



Growth and survival of planted seedlings was highest in areas that used a clustered planting strategy, which also had the lowest shrub cover post-fire.

Salvage logging treatments that included both merchantable and biomass trees were most effective at reducing the potential for future severe fire.

Effects of different salvage treatments and tree planting patterns on forest recovery following the 2014 Eiler Fire

In this project, we examined how different salvage treatments and planting patterns implemented after the 2014 Eiler Fire influenced post-fire fuel loads, understory plant response, and the survival and growth of planted trees on the Lassen National Forest.

Key Findings

- Surface fuels were inversely related to salvage treatment intensity with the highest fuel loads in areas with no salvage, followed by biomass only, merchantable only, and merchantable/biomass combined.
- Shrub cover was highest in areas that were not planted or were planted on a 12' by 12' grid; the lowest shrub cover was found in the cluster planting (3-5 grouped seedlings).
- Understory plant diversity and cover was inversely related to the amount of shrub cover, with the highest diversity/cover in the cluster planting and the lowest in the no planting and evenly spaced grid.
- Seedling survival and growth rates were much higher in the cluster planting and high-density clump treatment compared to the 12' by 12' grid.



Tree seedlings planted in a high density clump in an area that had been grubbed (shrubs removed)

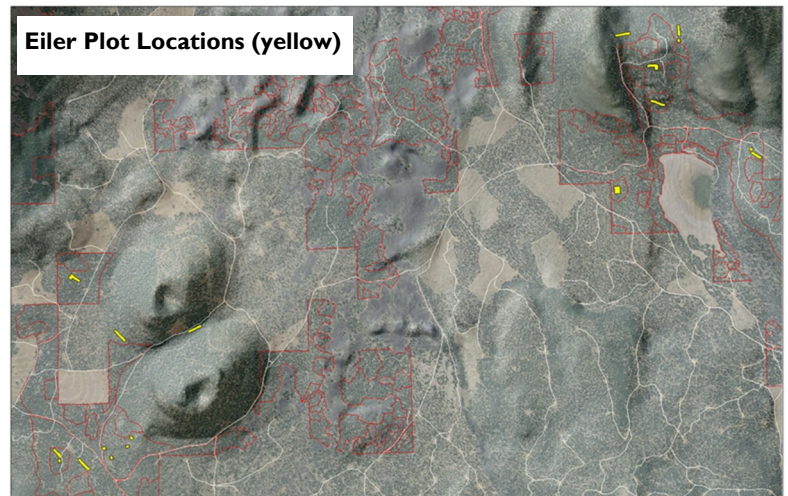


Dense shrub (Ceanothus) cover five years after the Eiler Fire



Project Overview

In 2014, the Eiler Fire burned 32,416 acres, with 65% burning at high severity. In 2016, we established twelve permanent plots (72 x 400 ft) in areas burned at high-severity to examine the effects of different salvage logging and replanting strategies on surface fuels, understory vegetation, and the survival and growth of planted trees. We monitored four salvage treatments, including no removal, biomass-only removal (i.e., small diameter trees), merchantable-only removal (i.e., larger diameter trees), and a combination of biomass and merchantable removal. We also examined four planting strategies that included no planting, as well as 50 seedlings planted in a 12 x 12' evenly spaced grid, 50 seedlings in clusters of 3-5, and 50 seedlings in high-density clumps of 10, 16, or 24. Salvage logging and planting treatments were implemented in 2017, and plots were monitored annually between 2017 and 2022 (except for 2021).



Monitoring Outcomes

We found that salvage treatments reduced the risk of modeled future high severity fire, but had little effect on shrub cover and understory plant diversity. High-severity fire effects in the Eiler Fire triggered a vigorous shrub response, with shrub cover averaging 90% after four years. We also found that planted tree seedling survival and growth was greatest in the clustered and high-density clump plantings; however, this was likely related to the larger area around the seedlings that planters had grubbed (i.e., removed shrubs) to accommodate the grouped planting. In the traditional 12' by 12' grid spacing, only a small area around individual seedlings was grubbed and shrubs quickly overtopped and shaded out many of the shade-intolerant pine seedlings.

Table. Average shrub and understory cover, understory richness, and tree seedling survival and height in 2022 by planting treatment. Values did not significantly differ between salvage treatments. NA = not applicable.

Variable	No Treatment	12' X 12' regular	3-5 seedling clumps	High density clumps
Shrub cover	90%	86%	71%	77%
Understory cover	4%	8%	21%	18%
Understory richness (# species)	5	6	15	11
Seedling survival	NA	23%	62%	53%
Live seedling height (inches)	NA	14	26	23

This project addressed the following monitoring question from the Burney Hat Creek CFLRP
Ecological Monitoring Strategy: RF.1.0. What are the effects of different salvage and reforestation strategies on post-fire fuel loads, understory species, and the survival and growth of planted trees?