Northwest Fire Science Consortium
A JFSP FIRE SCIENCE EXCHANGE NETWORK

POST-FIRE LOGGING

EXAMINING LONG-TERM EFFECTS ON UNDERSTORY VEGETATION

RESEARCH BRIEF 10 • SUMMER 2016

There has been much debate around the effects of post-fire logging on understory vegetation, wildlife communities, soil properties, and ecosystem processes. Previous studies have shown that post-fire logging can increase soil disturbance and erosion, alter the cover and composition of native vegetation, damage natural tree regeneration and increase surface woody fuels within 2-4 years after fire and logging. These short-term disturbance impacts can diminish as ecosystems recover however, and it is unclear if there are long-term impacts that exceed ecosystem resilience thresholds, thereby altering trajectories of post-fire recovery and succession.

Area burned in the 1996 Summit Fire burn, October 2015. Photo courtesy Autumn Ellison, University of Oregon.

This study investigated the long-term response of understory vegetation to two post-fire logging treatments (commercial salvage logging with and without additional fuel reduction logging) in northeastern Oregon. Researchers assessed if there were lasting effects on understory plant cover, species diversity, plant community composition, and exotic species cover in experimental treatment units 15 years post-treatment. The study area is located within the area burned by the 1996 Summit Fire, which burned mostly at high severity although it occurred in dry coniferous forests that historically burned at frequent intervals (14-16 years) and at low severity.

Post-fire treatments in study

Control: No logging.

Commercial logging: Removal of 2/3 of the dead merchantable trees; leave 17 snags/ha that are greater than 30 cm diameter at breast height (DBH).

Commercial plus fuel reduction logging: Removal of most dead merchantable trees and non-merchantable small trees (10-29 cm DBH); leave at least 6 snags/ha greater than 30 cm DBH.

KEY FINDINGS

- Post-fire logging treatments did not affect plant community composition, understory plant cover, or plant diversity 15 years after treatment.
- Fire severity (inferred by residual tree density) and post-fire regeneration density may have greater long-term impacts on post-fire understory vegetation than post-fire logging.
- At the species level, only one of the eight common understory species examined responded differently to the two logging treatments.

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RESULTS

Plant community composition

The authors used multivariate statistical analysis to examine relationships among plant communities in the three post-fire logging treatments (control, commercial logging, and commercial plus fuel reduction logging), as well as relationships between overstory and understory species. The analysis of the understory plant community composition showed no persistent treatment effects 15 years post-treatment. The analysis also showed gradients in plant community composition that were correlated with sapling density (regeneration) and also with residual overstory tree density. This indicates that fire severity (measured as tree mortality) and post-fire regeneration may have greater long-term impacts on post-fire understory vegetation than post-fire logging. Overstory trees (including large saplings) can influence understory biomass production and species composition through both above-ground and below-ground competition for resources.

Understory plant cover

Post-fire logging treatments had no effect on graminoid, forb, woody plant, or exotic plant cover or total species richness. Exotic species cover was high throughout the study area but the logging treatments had little effect on the total exotic plant cover. There was some evidence of an effect on total vascular plant cover between the two logging treatments, with the commercial logging treatment having the highest mean cover. At the species level, mean plant cover differed between treatments for only one species, California brome (B. carinatus). There was higher cover of this species in the commercial logging treatment than in the fuel reduction treatment, but neither was significantly different from the control. Treatment differences in total vascular plant cover and mean plant cover of California brome may be attributed to post-fire structural characteristics, such as tree density and/or regeneration. Differences may also be attributed to soil disturbance from the logging operation and the ability of pre-fire soil properties (e.g., nutrients, water holding capacity, etc.) to persist.

Understory plant diversity

Post-fire logging treatments also produced no effect on understory plant diversity or community heterogeneity. Despite there being high exotic species cover throughout the study area, native plant diversity was high. Species richness at the plot level (40 m^2) ranged from 31.8 species for the commercial plus fuel reduction logging treatment to 34 species in the control.

MANAGEMENT IMPLICATIONS

The short-term effects from post-fire logging that have been reported in some studies were not found in the long-term post-fire logging study on understory vegetation. Many plant species in dry coniferous forests in the interior Pacific Northwest have traits (e.g., sprouting) that allow them to persist through wildfires and/or recolonize sites after wildfires (e.g., long-distance seed dispersal or persistence in the soil seed bank). These traits could also allow them to persist through other disturbances, like logging. To minimize the impacts of logging, managers should use best management practices that limit damage to soils, like logging over snow or frozen ground. The logging in this study was done over snow, with a feller-buncher to cut the trees down, and a skidder to tow whole trees back to landings. The skidder traveled on a limited number of main trails to which logs were yarded and stacked from where they were felled. The amount of soil surface disturbance in each of the logging units (15% commercial, 19% commercial plus fuel reduction) likely produced short-term reductions in understory vegetation cover and plot-level species richness. The short-term impacts in this area however were transient, and did not cause long-term ecosystem degradation or alternate recovery pathways.

Discussion in an area burned by the Summit Fire. Photo courtesy of Autumn Ellison, University of oregon

MORE INFORMATION

This brief is based on the following article :

David W. Peterson and Erich Kyle Dodson. 2016. Post-fire logging produces minimal persistent impacts on understory vegetation in northeastern Oregon, USA. *Forest Ecology and Management* 370: 56-64. Available online at: http://ow.ly/4ZWF301zKdN.

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