

Does mulch improve plant survival and growth in restoration sites?

Successfully restoring wildland conditions in urban areas is often a difficult process. Determining management practices to improve long-term plant survival and growth and developing effective methods for long-term weed control are both critical. This is especially true for restoration projects, where weeding, watering, and other after care is often minimal.

The goal of this research is to determine whether mulching an unmanaged restoration site prior to plant installation is more beneficial to plant growth and survivorship than applying herbicide to the site. Our hypothesis is that plants grown in the mulched plots will show higher rates of survival and growth than the plants grown in areas sprayed by an herbicide. For the first three years of the study, evidence has supported this hypothesis.

Study Procedure

In spring 2000, six 10 meter by 10 meter test plots were created in Seattle's Union Bay Natural Area. All six plots were mowed to remove aboveground vegetation. The plots were then randomly assigned to a treatment; three were sprayed with an herbicide, and three were covered with approximately eight inches of wood chip mulch. The plots were then planted with three northwest natives: snowberry (*Symphoricarpos albus* (L.) Blake), red-flowering currant (*Ribes sanguineum* Pursh) and oceanspray (*Holodiscus discolor* Pursh (Maxim.)). Since this experiment was designed to simulate a typical restoration project, no after-care is provided.

Analysis

Shortly before plant installation, each plot's soil was analyzed to ensure that texture, pH, bulk density, and moisture content were not significantly different. Starting in 2001, the plants have been monitored annually to determine their survival and growth rates; this monitoring will continue for five years. In addition, the height of each plant, from the root crown to the tip of the stem, is measured every other year. The relative success of the test plants and weedy invaders is also noted. Finally, the data are analyzed using single factor analysis of variance (ANOVA).



Figure 1: Typical mulched (left) and herbicide-treated (right) plots one year after installation; note the rows of mulched snowberry on the left, obscured by weeds on the right

Results and Discussion

Survival – As early as one year post-installation, and continuing each subsequent year, plants in mulched plots had a greater rate of survival than herbicide-treated plots (Figs. 1-2). For snowberry (n=3) differences between treatments were always significant ($p < 0.05$). For oceanspray (n=3) and red-flowering currant (n=3), mulched plants had higher rates of survival than those in herbicide-treated plots, but rarely significantly so. By 2003, snowberries in the mulched plots were reproducing, leading to survival rates of over 100 percent.

Growth - Mulched sites also had larger (taller and bushier) plants than herbicide-treated sites (Figs. 1 and 3). Mulched plants also broke bud earlier than unmulched plants and had more and larger leaves. In both 2001 and 2003 between-treatment differences in plant height were significant ($p < 0.05$) for snowberry ($n = 330$) and oceanspray ($n = 30$), but not for red-flowering currant ($n = 15$).

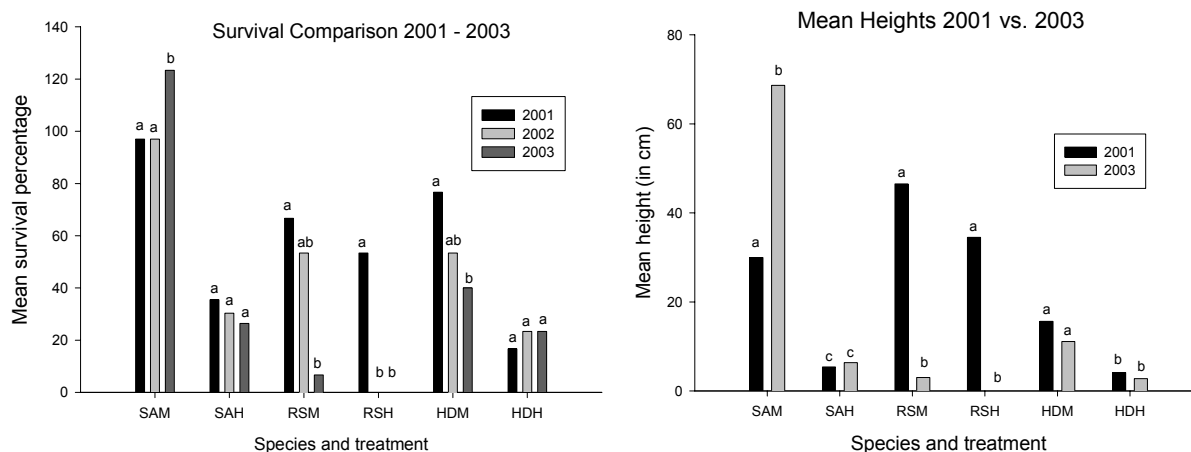


Figure 2 (left): A comparison of survival percentages from 2001 through 2003. Within each species and treatment (cluster of 3) bars with the same superscript letter(s) were not significantly different. SAM = *Symphoricarpos albus* mulch, SAH = *Symphoricarpos albus* herbicide, RSM = *Ribes sanguineum* mulch, RSH = *Ribes sanguineum* herbicide, HDM = *Holodiscus discolor* mulch and HDH = *Holodiscus discolor* herbicide

Figure 3 (right): A comparison of mean heights in each treatment/species from 2001 to 2003. Within each species, bars with the same superscript letter(s) were not significantly different ($p > 0.05$). SAM. = *Symphoricarpos albus* mulch, SAH = *Symphoricarpos albus* herbicide, RSM = *Ribes sanguineum* mulch, RSH = *Ribes sanguineum* herbicide, HDM = *Holodiscus discolor* mulch, and HDH = *Holodiscus discolor* herbicide

The results so far are providing substantial evidence that mulch can be beneficial to plants. Plants in mulched plots are larger, more vigorous, faster-developing, and have higher rates of survival than plants in herbicide-treated plots. The mulched plots also have fewer weeds, helping to reduce competition for resources. The soil under the mulch likely stays warmer longer into the winter and also warms faster in the spring, helping to extend the plants' growing seasons. The soil in the mulched plots also retains more water, which is crucial for plant establishment, especially in sites receiving no supplemental water.

Based on our findings, we believe that all restoration sites, but especially those receiving no supplemental water, should be mulched. A thick layer of organic mulch will help retain the soil moisture crucial for plant survival while also reducing growth of weeds that compete for needed resources. The mulch will also help to reduce soil erosion, provide organic matter to the plants and soil organisms, and moderate soil temperatures. These benefits, combined with other good management practices, can improve the success and survival of restoration sites while reducing the need for costly after care.

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