will vastly improve our ability to predict whether various strategies will succeed in achieving management objectives. Our study represents a beginning to such a process.

Salvage logging as a management tool

Our study was not designed to critique salvage logging as a management tool; it serves only to provide information on the immediate ecological response.

Where management objectives include rapid reforestation as a goal, it is useful to note that salvage has consistently been shown to reduce natural regeneration that is underway by 2 years after the fire[1,7,12]. The implications of this depend on the specific objectives for a site. We do not know of any evidence of an ecological need to log a burned site in order to plant it. To the contrary, studies of salvage and regeneration indicate a need to replant <u>because</u> of the logging[1,7,12]. These studies underscore a need to conceptually separate the activity of salvage logging from reforestation activities, which can occur with or without salvage. However, this does not preclude salvage as a management option. Rather, with information from this study and additional ones that isolate the effect of different harvest techniques and timing, any undesirable impacts of salvage could be minimized.

In Closing

Because the knowledge base from timber harvest has limited inference for post-fire ecology, our understanding of the effects of post-fire intervention will only advance with well-designed experiments that include controls and pre-treatment data. Furthermore, quantifying short-term responses and isolating individual management actions provide critical reference points for understanding long-term processes. In light of this, we intend to expand our research across a broad range of time scales, ecosystems and fires in order to address many of the questions currently being raised as a result of our paper.

Some additional closing remarks:

- Retention of surviving trees and other legacies will likely contribute to ecosystem response following disturbance.

- Knowledge of ecosystem responses must be combined with management objectives to determine whether actions need to be taken following disturbance.

- Considerations of post-disturbance intervention should be placed within the context of fire regime, landscape conditions, and forest type.

Thank you again for the opportunity to present our findings.

<u>Citations</u>

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