



Restoration Planting Options for Limber Pines Impacted by Mountain Pine Beetles and/or White Pine Blister Rust in the Southern Roc Mountains

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Limber Pine (*Pinus flexilis*) populations in the southern Rock Mountains are severely threatened by the combined impacts of mountain pine beetles and white pine blister rust. Limber pine's critical role these high elevation ecosystems heightens the importance of mitigating impacts. To develop forest-scale planting methods six seedling planting trial sites were installed extending from the Medicine Bow Nation Forest in southern Wyoming to the Great Sand Dunes National Park and Preserve in southern Colorado. At each site six plots were split between high and low density canopy conditions. In these blocks treatments included presence/absence of a nurse object and presence/absence of Terra-Sorb Hydrogel, with six replicates of each treatment combination, for a total of 432 seedling planted in each of the four sites with the Terra-Sorb Hydrogel treatment and 216 seedlings planted in both of the two sites without hydrogel treatments. We created nurse objects by burying 50 cm tall tree stem segments (20-40 cm dia) 10 cm in the ground. Trees were planted as close as possible to the object at the four cardinal directions to further test exposure stress. In the check treatment we planted

seedlings in an east/west orientation 40cm apart. Terra-Sorb Hydrogel (Pittsburgh, PA) is a potassium-based co-polymer gel that absorbs up to 200 times its weight in water. Hydrogels are commonly used in horticulture; however scientific literature shows mixed results for tree survival. In hydrogel treatments we dipped seedling roots in a hydrogel slurry before planting, per manufacturer directions, and in check treatments we dipped seedling roots in water before planting. In surrounding natural stands of limber pine we installed transects to sample forest stand structure and determine density and periodicity of regeneration. We will continue monitoring health and survival of the outplanted seedlings, as well as the incidence of natural regeneration in 2010. Results from this project will be used to develop limber pine planting protocols for the southern Rocky Mountains.

In: Adams, J. comp. 2010. Proceedings of the 57th Western International Forest Disease Work Conference; 2009 July 20-24; Durango, CO. Forest Health Technology Enterprise Team Fort Collins, CO.

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