DOWN WOODY DEBRIS MICROSITES FOR GROWING BLACK HUCKLEBERRY SHRUBS

Introduction

Black huckleberry (*Vaccinium membranaceum*) is a shrub in the heather family (Ericaceae) that is ecologically, economically, and culturally important in the Pacific and Inland Northwest (Figure 1). Many people pick huckleberries every summer or attempt to grow them to ensure access to their highly palatable and delicious berries. Despite its abundance in many forest environments, black huckleberry requires very specific habitat conditions to successfully establish, grow, and produce berries. Ideal black huckleberry habitat includes a partial canopy (~40% shade) of mature conifers like Douglas-fir or mountain hemlock (Martin et al. 2008). Canopy shading reduces stressful soil surface temperatures and increases available soil moisture, enhancing black huckleberry survival. Black huckleberry patches often occur at elevations above approximately 3,000 ft. Because of these specific growing conditions and other factors, black huckleberry has not been commercially cultivated so usually has to be accessed by picking from naturally established shrub fields. As previously burned areas fill in with trees, with fewer new burned areas due to fire suppression efforts and curtailment of Native burning, black huckleberry habitat has declined from the mid-twentieth century forward (Minore 1972), putting huckleberry restoration at the forefront of today's conservation efforts.

Our study identified down woody debris (DWD) as a tool to facilitate favorable black huckleberry growing conditions in the absence of one or more of their habitat requirements. DWD consists of logs that have fallen to the forest floor. This structure occurs naturally in forest environments but can also be supplemented through logging or tree-felling operations, especially with "cull" logs that will not be used for forest products. Recent research has shown that DWD on the forest floor creates small areas of more favorable growing conditions for seedling establishment, known as microsites, compared to surrounding environments (Marangon et al. 2022; Marzano et al. 2013). DWD microsites facilitate areas of lower surface temperature and higher soil moisture, conditions that are favorable to black huckleberry seedling establishment (Figure 2).

Figure 1. A berry-producing black huckleberry shrub growing in a forested environment in northern Idaho.

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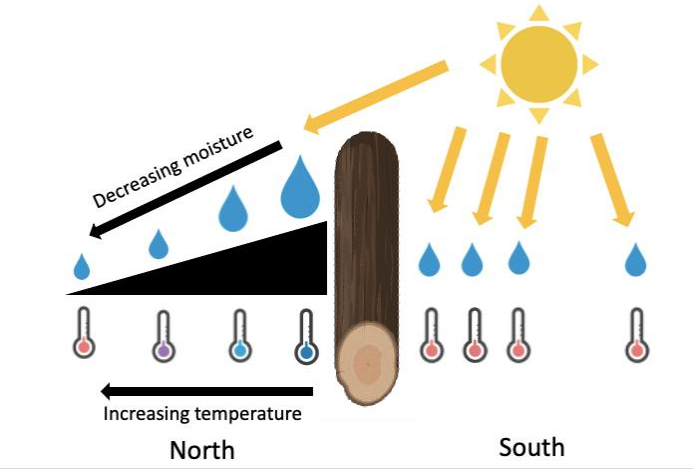

Figure 2. In the northern hemisphere, a segment of DWD that is oriented east–west will cast shade on its north side at midday when the sun is at its peak. This shade will be most pronounced right next to the DWD and will decrease with distance. As a result, temperature will also increase with distance and soil moisture will decrease. Alternatively, the south side will not be shaded at this time and will exhibit higher temperatures and lower moisture that will generally be consistent at all distances. Image created with BioRender.com.

Methodology

In this study, we placed six DWD segments at each of three study sites in low elevation forests of northern Idaho (Figure 3). All sites were below 3,000 ft in elevation and had no canopy cover, and therefore low soil moisture and high temperatures, a combination that rendered them unsuitable for natural black huckleberry establishment. This allowed us to observe the DWD microsite benefit under relatively extreme growing conditions for black huckleberry. DWD segments were greater than 13 inches in diameter and were oriented east–west. We planted black huckleberry seedlings (one-year-old plug nursery stock; Figure 4) on the north and south sides of each DWD segment and at four distances from each segment (0 m [0 ft], 0.25 m [0.82 ft], 0.5 m [1.64 ft], and 1.5 m [4.92 ft]) to capture the directional and spatial extent of the DWD microsite and identify the locations relative to the DWD that were most beneficial to the survival of black huckleberry seedlings. Over one growing season, we took monthly measurements of seedling survival, stress, and photosynthetic capacity and abiotic measurements of soil surface temperature and soil moisture in order to identify the abiotic conditions altered by DWD presence.

Results

Seedlings planted on the north side of DWD and at closer distances to DWD (0 m [0 ft] or 0.25 m [0.82 ft]) experienced the greatest microsite benefit and had the highest survival by the end of the growing season in August (Figure 5). These locations were also associated with the lowest soil temperature and highest soil moisture. While overall seedling survival was low (21%), survival at nearer distances on the north side was significantly higher (45% at north, 0 m [0 ft]; 35% at north, 0.25 m [0.82 ft]), indicating locations to prioritize planting black huckleberry seedlings within the DWD microsite. Overall seedling survival was low due to the unsuitability of the chosen field sites for black huckleberry, which was done intentionally in order to test the strength of the microsite benefit provided by DWD. We hypothesize that locating DWD microsites under partially closed canopies and at higher elevations will increase black huckleberry seedling survival, but more research is required to address this.

Figure 3. Map of the study site locations in northern Idaho (left image; map made with ArcGIS online). DWD segments were intentionally placed at each field site using a tractor (center photo). Layout of DWD segments at each site with six DWD segments oriented east–west (right photo).

Figure 4. A black huckleberry seedling planted within the DWD microsite.

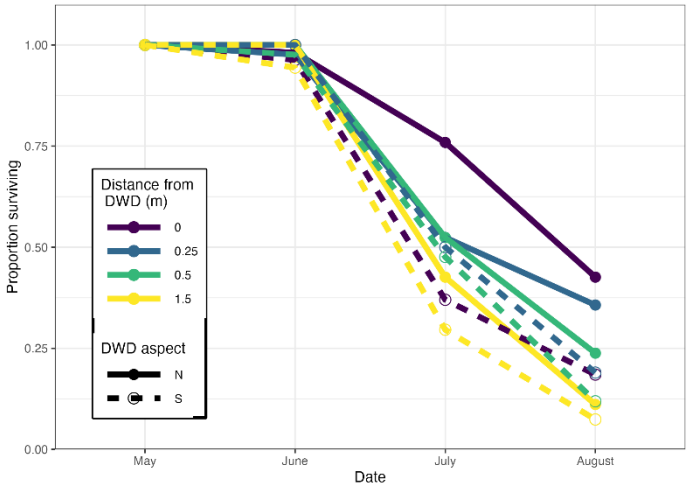

Figure 5. Proportion of seedling survival at each planting location over the course of one growing season. Each trace represents a DWD aspect and distance from DWD. Solid lines with closed points represent the north side of DWD, and dashed lines with open points represent the south side of DWD. *Note:* each color represents a planting distance: purple: 0 m (0 ft), blue: 0.25 m (0.82 ft), green: 0.5 m (1.64 ft), and yellow: 1.5 m (4.92 ft).

Conclusions

DWD microsites create the abiotic conditions that black huckleberry need to survive, but only on the north side and at close distances from the DWD. More research is needed to identify the optimal habitat and microsite combinations that increase black huckleberry survival in otherwise unsuitable habitats, but this research provides good insight for using DWD to grow black huckleberries. Our findings suggest that the best practices for growing black huckleberry in DWD microsites are:

- Orienting DWD east–west (or southwest to northeast) in order to take advantage of lower temperatures and higher soil moisture on the north side.
- Utilizing any species and size of DWD. However, larger diameter DWD segments may create larger microsites and more areas for planting. The size of DWD you choose may depend on how many seedlings you are planting.
- Planting your huckleberry seedlings on the north side of the DWD, and directly adjacent to the DWD, or within 0.25 meters. On the south side and at farther distances from the DWD, we observed less favorable growing conditions.
- Placing DWD segments under partial shade or forest canopy. See *Growing Western Huckleberries* (Barney 1999) for more suggestions on ways to enhance black huckleberry habitat.

Extra Considerations

Black huckleberry shrubs may take as long as 7–15 years to produce berries (Barney 1999). The DWD microsite will not accelerate this process but helps to keep seedlings alive long enough to grow, develop, and reach berry-producing life stages.

Black huckleberry is difficult to grow from seed and difficult to transplant from natural populations due to complex root systems, so planting already established seedlings may be your best chance for success. Black huckleberry seedlings can be purchased from nurseries, which may include private nurseries, university facilities, and nurseries associated with conservation districts.

Potential seedling sources:

- Franklin H. Pitkin Forest Nursery—University of Idaho, Moscow, ID.
- Plants of the Wild—Tekoa, WA.
- Washington Association of Conservation Districts Plant Materials Center (https://wacdpmc.org/).

Acknowledgements

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