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TECHNICAL NOTE

Whitebark Pine Planting Guidelines

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ABSTRACT

This article incorporates new information into previous whitebark pine guidelines for planting prescriptions. Earlier 2006 guidelines were developed based on review of general literature, research studies, field observations, and standard US Forest Service survival surveys of high-elevation whitebark pine plantations. A recent study of biotic and abiotic factors affecting survival in whitebark pine plantations was conducted to determine survival rates over time and over a wide range of geographic locations. In these revised guidelines, we recommend reducing or avoiding overstory and understory competition, avoiding swales or frost pockets, providing shade and wind protection, protecting seedlings from heavy snow loads and soil movement, providing adequate growing space, avoiding sites with lodgepole or mixing with other tree species, and avoiding planting next to snags.

Keywords: *Pinus albicaulis*, reforestation, tree-planting, seedlings, plantations

Whitebark pine (*Pinus albicaulis*) is a keystone species in high-elevation ecosystems of the west. It has a wide geographic distribution (Tomback 2007) that includes the high mountains of western North America including the British Columbia Coastal Ranges, Cascade and Sierra Nevada ranges, and the northern Rocky Mountains from Idaho and Montana and East to Wyoming (Schmidt 1994). It occurs at elevations ranging from 5,000 to 11,000 ft, growing along ridge tops. It is important for watershed protection, esthetics, recreation, wildlife habitat, and is an important food source for birds, small mammals, and threatened grizzly bears (*Ursus arctos horribilis*) (Craighead et al. 1982). Clark's nutcrackers (*Nucifraga columbiana*) depend on it as a food source and are the primary seed disseminators.

Unfortunately, many fragile subalpine ecosystems are losing whitebark pine as a functional community component. Throughout its range, whitebark pine has dramatically declined due to the combined effects of an introduced disease, insects, and successional replacement. White pine blister rust (*Cronartium ribicola*), an introduced disease, has caused rapid mortality over the last 30–60 years. Keane and Arno (1993) reported that 42% of whitebark pine in western Montana had died in the previous 20 years with 89% of remaining trees being infected with blister rust. The ability of whitebark pine to reproduce naturally is strongly affected by blister rust infection; the rust kills branches in the upper cone-bearing crown, effectively ending seed production (McCaughey and Tomback 2001). Whitebark pine may have the highest susceptibility to blister rust of any of the 5-needle pines in North America. Fortunately, individual trees express notable resistance (Hoff et al. 1994, Kendall and Keane 2001). Whitebark pine appears to have resistance to blister rust allowing management strategies to incorporate resistance genes into planting programs (Hoff et al. 2001).

Montana is currently experiencing an active mountain pine beetle (*Dendroctonus ponderosae*) epidemic. According to Ken Gibson (Forest Service entomologist, Missoula, MT, personal communication, 2007), the impact to whitebark pine is the worst that has been seen since the 1930s. Mountain pine beetle prefer large, older trees, which are the major cone producers. In some areas the few remaining whitebark that show the potential for blister rust resistance are being attacked and killed by mountain pine beetles, thus accelerating the loss of key mature cone-bearing trees.

Wildfire suppression has allowed plant succession to proceed toward late successional communities, enabling species such as subalpine fir (*Abies lasiocarpa*) and Engelmann spruce (*Picea engelmannii*) to encroach into some high-elevation stands that were historically dominated by whitebark pine. These new cover types have higher fuel loading and increase the risk of stand-replacing wildfire. In addition, interspecies competition diminishes cone production and reduces natural regeneration.

Without prompt action, whitebark pine may soon be lost as an important vegetative component in many of our high-elevation ecosystems. In cases where natural selection of blister rust resistant trees are slow or where whitebark pine are lost to mountain pine beetle or where succession is occurring, planting whitebark pine is one management strategy for retaining or restoring the presence of whitebark pine.

Keane and Arno (2001) describe a seven-step process that is important in whitebark pine restoration efforts; managers need to add planting to this critical reforestation process. The practice of planting whitebark pine is relatively new compared to traditional conifers such as Douglas-fir (*Pseudotsuga menziesii*), lodgepole pine (*Pinus contorta*), ponderosa pine (*Pinus ponderosa*), and western larch (*Larix occidentalis*). There is limited research on planting techniques for whitebark pine, but knowledge about physiological and ecological characteristics of this species is increasing. Initial planting guidelines for whitebark pine were developed by Scott and McCaughey (2006). This article incorporates new information and experience to expand and further define those planting guidelines.

Growing Whitebark Pine Seedlings

The first step in a planting program for whitebark pine is collection of viable seed from potentially rust-resistant trees within the local seed zone (Mahalovich and Dickerson 2004, Bower and Aitken 2008, Burns et al. 2008). Cones should be protected with wire cages to eliminate loss from seed predators, and cone collection techniques should be followed to ensure quality seed is collected

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