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2018 Glacier Spruce Beetle Spring Population Assessment

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Spring Spruce Beetle, *Dendroctonus rufipennis* (SB) population assessments were conducted in Glacier National Park from May 23 to 28, 2018. In total, 7 locations were sampled spread across the currently accessible range of SB populations, located between the Roger's Pass Interpretative Centre and the RockGarden area. Three NRCan-CFS technicians participated in the survey.

Traditional R-Value calculations, as employed for MPB, are not as straight-forward for Spruce Beetle population assessments since they are a 2-year cycle pest and the ratio of male to female is 1:1. We are also most interested in this current year's beetle flight, so we focus on that part of the population. To this end, an old CFS FIDS method of calculating the spruce beetle Trend Ratio (*Tr*) was employed to assess current year population levels. A heat map was prepared using inverse distance weighted (IDW) interpolation with a 7-point weighting (ESRI ArcGIS), to help illustrate these map zones. Attack density and larval densities are also calculated, and general evaluations are discussed based on the number of live and dead over-wintering adults and larvae, and amount of predation and parasites.

An overview, survey protocols, and a population status summary is provided below.

Overview

There has been substantial spread from 2017 causing an increase in new faders throughout the current extent of spruce beetle in GNP. The area of mortality mapped will increase in 2018. Most of the new faders are along the north side of the valley, however others were noted on the south side by Rock Garden, Cougar Brook, near LoopBrook, and along the 1885 Trail near the Illecillewaet campground.

According to the data, the current hotspots along the main valley for this year's flight, are in the RockGarden area, and by Glacier Station north along the south and east facing slopes of Cheops Mountain. All 7 sites sampled had very high numbers of live beetles despite having relatively high predation and parasites. Attack densities between the sites were consistent ranging between 2.9 (High) and 4 (Severe), while Larval Densities were highest at *Cougar1*, *LoopBrook*, and *Rogers* which registered at 16.8, 15.9, and 15.4 respectively. Though population trend ratios are classed as Low, Moderate, and Heavy in this assessment, it does not mean that there will not be substantial flights occurring from areas classed as Low. Each site had a substantial number of healthy broods with adults showing good vigor, the heavier sites will just have more than others.

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Survey Protocol

Current-attacked codominant trees are sampled at least 50m from stand edge and within a radius of 50m. Public areas are avoided if possible. Sample trees are selected at random and include all forms of attack (i.e. light, mass, strip), and resistance. Woodpecker trees are also included as sample trees if the sample bark is not completely removed. Both the north and south sides of trees are sampled by exposing a 6-inch square (15.24 cm²) patch of bark using a chisel and mallet, with a "tree apron" to catch potential falling larvae. General site information and data for each sample is recorded. Specific sample data includes the number of live beetles (all stages), number dead, galleries, attack starts (entry holes), and predator/parasite info.



The data are evaluated by calculating the adult trend ratio, the % of the population that may fly in the current year, the attack density, and the larval density.

The trend ratio for pupae and adults are calculated as follows:

Adult Trend ratio (Tr) = (Sum of (#pupae and adults – (2 x attack starts)) / (2 x attack starts) per tree) / # of trees

Note: According to the FIDs method, the 2x attack starts accounts for mating pairs per gallery.

Tr Classes are:

Low: 0 - 0.7

Moderate: 0.7-1.4

Heavy: ≥1.4

The Attack Density and Larval Density are calculated by tallying attack starts and live larvae per site and averaging by the number of sample trees. They are expressed as follows:

Attack Density Classes:

Low: <1

Moderate: 1-1.9

High: 2 – 3.9

Severe: ≥4

Larval Density Classes:

Low: <4.9

Moderate: 5-14.9

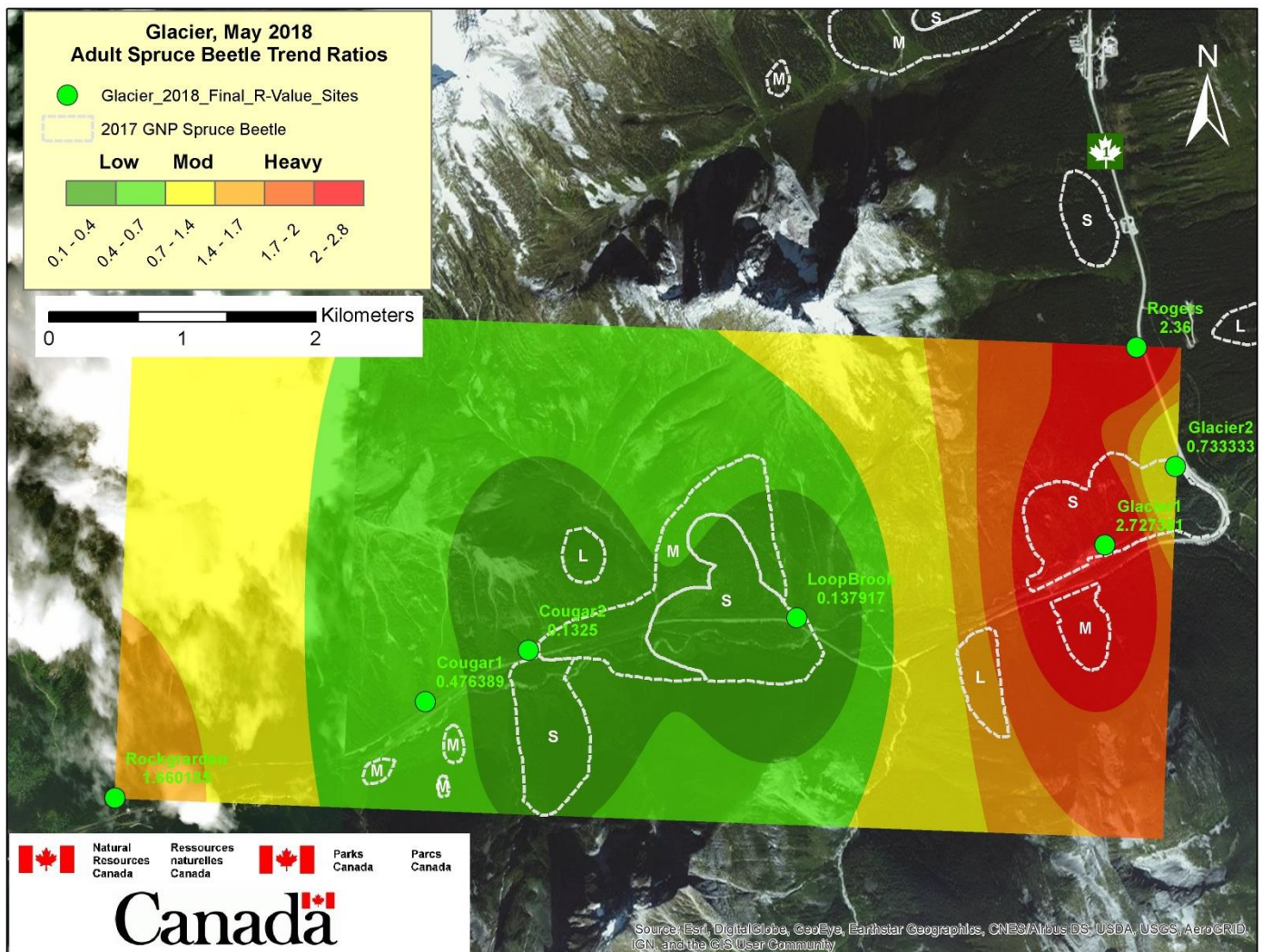
High: 15 – 24.9

Severe: ≥25

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Population assessment

Low (≤ 0.7): Low *Tr* values were recorded for *Cougar1* (0.48) and 2 (0.13) and the *LoopBrook* (0.14) sites. This class is marked by the 2 green shades on the map. Regardless of being classed as Low, there will be a flight from these locations as adult numbers were high enough (106, 86, and 96 respectively). The proportion These sites were also at lower elevations in the valley, so higher elevations may have different numbers. If including the live larvae counts, *Cougar1* would be the 3rd highest and *LoopBrook* the 4th, of all 7 sites. *Cougar1* also had the highest number of overwintering mortality observed in all the sites with 158 found, roughly 40% of the total population found (live and dead). It also had the highest number of live larvae which could mean better numbers from this area in 2019. A substantial number of insect parasites and predators were found at *Cougar2*, which totaled 189, the highest count in all 7 sites. The insect parasites and predators were comprised of 40% Diptera, 48% Cleridae larvae, and the rest of Rover beetles, Hymenoptera, and *Rhizophagus brunneus* (Monotomidae). Woodpecker predation caused 70%



damage to sample tree boles at *Cougar1*, 60% at *Cougar2*, and 65% at *LoopBrook* which also helped reduce counts in these sites.

Moderate (0.7-1.4): The moderate class is marked by the yellow area on the map. There was only one site in this category, which was *Glacier2* with a *Tr* of 0.73. This site has the potential for 62% of its population (pupae and adults) to fly this year. Parasites totaled 82 for the site comprised of Diptera, Hymenoptera, Cleridae larvae, and Rover beetle species. Woodpecker predation was high at this site, an average of 70% of each bole sampled were damaged and 65% of the samples themselves which would substantially reduce the numbers found.

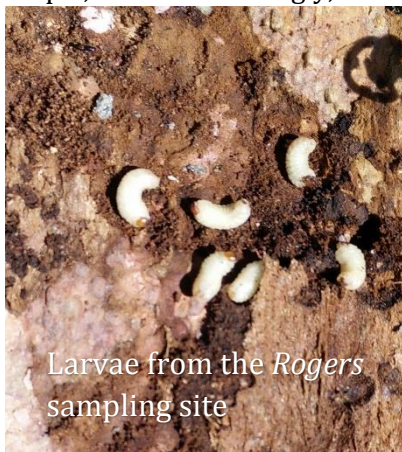
Heavy (≥ 1.4): The Heavy class is represented by the light orange to red areas of the map. These heavy classed sites include *RockGarden* (1.66), *Glacier1* (2.73), and *Rogers* (2.36).

RockGarden had a population of 194 alive and only 38 dead, which is a very healthy population. This site has the potential for approximately 82% of its population to fly from the site. Contributing significantly to the health, parasite counts were only 48, and woodpecker predation averaged 48% of each sample tree bole and 11% of each sample, all of which are the lowest in all the sites surveyed.

Glacier1 had the highest *Tr* of all the sites surveyed (2.73) and the 2nd highest live count of 278, of which approx. 68% may fly. The high numbers were surprising given the predation and parasites found on the site. Each bole averaged 75% woodpecker predation and each sample, 52%. Interestingly, 62% of insect parasites and predators found at this site was Hymenoptera. There are



substantial numbers of new faders in this area, however most new mortality mapped in 2018 will likely be infilling of the 2017 polygons with some additional expansion.



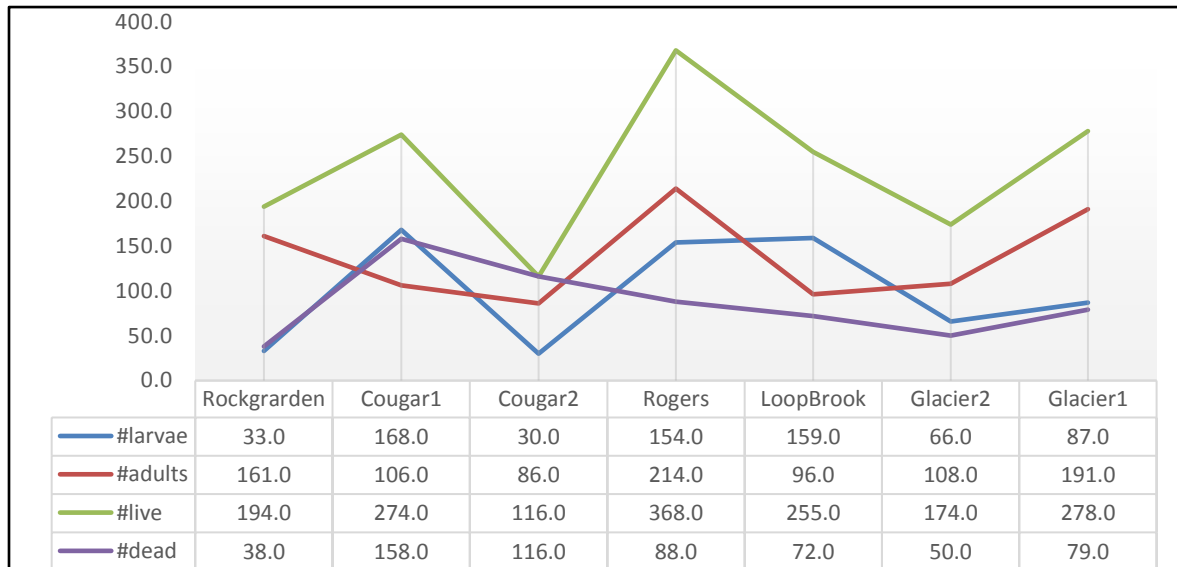
The *Rogers* sampling site had the highest number of live counted at 368, which was comprised of 214 adults and 154 larvae. This means potentially 58% of this population can fly. The overall count is very high considering the boles sampled were the hardest hit in all sites by woodpecker predation, averaging 80% per tree. Brood production here was very good and larvae looked healthy. Larval density at this site was 15.4 (high). Three trees sampled at this location had no live adults.

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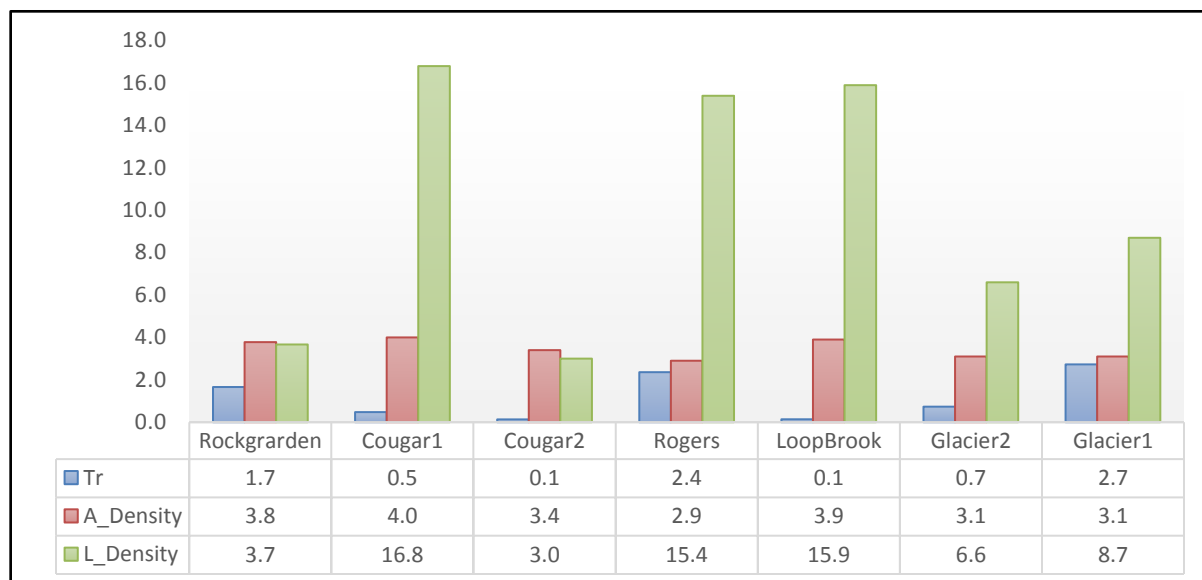
Summary table of site data.

Plot	Locale	Lat	Long	Alt	slope	%Flight	Tr	A_Density	L_Density	#larvae	#adults	#live	#dead	P&P	%WPbole	%WPsamples
1	Rockgrarden	51.2484	-117.6223	1039	F	83.0	1.7	3.8	3.7	33	161	194	38	48	47	11
2	Cougar1	51.2558	-117.5891	1069	SE	38.7	0.5	4.0	16.8	168	106	274	158	73	70	18
3	Cougar2	51.2596	-117.5782	1084	SE	74.1	0.1	3.4	3.0	30	86	116	116	189	60	18
4	Rogers	51.2817	-117.5138	1306	NE	58.2	2.4	2.9	15.4	154	214	368	88	67	80	25
5	LoopBrook	51.2624	-117.5494	1106	F	37.6	0.1	3.9	15.9	159	96	255	72	60	65	33
6	Glacier2	51.2737	-117.5091	1239	S	62.1	0.7	3.1	6.6	66	108	174	50	82	78	65
7	Glacier1	51.2682	-117.5164	1161	F	68.7	2.7	3.1	8.7	87	191	278	79	85	75	53

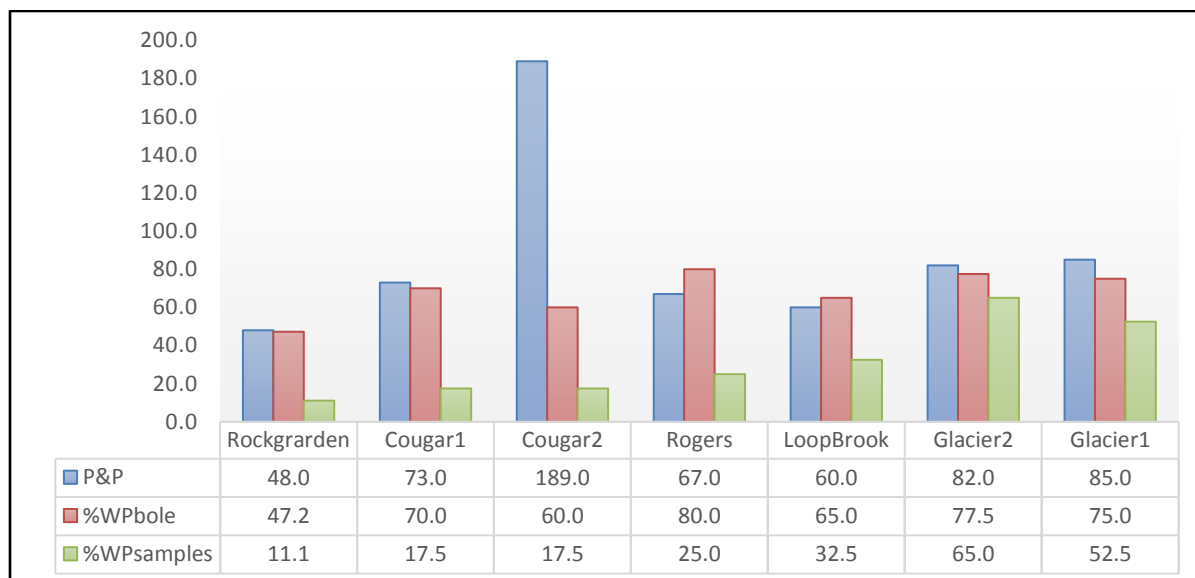
Summary chart of counts: larvae, adults, total live and total dead.



Summary chart of Trend ratio, attack density and larval density.



Summary chart of insect predator and parasite (P&P) counts and % woodpecker predation.



Recommendations

Future surveys: Heli-time may be required for more complete and accurate sampling. Due to time constraints, we are currently limited by ground accessible sites, however conducting sampling in some of the more remote areas would greatly aid the accuracy of these surveys and make for a more complete and accurate heat map. Two to 3 hours of heli flying time would be sufficient.

The Northern Forestry Centre has a new bark beetle ecologist starting this fall. It is hoped the spruce beetle population assessment methodology will be reviewed and revised for next year so results can more accurately reflect conditions.

MRG priority areas should be communicated prior to ground surveys to ensure they are included and evaluated as best possible. I will inquire about priority areas during early spring field scheduling.

SB Maintenance: Maintenance of hazard trees will become a consideration in some areas of the park. Currently RockGarden and Sir Donald Campground are of concern, but LoopBrook and Illecillewaet campground may also be soon. Trap trees or pheromones may be employed at some of these priority areas to divert attacks, but I have limited experience with these techniques. I recommend discussing with provincial entomologists.

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