EFFECTS OF PRESCRIBED BURNING ON VEGETATION AND SOIL WATER PROCESSES IN MIXED-CONIFER FOREST STANDS AT BOGGS MOUNTAIN STATE FOREST, CALIFORNIA

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Abstract

The four papers presented in this dissertation address various ecological aspects of fire effects on mixed-conifer stand sat Boggs Mountain State Forest (BMSF), north of Middletown, California. The first paper evaluates the effect of prescribed burns on water infiltration into the soil (i e , if there is hydrophobicity) under mixed-conifer forests. The experiment followed a randomized complete block design and had three burn treatments characterized by different amounts of forest floor fuel consumption (i e , control, low, and high consumption) Infiltration capacity was measured with 100mm-diameter ring infiltrometers in both burned and unburned conditions The infiltration rates were not significantly changed by controlled burns of low fireline intensity and low to high fuel consumption. Therefore, we can reduce fuel accumulations, and thus wildfire hazard, using prescribed burns without significantly changing the infiltration capacity of the site.

The second paper evaluates the germination response of seeds from several hard-seeded shrubs species common to BMSF. The experimental units were sets of 25 seeds The following species were investigated: *Arctostaphylos manzanita* C.Parry (ARMA), *Arctostaphylos canescens* Eastw. (ARCA), *Ceanothus prostratus* Benth. (CEPR), and

Rhamnus californica Eschsch (RHCA). Experimental investigation provided evidence into germination requirements, and interpretation of these results elucidated fire-related mechanisms associated with plant persistence Treatments were designed to emulate. (1) fire induced scarification, (2) winter stratification, and (3) effects of leachate from burned litter The heat treatment lasted four minutes because this is representative of the time of duff and soil heating at high temperatures during fires. RHCA seeds showed higher germination when non-stratified versus when stratified, at 80°C versus any other temperature, in moist heating treatments versus dry ones at the same temperature, and did not display differences between leachate and non-leachate treatments CEPR and ARCA seeds showed better germination when stratified. ARMA percentage germination was negligible.

The third paper addresses short term (< 5 years) ecological effects of prescribed burns on vegetation plant diversity and spatial distribution patterns (i.e., random, uniform, and cluster) by comparing stands with different prescribed burn histories. Distance sampling techniques were used in the study of spatial distribution patterns Results support the hypothesis that prescribed fire removes trees and shrubs preferentially from clumped areas leaving a more random distribution of individuals. Overstory trees are more sparsely distributed in underburned stands, and tended towards a sparse distribution for the understory layer. This pattern may be caused by a higher accumulation of dead and down fuels in clumps; and therefore, individual plants have a higher mortality chance in a fire event (i.e., leaving a more random distribution of individuals) No significant differences in species richness were found among treatments (i.e., control, underburned) in any strata.

Diversity indices consistently suggested that in the underburned conditions plant species diversity was lower than in controls. Evenness indices consistently suggested a more even distribution of individuals among species in the control stands versus a more clear dominance (in numbers) by one or two species in the underburned stands

The last paper examines if there are small-scale habitat differences among tree seedlings of the main tree species common to BMSF. The experimental units were randomly selected individual seedlings. There were five species (PM = *Pseudotsuga menziesii* (Mirb) Franco, PP = *Pinus ponderosa* Dougl , PL = *Pinus lambertiana* Dougl., QK = *Quercus kelloggii* Newb . and QW = *Quercus wislizenii* A CD) and 26 individuals per species Significant differences among species were only found for depth of litter and duff. and for percent plant cover ($\alpha = 0.05$) The distance to the nearest outcompeting individual yielded P-values of 0.0592 (ANOVA) and 0.0922 (nonparametric Kruskal-Wallis ANOVA) Percentage of soil covered by conifer litter and duff. light intensity (as percent of open-site light intensity), and nearest neighbor distance were nonsignificant in separating the five species of this study.

Keywords Prescribed burns. infiltration, forest floor consumption, hydrophobicity germination, fire induced scarification, stratification, leachate, spatial distribution patterns, species diversity indices, evenness indices, mixed-conifer stands. seedling microhabitat

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