Determining the Relationship between Whitebark Health and Visits by Clark's Nutcrackers

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Whitebark pine (*Pinus albicaulis*) in the northern Rocky Mountains is declining as a result of *Cronartium ribicola*, the invasive pathogen causing white pine blister rust, and also from on-going outbreaks of mountain pine beetle (*Dendroctonus ponderosae*). Clark's nutcracker (*Nucifraga columbiana*) is the primary seed disperser for whitebark pine. Previous work shows that nutcrackers make fewer visits to damaged forests than to healthier forests when seeds are ripe. (McKinney and Tomback 2007, McKinney et al. 2009). If nutcrackers are not visiting whitebark pine in heavily damaged stands, natural regeneration will diminish greatly.

We tested published predictions relating live trees and cone production to the likelihood of nutcrackers visiting whitebark pine (McKinney et al. 2009). We worked in four national parks--Grand Teton, Yellowstone, Glacier, USA, and Waterton Lakes, Canada

Materials and Methods

Three 1 km x 30 m nutcracker-monitoring transects were established in stands of mature whitebark in Glacier NP, two in Waterton Lakes NP, two in Yellowstone NP and two in Grand Teton NP. Transects were monitored twice in July and twice in late August, 2008. Each transect has 6 nutcracker point count stations, one every 200 m, and each point count required 10 minutes. Point count data will be supplemented in 2009 with information on nutcracker sightings, activities, and tree preferences gathered off transects. Two 50 m x 10 m plots were established at a randomly generated point adjacent to each monitoring transect to survey stand structure, blister rust infection and canopy damage, mountain pine beetle symptoms, tree mortality, and whitebark pine regeneration. Cones per tree were counted on each plot in July and again in late August. These protocols will be followed again in 2009.

Results (2008 field season)

Ten transects and 20 forest health plots were successfully installed across all four parks. Whitebark pine in Glacier and Waterton Lakes National Park has the highest overall average blister rust infection level (33% and 70%, respectively) (Fig.1). Mountain pine beetle infestation was highest overall in Grand Teton National Park at 34.1% of trees (Fig. 2), although the Avalanche Peak area in Yellowstone National Park was much higher. The highest percent dead whitebark pine occurred in Glacier National Park (37.5%), although Grand Teton and Waterton Lakes National Parks were high as well (36.5% and 33.3%, respectively) (Table 1). The highest density of living trees was found in Yellowstone National Park, with low densities in Glacier and Waterton Lakes National Parks (Table 1). Average nutcracker occurrence was highest in Yellowstone National Park, and lowest in Waterton Lakes National Park (Table 2).

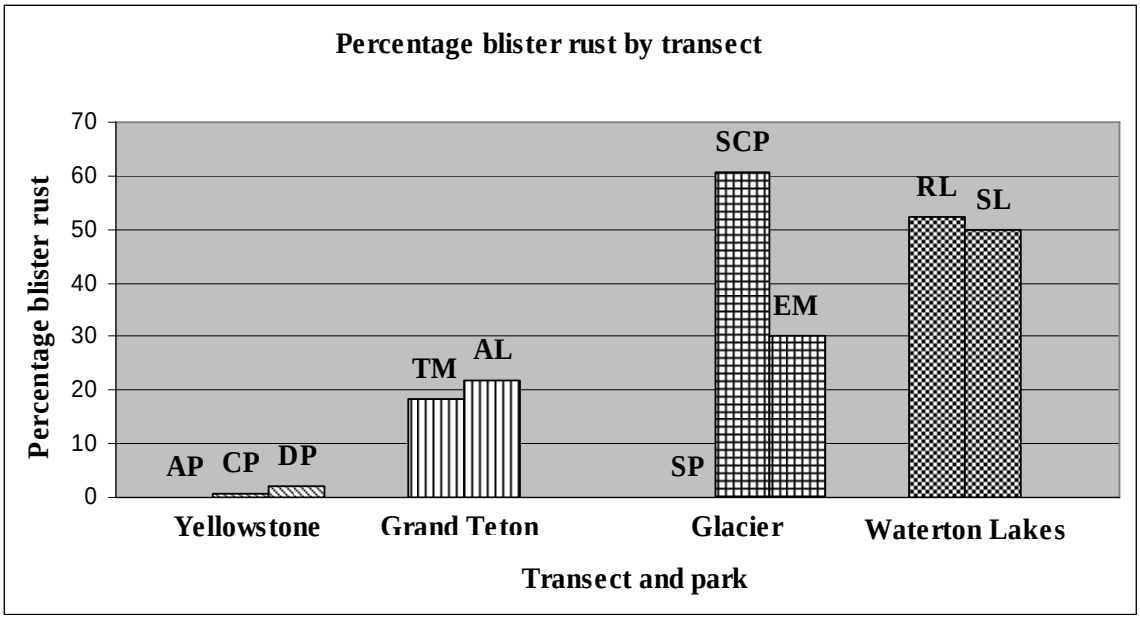

Figure 1. Percentage infection by blister rust by transect and national park. Each bar is named for the trail or area where the transect and plots were placed.

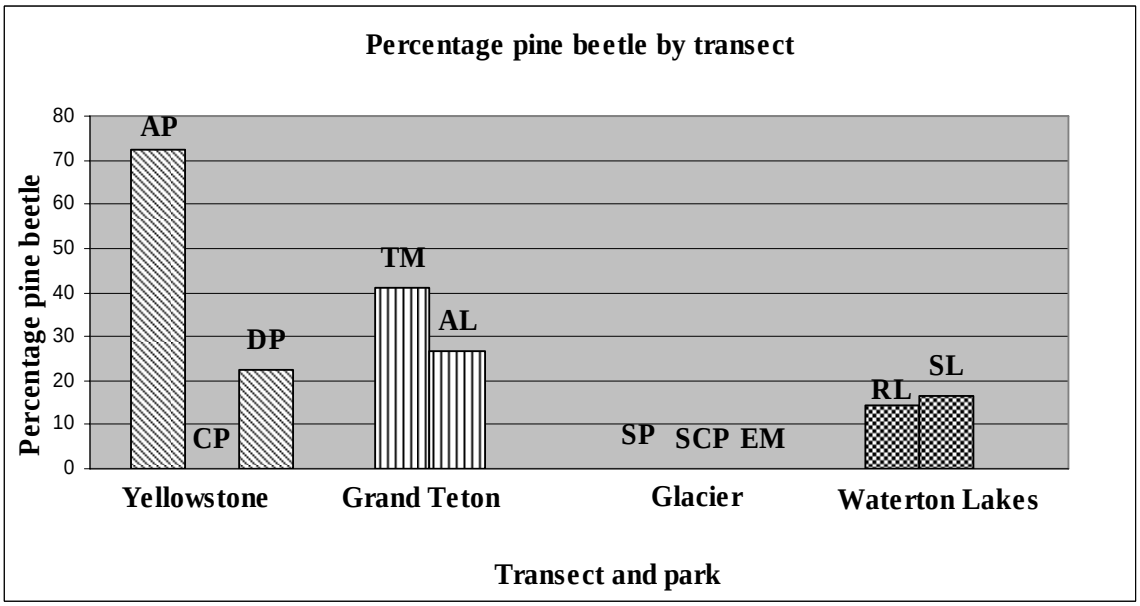

Figure 2. Percent of trees infested by pine beetle by transect plots and national park.

Average per park	Yellowstone	Grand Teton	Glacier	Waterton Lakes
Percentage dead whitebark	17.9%	36.5%	37.5%	33.3%
Living whitebark density	0.076 per m^2	0.027 per m^2	0.008 per m^2	0.009 per m^2
Cones per park subplot	24.8	5	2	0

Table 1. Percentage of dead whitebark, and living whitebark density. Data are overall means among all transect health plots within a national park.

Nutcrackers observed on point counts	Yellowstone	Grand Teton	Glacier	Waterton Lakes
High count of 6 point counts	9	9	1	1
Average among 6 point counts	5.6	7	0.33	0.50

Table 2. Nutcrackers observed on point counts

Discussion

Whitebark pine health is generally poor throughout the species' range. Declines are occurring across all four parks from blister rust infection and mountain pine beetle outbreaks. Blister rust is highest in Waterton Lakes NP; there, cone density is lowest. Overall, 2008 was a poor cone year; 2009 appears likely to yield better cone production across the Central and Northern Rocky Mountain Region. Not surprisingly, cone production was highest where live tree density was highest. Nutcracker counts paralleled cone production numbers, with observed nutcracker numbers highest in areas with high whitebark density and cone counts. Similarly, areas where whitebark is much reduced were also areas with fewer nutcrackers.

We will be repeating cone counts and nutcracker point counts in 2009. Once we have obtained those data, we anticipate using a rigorous data analysis protocol for both years across all four parks. If the count trends obtained in 2008 hold across the parks in 2009, the results will generally support the conclusions of McKinney et al. (2009), who documented fewer nutcracker seed dispersal visits in late August and early September to whitebark pine in Glacier NP than in other areas with lower whitebark pine damage and mortality. If our initial findings are confirmed in 2009, this would support McKinney et al.'s (2009) suggestions that active management in the Northern Continental Divide Ecosystem is indicated in order to maintain whitebark pine communities, given the lower probability of seed dispersal services available from nutcrackers.

Acknowledgments

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