

Sierra Cascade Intensive Forest Management Research Cooperative Proposal 00-02, Site Preparation Study

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Title: Survival and growth of three conifer species following three types of site preparation and three levels of subsequent shrub control: 21 years after planting

Years Funded: 2000, 2002

Executive Summary:

An experiment was established in the fall of 1978 to determine the best type of site preparation for conifer planting on harsh sites. The objectives of the experiment were to compare the survival and growth of transplanted white fir (*Abies concolor*), sugar pine (*Pinus lambertiana*), and ponderosa pine (*Pinus ponderosa*) following site preparation by the use of fire, a rotary masticator (Hydro Ax), and a brush rake. Three levels of subsequent weed control, a single herbicide treatment at one year after planting, two herbicide treatments at one and two years after planting, and no subsequent treatment after planting, were over-laid on the site preparation treatments.

The site preparation portion of the study was installed in September of 1978 on the Tahoe National Forest approximately 15 miles northeast of Foresthill, CA at an elevation of 5000 ft. The study site was occupied by mature shrub species and weedy trees for at least 18 years since the Volcano Fire, and possibly much longer. A rotary masticator cut shrubs off close to ground level, with no disturbance to the soil. On the brush rake treatment, a crawler tractor equipped with a brush rake pushed all the shrubs and trees into piles for later burning. This treatment removed large roots in the process and caused

disturbance in the top 12-18 inches of soil. The shrubs in the fire plots were crushed by the tractor prior to burning. Several weeks later, the fire plots were burned. There was no soil disturbance from the burn treatment. In early May of 1979, 1-0 ponderosa pine, sugar pine, and white fir seedlings were transplanted into all the plots. The untreated (no release treatment) plots did not receive any further management. The single release plots received a directed herbicide treatment in the spring of 1980, and the two-release plots received a directed herbicide treatment in the springs of 1980 and 1981.

Survival and tree growth were recorded for the planted seedlings until 1983. In September 2000, twenty-one years following conifer planting, conifer survival, diameter at breast height, and total height were recorded for each surviving tree.

Ponderosa pine survival was significantly affected by the site preparation method. Survival was highest with the brush rake treatment and least on the Hydroax treatment. Survival of ponderosa pine was also significantly greater with herbicide release treatments, compared to not treating. Each additional release treatment increased survival.

Sugar pine survival was so low on all the plots that meaningful results are not possible. Most of the mortality was disease related.

White fir survival was not affected by the site preparation method. Survival was affected significantly by the level of subsequent weed control following site preparation. White fir survival was about equal on the plots receiving no release treatment and the plots receiving two treatments. Survival on these treatments differed significantly from survival on the plots receiving one release treatment, where survival was the lowest.

Ponderosa pine diameter at breast height (dbh) was not affected by site preparation method but increased significantly with release treatments (figure). The diameters of trees in plots receiving a single release treatment or two release treatments did not differ from each other. But both of these treatments resulted in diameters that were significantly greater than diameters in the plots receiving no release treatment.

White fir diameter growth was affected by site preparation method, with trees on the fire plots having significantly smaller dbh than those on the brush rake plots (figure). White fir diameter was increased substantially with the release treatments as compared to no release treatments. The more release treatments, the larger the dbh.

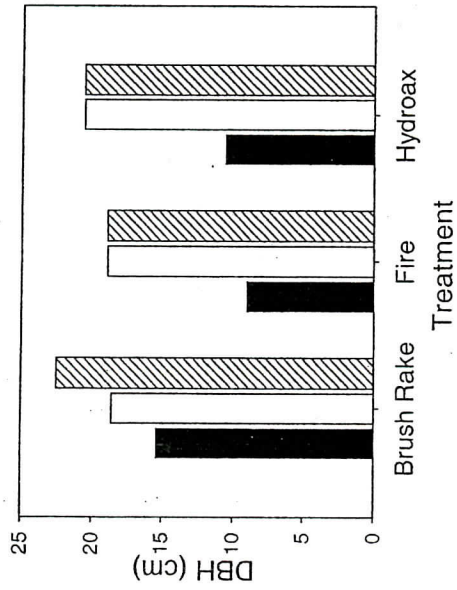
Ponderosa pine height was not significantly affected by site preparation method (figure). Trees on the brush rake treatment plots were taller than trees on the other site preparation treatments but not significantly so. Release treatments significantly increased the height of ponderosa pine over that of trees in the untreated plots.

White fir height was not affected by site preparation method (figure). As with ponderosa pine, release treatments significantly increased height.

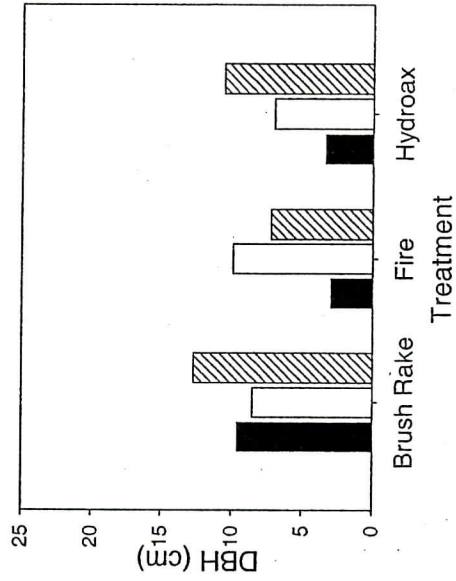
Conclusions: Twenty-one years after planting, ponderosa pine survival is about 55%, white fir about 24%, and sugar pine less than 5% of the original number of trees. On many of the plots, which received two herbicide treatments, conifers have achieved canopy closure and shrub growth is minimal. However, if tree survival was poor, the shrubs continue to significantly compete with the remaining conifers. It appears that the brush rake treatment reduced shrub re-growth better than fire and Hydroax treatments, which improved survival and growth. Although there was consistent conifer growth benefits associated with herbicide treatments, there also appeared to be some conifer injury, based on the reduction in white fir survival. Where survival is high, trees are competing more with each other than with other vegetation.

Average DBH and height of planted conifers relative to site preparation method and number of herbicide applications.

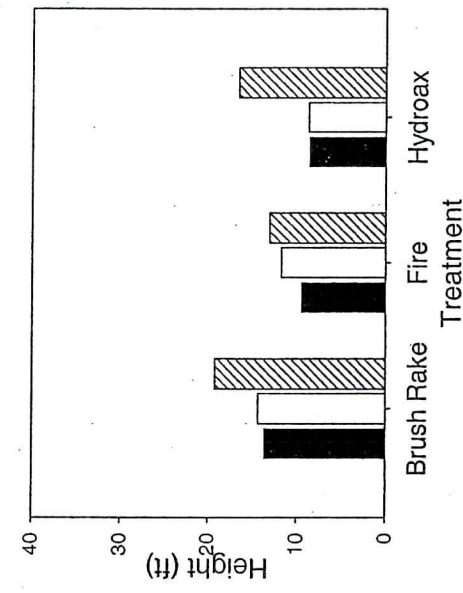
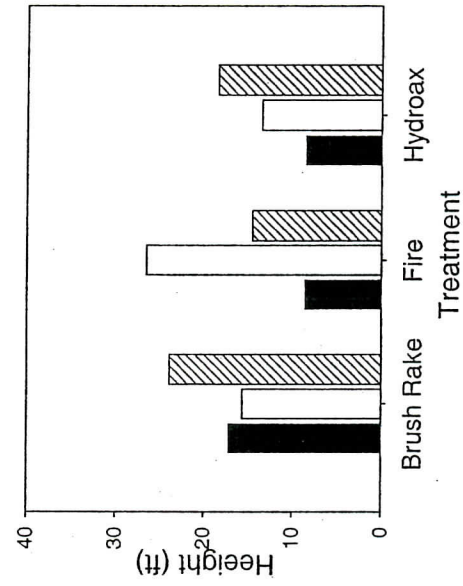
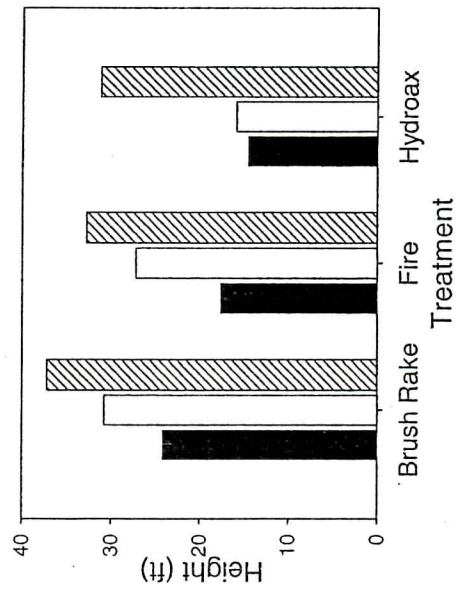
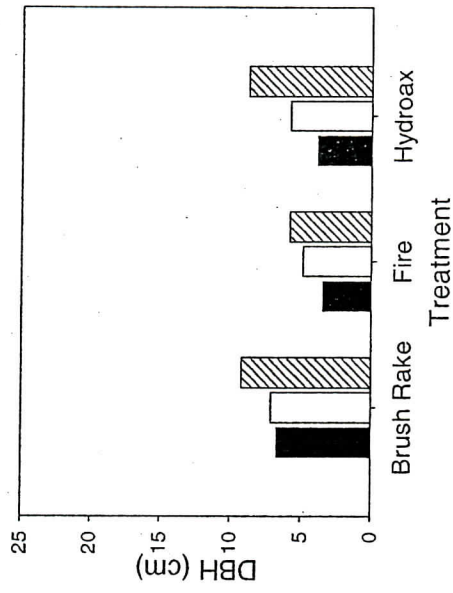
Ponderosa Pine



Sugar Pine



WhiteFir



■ No Herbicide Application

□ 1 Herbicide Application

▨ 2 Herbicide Applications