

Determining Clark's Nutcracker Use of Whitebark Pine Communities in Regard to Stand Health in Waterton-Glacier International Peace Park

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Introduction

Whitebark pine (*Pinus albicaulis*), one of five stone pines worldwide, is found at treeline and subalpine elevations in the mountains of western North America (McCaughey and Schmidt 2001). Considered a keystone species, it helps maintain subalpine biodiversity, protects watersheds and promotes post-fire regeneration (Tomback and others 2001).

The Clark's nutcracker (*Nucifraga columbiana*) and whitebark pine are co-evolved mutualists (Tomback 1982). Nutcrackers remove seeds from whitebark pine cones and cache them in high- and low-elevation forests and terrain, returning to feed on the seeds for up to a year. Nutcrackers are the principal mode of seed dispersal for whitebark pine, and unretrieved seeds are the primary source for regeneration (Hutchins and Lanner 1982; Tomback 1982, 2001).

White pine blister rust, caused by the exotic fungus *Cronartium ribicola*, has damaged whitebark pine communities throughout most of their range. Whitebark pine has been hit especially hard in the Crown of the Continent Ecosystem, an area of approximately 41,439 square kilometers, where Alberta, British Columbia, and Montana meet. This ecosystem includes Waterton-Glacier International Peace Park, and the Bob Marshall Wilderness Complex in Montana (Thompson 2009). Blister rust was found in Glacier National Park in 1938 (Mielke 1943). Today, approximately 50 percent of the whitebark pine in Waterton-Glacier International Peace Park are dead, with 70 percent infected. There is an estimated 5 percent per year increase in mortality in Waterton Lakes National Park (Smith and others 2008).

By killing the upper canopy—the cone producing branches of whitebark pine—blister rust reduces or ends cone production (McDonald and Hoff 2001). Previously, McKinney and Tomback (2007) found, in their study in the Bitterroot and Salmon national forests, that whitebark pine stands with higher levels of blister rust infection and damage had lower cone densities than those stands with lower levels of blister rust infection and damage. They also found that stands with lower cone densities had a lower proportion of cones surviving to time of seed dispersal, and thus stands with a lower proportion of cones surviving were less likely to have seeds dispersed by nutcrackers. McKinney and Tomback (2007) and McKinney and others (2009) suggest that loss of whitebark pine cone production due to tree damage and mortality caused by blister rust and mountain pine beetle (*Dendroctonus ponderosae*) will likely lead to a decline

in nutcracker visits over time, and thus a reduction in future whitebark pine regeneration. With continued losses of whitebark pine, it is likely that nutcrackers will no longer be attracted to whitebark pine communities and thus the potential for regeneration will be lost (Tomback and others 2001).

There is concern over potentially declining numbers of nutcrackers in the Crown of the Continent Ecosystem. Given the extent of blister rust infection, canopy kill, and tree mortality, it is unknown whether nutcrackers will appear and harvest seeds during years of cone production. Nutcracker numbers, distribution, and use of their habitat within the Crown of the Continent Ecosystem require further study.

Objectives

Our objectives in this study are to determine: 1) health status and cone production in whitebark pine, 2) the density of nutcrackers in whitebark pine communities in selected study areas when seeds are available, and 3) whether the nutcrackers are harvesting and potentially storing seeds from the remaining productive whitebark pine within the park.

Methods

In July 2009, we selected four whitebark pine study areas in Glacier National Park: Numa Ridge, Preston Park, White Calf Mountain, and Two Medicine. One study area was selected in Waterton Lakes National Park: Summit Lake. Within each study area we set up one to three transects ranging from 0.5 to 1.0 km in length for the purpose of using transect distance sampling to determine nutcracker densities. For each transect, we established two 10 x 50 m plots to determine whitebark pine health status and cone production. Stand health was assessed once, in July 2009. We visited each transect three times between 28 July and 16 September, 2009, to conduct nutcracker surveys, and to count cones.

Results

Thirty-five nutcrackers were observed over the 2009 field season, with the majority observed at Numa Ridge

and Summit Lake. We found a blister rust infection level of 72 percent to 97 percent across study areas, with no sign of recent pine beetle infestation. Seventy-seven of 170 whitebark pine trees evaluated (45 percent) were dead from previous mountain pine beetle infestations. Only two out of 93 live trees within our 20 health plots were cone-bearing, producing a total of 11 cones. There seemed to be a greater number of nutcrackers in areas with a greater number of living whitebark pine, although nutcrackers and numbers of cones did not appear to be correlated. However, sample sizes for 2009 cone data are too small to be statistically analyzed at this time. Canopy kill was greatest at Numa Ridge and Preston Park, where about half the trees evaluated had canopy kill greater than 50 percent.

Discussion

The results reported here for the 2009 field season must be considered preliminary. Nutcrackers were sighted more often in whitebark pine stands which had a higher number of live trees. However, this generalization did not apply to Preston Park, where no nutcrackers were observed during surveys, despite an extensive stand of mature whitebark pine. In addition, the preliminary data suggest little relationship between numbers of cones and nutcrackers. Tree damage from a high rate of blister rust infection has led to low cone production, which in turn may reduce the number of nutcrackers that forage in these areas. One sampling issue with the 2009 data was that nutcrackers were observed over long transects but cone counts were restricted to two health plots; data were not entirely comparable. We altered our methodology for the 2010 field season in the following ways to collect more data: 1) nutcracker surveys were increased to seven per transect over the summer, with two counts per survey per day, one in the morning and one in the afternoon, and 2) we surveyed for cones using the same distance sampling method in order to better evaluate cone production surrounding our transects. Results for the 2010 field season are pending.

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