Title: Thinning enhances whitebark pine (*Pinus albicaulis*) growth and resin duct defenses

Abstract: Whitebark pine (*Pinus albicaulis*) is an important component of high-elevation ecosystems throughout the northern Rocky Mountains; however, the species was recently listed as "threatened" under the Endangered Species Act due to widespread mortality throughout its native range. Land managers tasked with whitebark pine conservation and restoration require information on strategies that can positively influence whitebark pine establishment and promote growth and defense of preexisting trees on the landscape. Our study investigated the response of whitebark pine tree growth and resin duct defenses to thinning and removal of competing shade-tolerant conifers in the Caribou-Targhee National Forest, Idaho, USA. In the nine years following thinning treatments, we found that whitebark pine trees (> 12.7 cm DBH) responded favorably to thinning and experienced a 60% increase in basal area increment (52% increase in ring width index) while also producing 34% more resin ducts. Additionally, resin ducts were 23% larger with 49% increased area in the nine years post-thinning compared to trees in the control. Small diameter (< 5 cm DBH) whitebark pine in the treatment experienced a dramatic growth release with over 90% increase in basal area increment (74% increase in ring width index). Thinning also created conditions favorable for whitebark pine seedling and sapling establishment. In the treatment, 75% of seedlings and 93% of saplings were whitebark pine, compared to 32% seedlings and 14% saplings in the control. In addition, 93% of overstory trees in the treatment were whitebark pine, compared to 42% in the control. Whitebark pine tree mortality was similar across both the control (26%) and the treatment (25%), indicating that the thinning treatments did not have any adverse impacts on tree mortality. The positive effects of thinning on whitebark pine establishment and tree growth, coupled with the lack of elevated mortality in the treatment, provides strong evidence in support of thinning as a viable silvicultural technique in whitebark pine conservation efforts.