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A BIOLOGICAL EVALUATION OF SPRUCE BEETLE ACTIVITY IN THE ABAJO MOUNTAINS

MANTI-LASAL NATIONAL FOREST

MONTICELLO RANGER DISTRICT

By

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Introduction

A significant increase in Engelmann spruce mortality attributed to spruce beetle, *Dendroctonus rufipennis* Kirby (Coleoptera: Curculionidae, Scolytinae) was detected this year in the Abajo Mountains on the Moab/Monticello Ranger District, Manti-LaSal National Forest. In late July, between 300 and 400 fading spruce in total were aerially mapped in the North Creek drainage; on Bob Park Peak and Mount Linnaeus; in the upper Indian Creek drainage; along Jackson Ridge and the ridge between Abajo Peak and South Peak. A total of less than 50 trees were mapped in these same areas last year.

These results support observations of increased activity made during an FHP site visit earlier this spring and raised several concerns. The primary concern was that the crowns of spruce beetle-infested trees typically remain green for up to two years and the number of fading trees observed might represent only a small percentage of the actual current spruce beetle activity. The presence of high spruce beetle population levels would pose a significant threat to remaining healthy and old growth stands in the area.

The Moab/Monticello Ranger District consequently requested that Forest Health Protection assist them in conducting a more intensive ground survey to quantify the amount of healthy, currently infested, and older dead spruce within outbreak areas. This survey was completed during the week of August 2-6. The following report describes the methods used to conduct the survey and provides the results. Recommendations for spruce beetle management are also discussed.

Methods

Forest Health Protection originally delimited twelve management units in the upper North Creek drainage, Twin Peaks, and Horsehead Peak for completing a biological evaluation of spruce beetle activity on Abajo Mountain in 2000 (Anhold and Dymerski, 2000). Additional spruce-fir stands were delimited in the vicinity of Jackson Ridge to evaluate spruce beetle activity in the upper Indian Creek drainage in 2002 (Hebertson, 2002). The majority of stands in both of these areas were resurveyed this year (Appendix A).

The total area re-surveyed was approximately 1,500 acres. Data was collected on variable radius plots systematically distributed in each unit. Plots were spaced ten chains apart to ensure adequate coverage of the area and to locate small, isolated centers of spruce beetle infestation. Due to the steep terrain actual distances between individual plots sometimes varied. From plot center, a 20 basal area factor gauge was used to determine sample spruce. Only spruce greater than five inches diameter at breast height (dbh) were tallied. Data collected for each spruce included dbh and spruce beetle condition class. The three condition classes included healthy, currently infested, and older dead. Healthy spruce were defined as those with no signs or symptoms of infestation. Currently infested trees had living spruce beetles (eggs, larvae, adults) within the inner bark. Older dead trees had evidence of previous infestation (crown symptoms, galleries, emergence holes, etc.) but no living beetles remaining in the tree. Current spruce beetle attacked trees observed between of plots were also mapped.

Upon completion of the survey, data was entered into a spreadsheet and summarized using the Forest Insect and Disease Tally (FINDIT) program (Bentz 2000). Stand susceptibility for each unit surveyed was previously determined using the hazard rating system developed by Schmid and Frye (1976). Hazard ratings are generally used to determine a stand's susceptibility to spruce beetle infestation. This system is based on the average diameter of live spruce > 10 inches dbh, the basal area of the live stand and the percentage of live spruce in the stand. This system also considers the physiographic location of the stand and site index. Stands considered most susceptible to spruce beetle attack include those located in drainage bottoms with basal areas exceeding 150 ft^2, a live spruce component > 60% and average spruce diameters > 16 inches dbh.

Results

Table 1 shows the total of number spruce per acre, the quadratic mean diameter (QMD) of spruce, the number of currently infested and older dead spruce per acre, and the percentage of those classes in each unit surveyed. The previous surveys indicate that Engelmann spruce is the primary component in these units comprising 65-75% of the total trees and 80% of the mean basal area per acre, respectively. Individual spruce are generally large with QMDs 19 inches. Diameter class distributions indicated most stands possess some age and size class diversity. Although not inventoried, few spruce saplings and seedlings were observed. Relatively large patches of aspen and small trees (7-10 inches dbh) were often interspersed with large diameter spruce, subalpine fir and Douglas-fir.

Table 1. Summary of FINDIT results for stands surveyed

Unit	TA*	QMD (in)	TAC	%C	TAO	%O	Haz Rating
NC-A	38	16	0	-	0	-	Mod
NC-B	62	18	0	0	6	10	Mod
NC-C	54	16	0	0	<1	1%	Mod-High
NC-E	38	20	3	7	<1	1%	Mod-High
NC-F	75	21	2	3	0	-	Mod-High
NC-G	76	-	<1	<1	2	3%	Mod-High
NC-H	156	13	0	-	0	-	Mod-High
NC-J	143	16	1	<1	2	1%	Mod-High
NC-K	82	20	0	-	0	-	Mod-High
NC-L	157	16	0	-	2	1%	Mod-High
IC	132	17	0	-	0	-	High

*TA=total trees per acre; QMD=quadratic mean diameter of spruce greater than five inches dbh; TAC=total number of currently attacked trees per acre; %C=percentage of current attacks in unit; TAO=total number of older attacked trees per acre; %O=percentage of older attacks in unit; Mod=moderate; NC=North Creek; IC=Indian Creek

With the exception of units NC-E and NC-F, current spruce beetle activity throughout the area was low (Table 1). In unit NC-E, currently infested and older spruce beetle-caused tree mortality was generally confined within the main drainage and occurred up to the ridge just below Abajo Peak. The majority of attacks were found on spruce greater than 19 inches dbh. The number of currently infested trees comprised only seven percent of the spruce component. Three currently infested trees tree per acre however equated to about 1,122 trees in total.

In unit NC-F, an average of two current spruce beetle-attacked trees occurred per acre. This comprised approximately three percent of the spruce component and equated to about 282 trees in total. These values are consistent with aerial survey estimates.

Interestingly, pockets of both current and older spruce beetle-attacked trees throughout all units were coincident with the placement of baited funnel traps used to monitor population levels. This observation suggests that the funnel traps may be contributing to local population increases and consequent spruce mortality, or that funnel traps may be serving to confine spruce beetle populations within these locations.

Another observation of note was that many 'older' mass attacked trees still had green crowns. In many cases, feeding woodpeckers had stripped these trees of outer bark. Altough not quantified, woodpeckers generally appeared to have consumed anywhere from 50 to over 90 percent of overwintering broods.

Discussion

These results suggest that spruce beetle activity in the Abajo Mountains has increased. Epidemic populations presently exist in the main North Creek drainage. Populations approaching epidemic levels have been defined as more than two clumps of at least five standing, infested trees for every five acres (Bentz and Munson 2000). The outbreak however is confined to the main upper North Creek drainage and populations presently remain at manageable levels. Healthy spruce-fir stands throughout the area have compositions and structures that are moderate to highly susceptible to spruce beetle spread. A no action approach would result in an expansion the outbreak. During the past two decades, spruce beetles have killed up to 90% of large diameter spruce in other forests throughout Utah.

Reducing spruce beetle populations using a silvicultural sanitation treatment would most effectively reduce spruce beetle risk over the short term. This treatment would consist of mechanically removing all infested spruce from outbreak areas. Some commercial value might be derived through the sale of timber or commercial firewood. Infested material could also be cut into 18 inch long bolts and removed from the stand for use as firewood or piled and burned.

Other benefits of this treatment would include a delay in the loss of local seed sources. Exposure of mineral soil during treatment might also facilitate natural spruce regeneration. A sanitation treatment however would not sufficiently reduce the long-term susceptibility of stands to spruce beetles. This treatment would have both beneficial and adverse impacts to wildlife depending on the species under consideration for management. Other undesirable consequences of this treatment might include more extensive site impacts, visual impacts, potential damage to

advanced regeneration, loss of structural diversity, an increased potential for windthrow, and the creation of heavy fuel loads.

Trap trees could also be used in isolated pockets of current activity to effectively reduce local populations. Trap trees are generally large, green spruce with diameters exceeding 16 inches dbh that are felled prior to the onset of flight to capture colonizing beetles. Infested trap trees are subsequently removed, or the developing brood killed by burning or debarking the same year trees are attacked.

To attract beetles, trap trees should be felled in shady locations retaining limbs to provide shading and support off the ground for greater surface colonization. Until sufficiently infested, trap trees should also remain unbucked to prevent desiccation. Careful consideration should be given trap trees felled in close proximity to uninfested stands to avoid the risk of attracting beetles to those stands. Avoid felling trap trees adjacent to standing host trees to prevent spillover. Felling trap trees in sites with more abundant non-host trees or small diameter spruce (< 10" dbh) will reduce the number of residual attacks on susceptible hosts. One trap tree per 2-3 infested standing trees is recommended. In centers of spruce beetle activity, clustering trap trees has proven effective. Two to four trees are felled one chain apart to concentrate attacks. Lindgren funnel traps (12 or 16 tiered) baited with pheromones (in a two or three-component lure) can also be used to contain local populations and/or capture beetles. Typically, one trap is hung for every 10-12 infested spruce. In centers of infestation, funnel traps are deployed in clusters of three with individual funnel traps spaced spaced 50 feet apart. Funnel clusters are spaced approximately 100 feet apart. To minimize spillover, funnel traps are hung on non-host or dead spruce and at least 30 feet away from any susceptible trees. This is the least effective means of reducing beetle numbers, however, when used in conjuction with trap or baited trees this technique can help reduce populations.

To maximize their effectiveness, selected treatment strategies should be implemented before the next spruce beetle flight (May-June, 2011) and while spruce beetle populations remain confined to local pockets. Should the outbreak expand, management options become increasingly limited and delays in treatment greatly reduce opportunities for success.

Conclusions

Outbreak populations of spruce beetles recently been detected in several stands throughout the Abajo Mountains. Although these populations remain confined to several pockets, they pose a threat to adjacent uninfested stands and stands in the upper Indian Creek drainage. Management units have moderate to high hazard based on conventional spruce beetle hazard rating systems and spruce-fir stands could experience a substantial loss of large diameter spruce should they become infested. Implementation of an aggressive management approach can minimize the potential of future spruce mortality. Strategies might include a combination of treatments discussed above. The use of silvicultural treatments would offer the greatest likelihood of effectively managing spruce beetle populations. These treatments must occur while populations remain at endemic levels to maximize their effectiveness. Management strategies would require a multi-year commitment of closely monitoring stands and implementing follow-up treatment to minimize potential spruce beetle impacts.

If you have any questions or comments regarding this report, or need further assistance, please feel free to contact me by phone at 801-476-9720 ext 217, or by email at lghebertson@fs.fed.us.

Sincerely,

/s/ *Elizabeth Hebertson*

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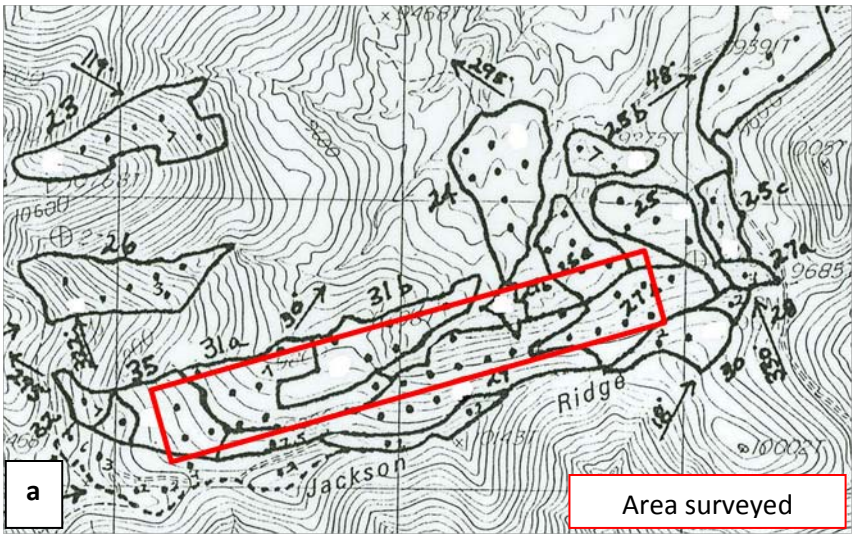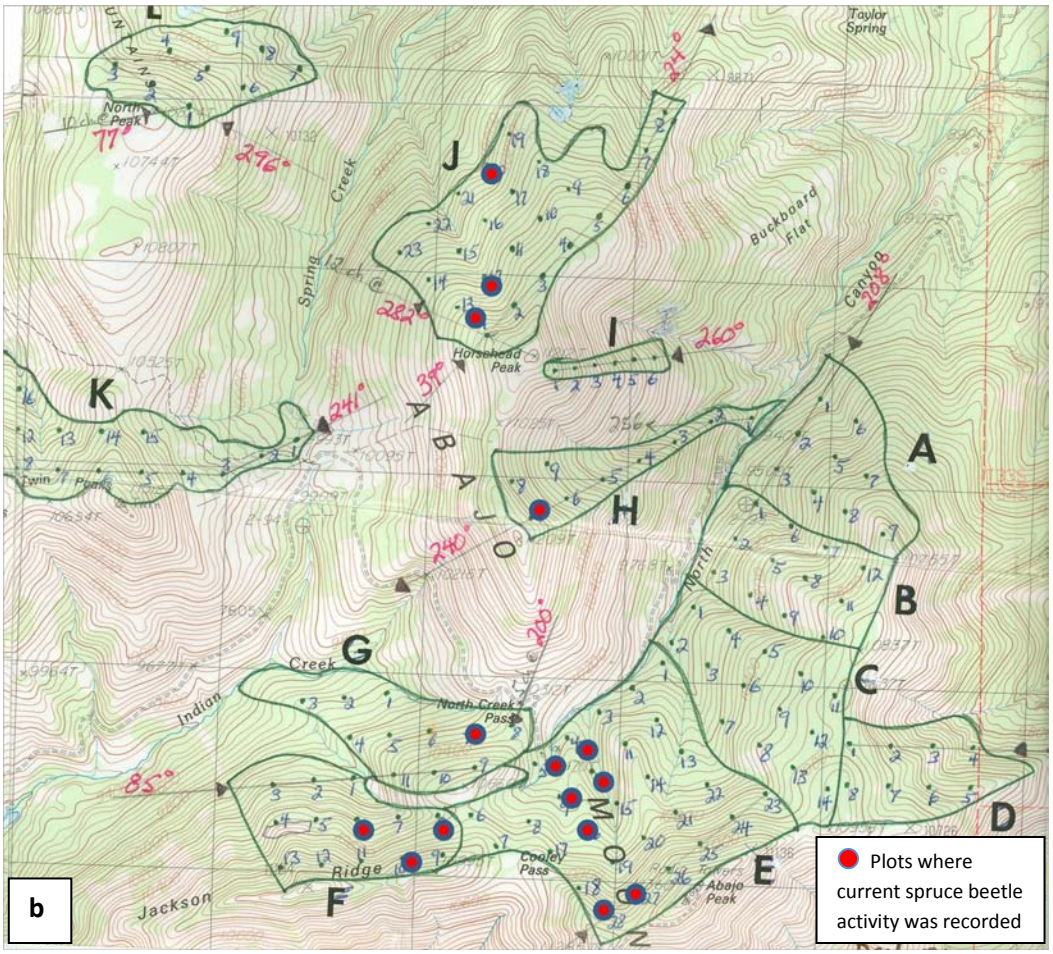
Appendix A. Maps of units surveyed for current spruce beetle activity in the Abajo Mountains, August 2-6, 2010. Upper Indian Creek (a); North Creek Units (b)