Chapter 2:
Vegetation Module

Plumas/Lassen Administrative Study Vegetation Module
Forest Restoration in the Northern Sierra Nevada:
Impacts on Structure, Fire Climate, and Ecosystem Resilience.

Report of Activities during 2007

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OBJECTIVES

The vegetation module of the Plumas-Lassen Administrative Study studies how changes in the forest canopy affect ecosystem functioning, including 1) microclimate, 2) growth and competition of shrubs and juvenile trees, 3) understory diversity, and 4) landscape continuity. The module objectives are:

1) determine the effects of reduction in tree canopy cover on microclimate, fuels dryness, and other factors contributing to flammability of the forest understory, and

2) determine effects of reduction in tree canopy cover on light, soil moisture, and other factors influencing composition and growth of the understory plant community.

3) examine stand- and landscape-level impacts of group-selection silviculture

Research approaches include stand-level experimental manipulations, measurement of plant growth and survival along existing environmental gradients, and assessment of impacts of routine (i.e., non-experimental) forest management activities.

RESEARCH ACTIVITIES 2007

Study on Effects of Experimental Thinning and Group Selection on Forest Structure, Fire Climate, and Plant Communities in West-Side Mixed-Conifer Forest.
(*Seth Bigelow, Malcolm North, Keith Perchemlides*)

The treatments for this study took place in May and June 2007. A feller-buncher felled trees and placed them in piles, and a skidder took them to landings outside the experimental plots. There, branches were removed, trees were cut to length, and merchantable logs were placed on log trucks. Measuring equipment and markers for sampling sites were replaced immediately following treatments. Treatments were completed early enough in the season that many post-treatment measurements were done.

Changes in canopy cover and light with treatments

Canopy cover was measured before and after treatments with vertical sighting tube (GRS densitometer) held at head height: 400 measurements in a 2.5 acre sampling site in the center of the 22 acre thinning plots or the smaller group selection plots. Light was measured from canopy photographs taken at breast height with a digital camera equipped with a fisheye lens (Table 1).

There was an average post-treatment canopy cover of 56% in sites with a 50% target, 49% cover in sites with a 30% target, and 12% residual cover in group selection openings. We identified several possible reasons for difficulties in reaching canopy cover targets. First, archaeological features were identified at several sites after it was too late to relocate treatments, placing unexpectedly large areas off-limits to forest operations. Second, one site may have intentionally been logged lightly after loggers received negative feedback from Timber Sale Administrators about stands logged earlier in the process. Third, errors may have been made by the marking crew. We emphasize that our studies have not been compromised by discrepancies between target and actual canopy cover, because our studies rely on small-scale spatial variation within plots as independent variables.

Treatment	Canopy Cover (%)		Area with light >25 mol m^{-2} d^{-1} (%)	
	Before	After	Before	After
Control	78	77	1	1
50%	69	56	8	9
30%	68	49	3	11
Group	70	12	7	87

Table 1. Overstory canopy cover and understory light before and after application of experimental thinning and group selection treatments. Average values from three plots. Light is proportion of sampling sites with enough light for regeneration of shade-intolerant pine species.

Our studies in the Plumas National Forest have identified 25 mol m^{-2} d^{-1} (40 percent of full sun; PFS) as a threshold light level for triggering rapid growth of shade-intolerant pines (Fig. 1). We detected little change in the 50% canopy cover plots in proportion of plots above the 25 mol m^{-2} d^{-1} threshold, but there was an increase in the proportion of plot area above the threshold in the 30% target plots (Table 1). A large proportion (87%) of the group selection openings had enough light to support rapid growth of shade-intolerants.

Immediate post-treatment data on stand structure, understory microclimate (air temperature, soil temperature and moisture, fuel moisture, windspeed) and fuels have not been processed yet. We anticipate that an additional season of data collection will be required to yield reliable data on understory microclimate.

Studies on performance of mixed-conifer saplings with respect to light and other factors (*Seth Bigelow, Carl Salk, and Malcolm North*).

The field component of these studies is complete. One manuscript based on this work is being revised and another is in preparation.

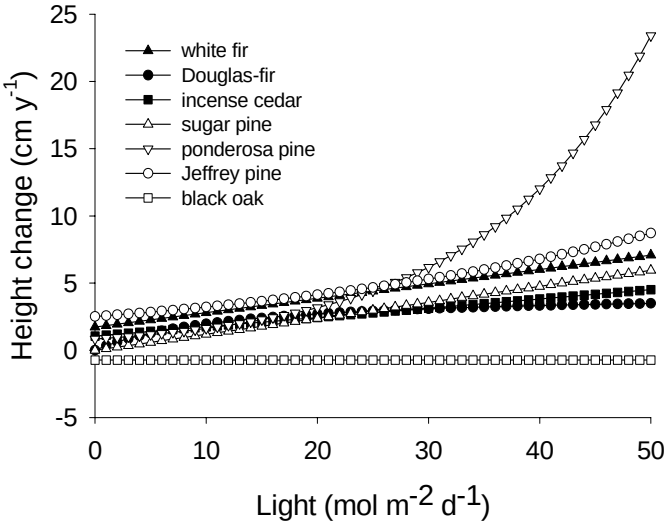

Figure 1. Seedling height growth in relation to understory light: ponderosa pine shows rapid growth at light above threshold of 25 mol m^{-2} d^{-1} (40 percent of full sun).

Resilience to harvest disturbance in patchy east-side forests
(Seth Bigelow, Sean Parks, Malcolm North)

This study evaluates stand- and landscape-level impacts of group-selection silviculture applied in east-side forests where areas of continuous forest cover are interspersed with grassy openings. Field work for the stand-level study was completed in 2005; minimal impacts on soil water and microclimate were detected. The landscape study asks whether

group selection openings will disrupt structural continuity of the landscape. Our work on four landscape areas where multiple group selection harvests were done in 2001-2002 (Red Clover and Stony Ridge projects) has indicated that under some landscape conditions and scales of analysis, landscape continuity can be disrupted by group selection silviculture (Fig. 2).

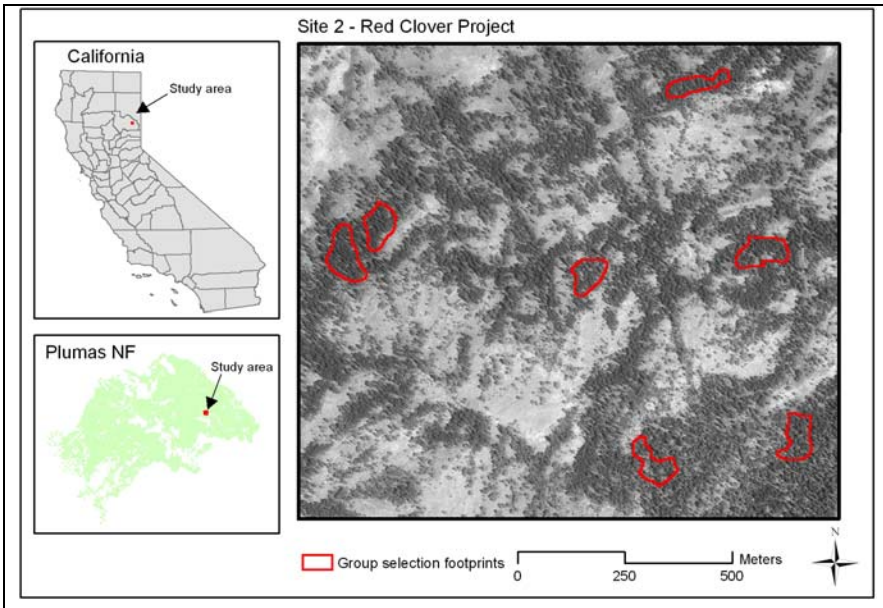

Figure 2. One of four landscapes where group selection silviculture was analyzed. Pretreatment photo is shown: red circles indicate locations where group selection openings were placed.

This year we generated guidelines for predicting conditions under which landscape continuity is vulnerable to perturbation. We focused on the interaction between level of forest canopy cover (habitat) at the scale of the landscape (i.e., the probability of habitat, p(H)), and probability of pixels of canopy/habitat being adjacent to one another (p(H|H)). Using the computer to randomly generate landscape models at different levels of p(H) and p(H|H) and asking whether an organism could travel across each landscape, we found a well-defined relationship between amount of habitat, probability of habitat self-adjacency, and the connectedness or probability of percolation of the landscape. There was good agreement between this theoretically predicted probability of landscape percolation, and the patterns of percolation we observed in the Red Clover and Stony Ridge projects (Fig. 3). This suggests that forest managers may be able to use our findings to reliably predict which landscapes are at risk of fragmentation of forested cover when group selection openings are placed in them.

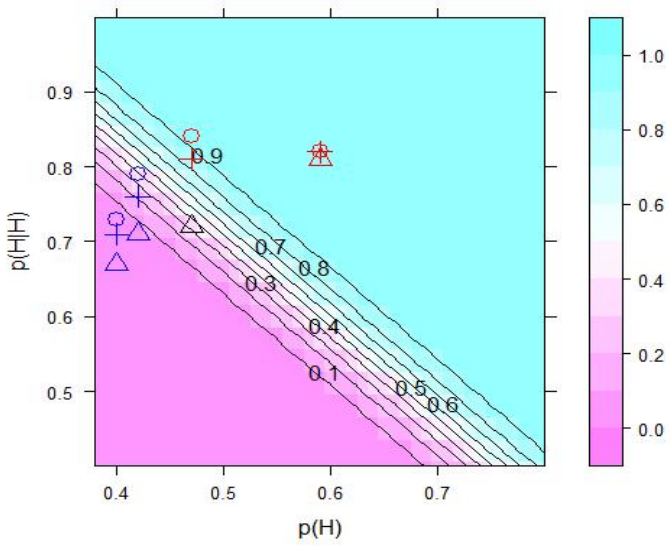

Figure 3. Percolation behavior of east-side landscapes under group selection silviculture compared to predicted probability of percolation. Each vertical group of symbols represents one landscape analyzed at 3 scales: 3 m (circle), 10 m (plus), or 30 m (triangle). Red symbol color denotes landscape that percolated before and after treatment, blue denotes landscape that did not percolate before treatment, and black indicates landscape that percolated before treatment but did not percolate afterwards. Pink background indicates low predicted probability of percolation, teal background indicates high predicted probability. Numbers indicate probability of percolation associated with individual contour lines. Note location of black triangle: the one landscape whose continuity was disrupted by group selection harvest fell close to the contour line for 50% probability of percolation.

Outreach

Vegetation module personnel gave three public presentations on their work:

Plumas-Lassen study symposium, Quincy, CA, March 2007.

Annual Meeting of the Ecological Society of America, August 2007, San Jose, California. Poster presentation: Light thresholds for competitive reversals in Sierran conifers: Enhancing the restoration component of fuels-reduction canopy thinnings.

Annual Meeting of the Society for Conservation Biology, Bay Area chapter, January 2008, Davis, California. Oral presentation: Light thresholds for competitive reversals in Sierran conifers: Enhancing the restoration component of fuels-reduction canopy thinnings.