

**Installation of pheromone-based funnel traps to monitor infestation levels of Southern Pine Beetle
(*Dendroctonus frontalis*) in 3 recent pine-kill areas**

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Photo: Southern Pine Beetle and associated wood pecker damage on a Shortleaf Pine (*Pinus echinata*) near Gatlinburg, TN. Troy Evans

Study Purpose

This study used funnel-style beetle traps to monitor infestation levels of Southern Pine Beetle (SPB) at 3 locations within GRSM. One trap was placed at each of 3 recently discovered pine-kill areas that have been confirmed with USFS as being caused by SPB. Two of these sites are in the Gatlinburg vicinity, and one site is along Lakeview Drive near Bryson City. By using standard methodologies recommended by USFS, these short-term trapping cycles should allow us to approximate population densities of SPB in the pine stands, as well as determining infestation stage (early, mid, late).

Field Methods

Three total funnel-style traps were placed in the field, one each near recently discovered pine-kill areas caused by Southern Pine Beetle (SPB). Each trap was baited with both a turpentine mixture (attractant) and a pheromone lure to specifically target SPBs. It has been found that these traps also attract clerid beetles, which are the most common predator of SPB. By correlating the ratio of SPB to clerids, an inference can be made on the stage of the infestation (Billings and Upton 2010). By using this technique, along with counts of SPBs alone, we determined the level of SPB infestations at each site.

Each funnel was baited and placed near an infested site following Billings and Upton (2010), the week of April 20-24th, 2015. Each trap included a solution of propylene glycol mixed with water at the base of the funnel, which kills all insects in the trap. The funnels were checked weekly for 4 cycles, and all catch removed and preserved in an isopropyl alcohol solution. At the end of the 4 cycles, all traps were removed.

Each trap catch sample was sent to the USFS Forest Health group in Asheville, NC, care of Paul Merten. Here, they were sorted and identified, and the data returned to GRSM. The trap in North Carolina was installed and attended by Dan Bryson, Vegetation Management, GRSM. The Gatlinburg area traps were installed and attended by various Vegetation Management crew members, under the direction of Glenn Taylor, GRSM.

Locations

There were 3 site locations for this study, each near an existing SPB infestation. Two sites were located within Great Smoky Mountains National Park (GRSM) boundary in Tennessee, and another within the GRSM boundary in North Carolina (Figure 1). Site 1 is known as the Bypass site, and is located adjacent to the upper overlook of the Gatlinburg Bypass. Site 2 is known as Cataract Falls, and is located just above Cataract Falls behind Park Headquarters. Site 3 is known as Fontana Lake and is located just south of Lakeview Drive near Bryson City, NC. See Appendix A for site coordinates and site maps.

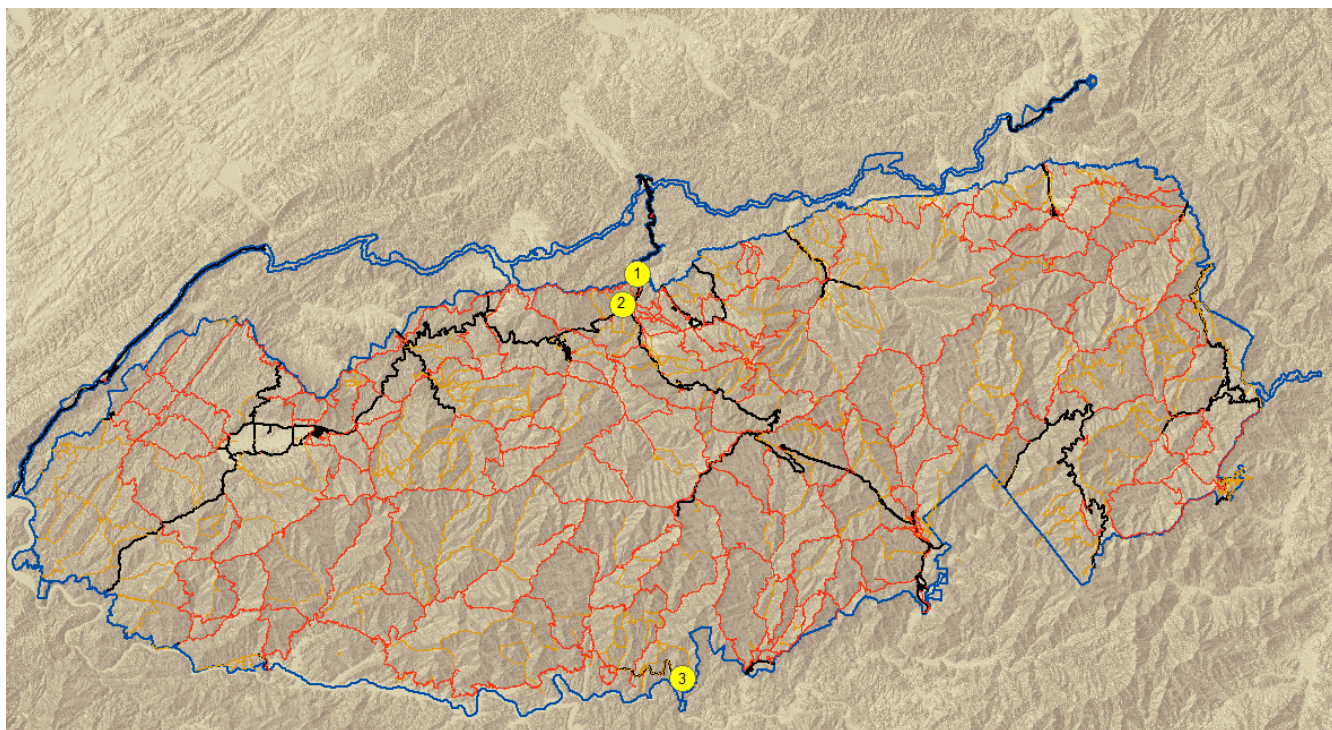


Figure 1: Southern Pine Beetle trap locations are shown in yellow. Traps 1 and 2 are in the Gatlinburg/Park Headquarters area, and Trap 3 is along Lakeview Drive near Fontana Lake.

Analysis

Data analyses followed Billings and Upton 2010. SPB beetle counts and clerid predator to SPB ratios were calculated to classify each site as Declining, Static, or Increasing. This information will be useful in informing decisions on how to proceed with SPB infestations in the near future. If sites are static or increasing, then an increased monitoring effort may be initiated to better understand the distribution and size of current SPB infestations.

Results

All sites were visited weekly for 4 weeks from 4/28/2015 to 5/21/2015. During each visit, all contents of the trap funnels were preserved in isopropyl alcohol, and sent to USFS Forest Health group in Asheville, NC, care of Paul Merten. Table 1 includes the weekly trap catch summaries for each site. Trap summaries include clerids, SPB, and any other pine pests identified in the trap.

Table 1: The below table shows trap catch information for all three SPB trap locations. The two species of interest for this study were the clerid (*Thanasimus dubius*) and SPB (*Dendroctonus frontalis*). Other pine pests are shown in the table, but are not used for SPB calculations.

Site 1 - Gatlingburg Bypass	Trap Collection Date			
	4/28/2015	5/5/2015	5/12/2015	5/20/2015
Clerid <i>Thanasimus dubius</i>	165	131	448	171
SPB <i>Dendroctonus frontalis</i>	95	128	190	171
<i>Hylastes</i> sp	2	5	0	2
BTB <i>Dendroctonus terebrans</i>	0	1	1	1
<i>Ips</i> sp	0	0	2	2
Site 2 - Cataract Falls	Trap Collection Date			
	4/28/2015	5/5/2015	5/12/2015	5/19/2015
Clerid <i>Thanasimus dubius</i>	131	135	117	63
SPB <i>Dendroctonus frontalis</i>	4	1	2	4
<i>Hylastes</i> sp	1	0	1	0
BTB <i>Dendroctonus terebrans</i>	0	2	0	0
<i>Ips</i> sp	0	0	0	0
Site 3 - Fontana Lake	Trap Collection Date			
	4/29/2015	5/7/2015	5/19/2015	5/21/2015
Clerid <i>Thanasimus dubius</i>	10	14	23	6
SPB <i>Dendroctonus frontalis</i>	14	31	21	20
<i>Hylastes</i> sp	0	0	3	1
BTB <i>Dendroctonus terebrans</i>	0	0	0	0
<i>Ips</i> sp	0	0	0	0

For each location, mean SPB/trap/day was calculated, as well as SPB ratio, which is defined as the (No. of SPB X100)/(No. SPB + No. Clerids) (Billings and Upton 2010, see Table 2). These values were then plotted according to Billings and Upton (2010), and the condition of the infestation inferred from the graph coordinates (See Figure 2).

Table 2: The table below shows calculated metrics for SPB at all three locations. Metrics used in the SPB Prediction Chart are SPB/Trap/Day and SPB Ratio.

Site	Trap Days	SPB/Trap/Day	Total SPB	Total Clerid	SPB Ratio
1 Gatlinburg Bypass	28	20.86	584	915	38.96
2 Cataract Falls	27	0.41	11	446	2.41
3 Fontana Lake	28	3.07	86	53	61.87

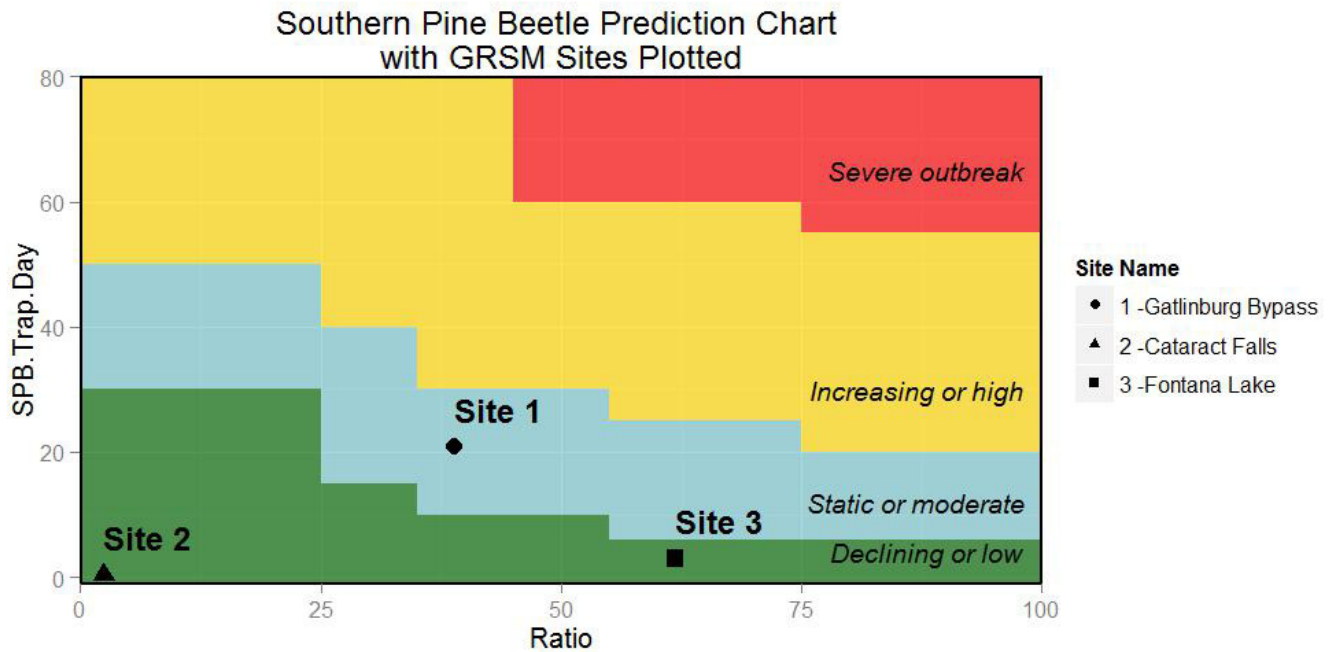


Figure 2: The above graph shows the SPB infestation trend levels from Billings and Upton (2010), with the values for the GRSM SPB sites plotted. Site 1 – Gatlinburg Bypass falls within the Static or moderate infestation zone, while sites 2-Cataract Falls and 3-Fontana Lake fall within the Declining or low infestation zone.

Discussion

The above results confirm what was suspected in the field; that the majority of active SPB sites in GRSM are small and declining. Site 1, Gatlinburg Bypass, appears the most active. In the field, Site 1 is small, but growing downslope (eastward) into a new grouping of pines. This likely accounts for the static population size.

Site 2, Cataract Falls, is the largest of the three sites, and likely the oldest. The SPB infestation appears to have been intense here, as a large grouping of pines have died, including a fair amount of White Pine (*Pinus strobus*). White Pine is often viewed as a less desirable host for SPB, so its decline may point to intense SPB pressure in recent years. Site 2 had the lowest SPB count, indicative of a much declined population, which supports the lack of freshly dying trees noticed at this site in 2015.

The only North Carolina location, Site 3 – Fontana Lake, also appears to have a declining or very low SPB population. This site is fairly isolated, and only included a small group of pines. The infestation appears to have already affected all pines in the small ridgetop group, which would lead to a declining population.

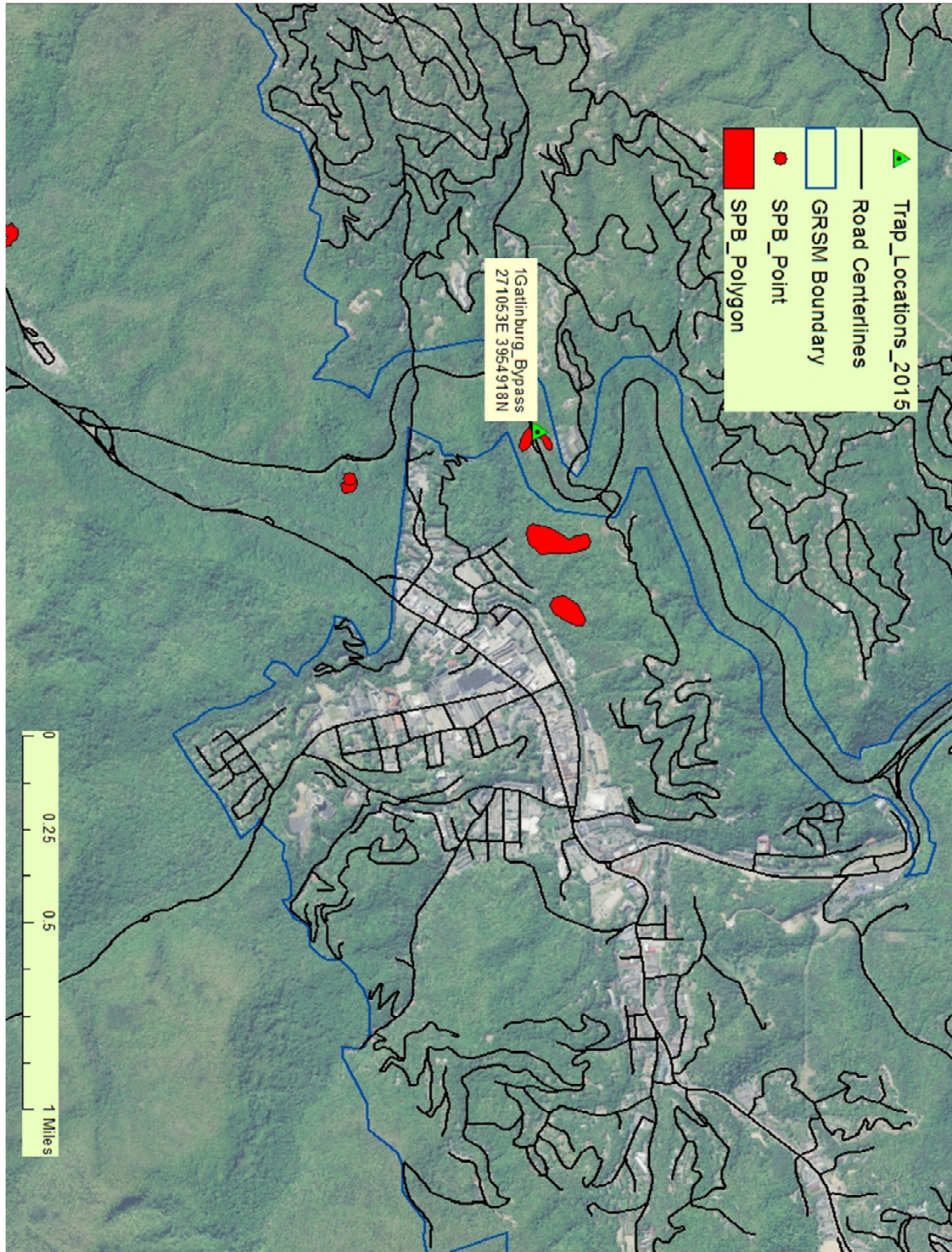
Based on this year's trapping results, we do not expect to see a large increase of SPB for the remainder of 2015, or in 2016. Areas of known infestation will continue to be monitored, or more trapping performed in spring 2016 if deemed necessary.

Literature Cited

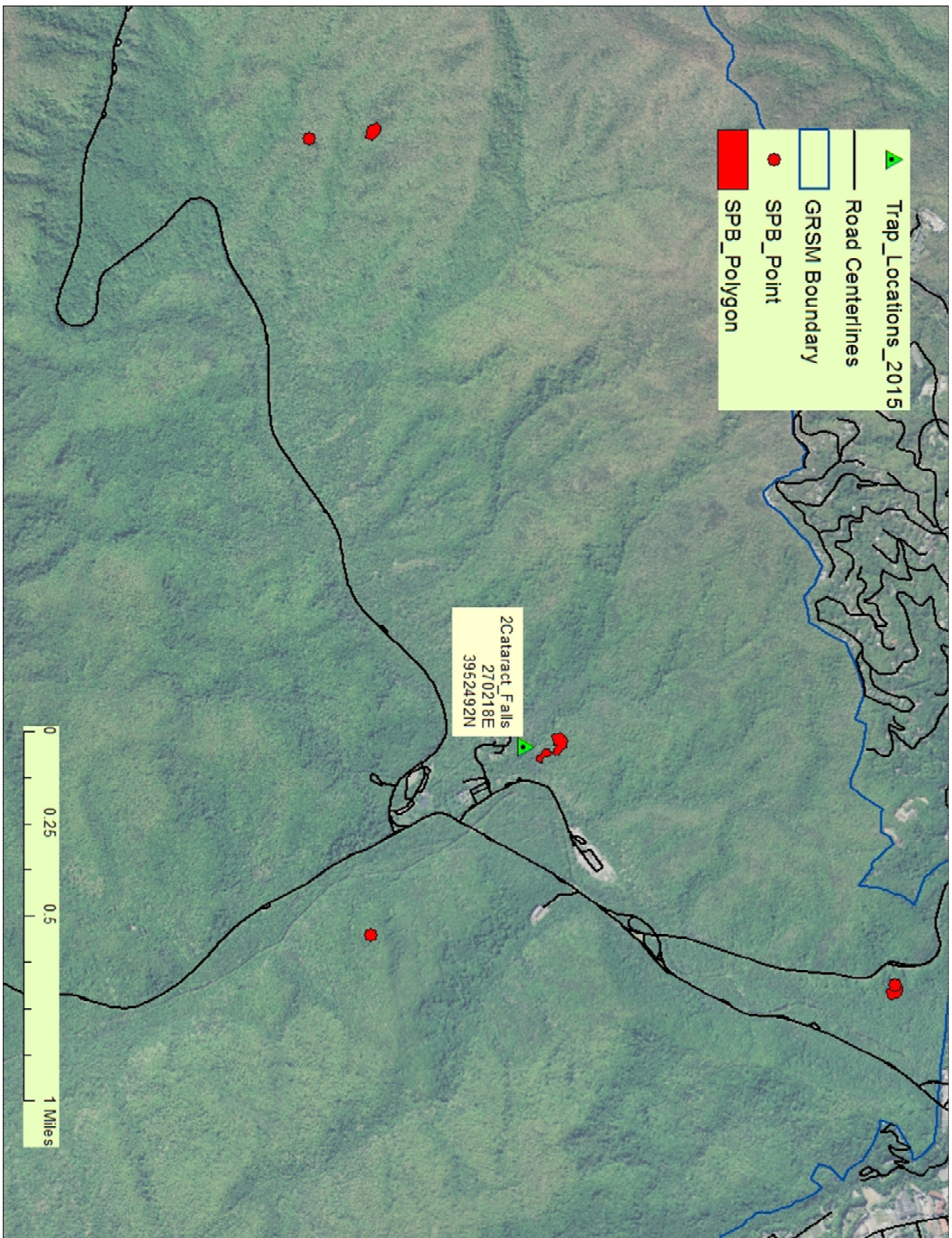
Billings, R.F. and Upton, W.W. 2010. A methodology for assessing annual risk of southern pine beetle outbreaks across the southern region using pheromone traps. In: Pye, John M.; Rauscher, H. Michael; Sands, Yasmeen; Lee, Danny C.; Beatty, Jerome S., tech. eds. 2010. Advances in threat assessment and their application to forest and rangeland management. Gen. Tech. Rep. PNW-GTR-802. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest and Southern Research Stations: 73-85.

Appendix A - Site Location Maps.

Site 1 – Gatlinburg Bypass. Trap location is denoted by a green triangle, and all known SPB infestations are shown in red.



Site 2– Cataract Falls. Trap location is denoted by a green triangle, and all known SPB infestations are shown in red.



Site 3– Fontana Lake. Trap location is denoted by a green triangle, and all known SPB infestations are shown in red.

