A.J Waters & Associates Inc.

Use of Pheromone Baited Funnel Traps to Manage Douglas-fir Bark Beetles on Woodlot Licence 1413

Mengqi Li
9-15-2014

Use of Pheromone Baited Funnel Traps to Manage Douglas-fir Bark Beetles on Woodlot Licence 1413

Prepared for

Tony Loring

Faculty of Forestry, the University of British Columbia

By

Mengqi Li

51491124

Burnaby, BC

September 15, 2014

Summary

Douglas-fir bark beetle is an important pest throughout British Columbia. The Douglas-fir bark beetle usually attacks mature Douglas-fir with thick bark which are dying, are under stress, or have recently been felled. However, they will also infest live, relatively healthy trees when preferred host material is unavailable. To reduce the Douglas-fir bark beetle attack on Woodlot Licence 1413, thirty-two pheromone baited funnel traps were established on May 7th to lure the beetles into a clearcut area which had been harvested from December 2012 to February 2013. The beetles trapped in the funnel trap containers were collected and counted on a weekly basis. On August 7th, after the beetles flight had slowed down significantly, field surveys were conducted to detect and mark all infested trees for salvage harvesting. Several 0.05 m^2 bark samples were cut and removed from attacked trees to predict the number of trees which would have been attacked and killed by the bark beetles which were captured in the funnel traps.

In this experiment, the Douglas-fir beetle population, flight activities, and development stages were monitored by setting up semiochemical funnel traps. The main flight happened from May 7th to June 5th and continued into August. In total, there were 351,896 Douglas-fir beetles collected in the traps from May 8th to August 7th. It is predicted that these trapped beetles might have attacked 338 mature Douglas-fir trees based on calculations of attack density per square meter of bark surface. The use of semiochemical funnel traps was very successful in concentrating the Douglas-fir bark beetle attack in a location close to the existing roads where it could be easily harvested. Without the use of semiochemical funnel traps or trap trees the 2014 flight may have resulted in Douglas-fir trees being attacked in scattered locations away from roads where it may have been more expensive or impractical to salvage.

The main reason for using funnel traps instead of trap trees was to reduce the amount of salvage logging associated with the 2014 Douglas-fir beetle flight. Because of the anticipated large beetle flight, it would have been difficult to fall enough trap trees and keep them in shade without damaging other healthy trees as the trap trees are felled and harvested. It can also be more costly to harvest or destroy trap trees that are dispersed within a stand.

To maintain a low Douglas-fir beetle population and minimize further infestation, there are some possible recommendations for management. First, logging slash piles consisting of large diameter, green Douglas-fir logs can be used as trap trees but must be burned before any Douglas-fir beetle brood in this material emerges. In addition, fresh blow down or standing Douglas-fir trees that are attacked by the Douglas-fir bark beetle need to be harvested or burned before the Douglas-fir beetle brood emerges. Ground detection surveys need to be done early (July or August), so action can be taken before the beetle brood emerges to attack additional trees. Sanitation harvesting before the beetles emerge from the attacked trees is the best way to reduce further expansion of the beetle population but may not always be possible. To avoid destroying valuable infested timber in small infestations, it may be possible to use pheromone baited funnel traps or pheromone baited trap trees to concentrate the emerging Douglas-fir beetles in areas that can be planned for harvest during the summer or winter after the beetle flight.

The Douglas-fir beetle population is expanding within the Quesnel Forest District as a result of pre-occupation with the harvesting of mountain pine beetle killed timber, wildfires that have burned Douglas-fir stands and restrictions on harvesting in highly susceptible Douglas-fir stands within old growth management areas and ungulate winter ranges. More active management of

the Douglas-fir bark beetle needs to occur in the Quesnel Forest District to prevent and reduce losses of valuable Douglas-fir timber and conserve other forest resource values.

Table of Contents

Introduction 1

Methods.....2

Results 4

Discussion.....6

Conclusion.....9

Recommendation.....9

Reference.....10

Appendix 1 11

Use of Pheromone Baited Funnel Traps to Manage Douglas-fir Bark Beetles on Woodlot Licence 1413

Introduction

The Douglas-fir beetle (*Dendroctonus pseudotsugae* Hopk.) is an important pest throughout British Columbia, particularly in the interior region of the province, where it attacks and kills Douglas-fir (*Pseudotsuga menziesii*). The Douglas-fir beetle prefers to attack recently cut, large diameter (> 20 cm) Douglas-fir logs with thick bark, such as cull logs left in logging slash. It also prefers to attack trees damaged by wildfire and blow down trees. However, the Douglas-fir beetle will infest live standing trees that are dying or under stress or relatively healthy mature or over mature trees when other host material is unavailable.

Figure 1. Douglas-fir beetle larvae and galleries

After boring into the live bark next to the cambium, the female beetles build galleries that are parallel with the length of the tree trunk and lay eggs along each side of the gallery. Healthy infested trees will exude copious amounts of resin and try to pitch the beetles out. Cut Douglas-fir logs or blowdown trees are unable to produce hardly any resin to deter the attacking beetles. This may be one of the reasons the beetles prefer such host material to healthy standing trees.

However, if a live standing tree is weak and there are too many attacking beetles, the tree may not be able to defend itself. Successfully attacked trees will be killed because the flow of nutrients, water and carbohydrates within the tree is blocked by the insect galleries created by the adult beetles and feeding larvae (Figure 1[1]) plus sapwood cells are killed by fungi introduced by the beetles.

During 2013 and 2014 most of the Douglas-fir beetles in the vicinity of Woodlot Licence 1413 matured on a one-year life cycle as a result of the relatively warm summer weather experienced during these years. These one-year cycle beetles would attack new host material in May, June or July; the developing offspring would overwinter as young adults which would emerge to attack new host material the following May, June or July. Shortly after attack (mid May to July), reddish-brown boring dust can be found in bark crevices and at the base of heavily attacked trees (Figure 2). This fresh boring dust provides an easy way to diagnose Douglas-fir bark beetle attack. By August after the summer following the year of successful attack, the dying Douglas-fir trees turn red. Almost all of the adult beetles will have already emerged (between May and July), from trees with red foliage.

[1] *http://www.natgeocreative.com/photography/1242983*

Woodlot Licence 1413, is located approximately 55 kilometers west of Quesnel, in the Cariboo Forest Region. The woodlot licence is in the dry warm Sub-Boreal Spruce Biogeoclimatic Zone (SBSdw2) and contains mixed stands of Douglas-fir with minor amounts of hybrid spruce, dead lodgepole pine, trembling aspen and paper birch. Cutblock 3 of Cutting Permit AA was harvested from December 2012 to February 2013 and had a tremendous amount of large non-merchantable Douglas-fir slash which was heavily attacked by Douglas-fir beetles between May and July of 2013.

Figure 2. The boring dust and frass of Douglas-fir bark beetle

In an effort to reduce the Douglas-fir beetle population, the slash accumulations were piled and burned prior to the 2014 beetle flight. In addition, over 30 cords of Douglas-fir firewood were removed from the area. The bark was removed from the large beetle infested pieces of firewood, hand piled and burnt.

Realizing that there would still be a significant beetle flight from large diameter stumps and infested Douglas-fir logs that were not burned or removed, a decision was made to establish pheromone baited funnel traps in the clearcut area in an effort to reduce or prevent the attack on green standing Douglas-fir trees.

Methods

On May 7, 2014, thirty-two (32) pheromone baited funnel traps[2] (Figure 3) were established in the clearcut area with an estimated spacing of 50 meters between traps. The traps were located at least 50 meters away from the clearcut boundary where the adjacent standing timber consisted of susceptible Douglas-fir trees over 20 centimetres in diameter. Traps # 23, 26, 27, 28 and 30 were located closer than 50 meters from the clearcut boundary since there was a young plantation or immature timber adjacent to the clearcut near these trap locations. All traps were located using GPS to create the map shown in Figure 4. Semiochemical lures purchased from Synergy Semiochemical Corp. were attached to each funnel trap to attract Douglas-fir beetles. After the beetles flew into the funnels and fell into the container at the bottom of the trap, it would be hard for them to escape because of the design of the funnel trap.

Figure 3. Pheromone funnel trap

[2] The funnel traps used in this project were generously provided by West Fraser Mills Ltd.

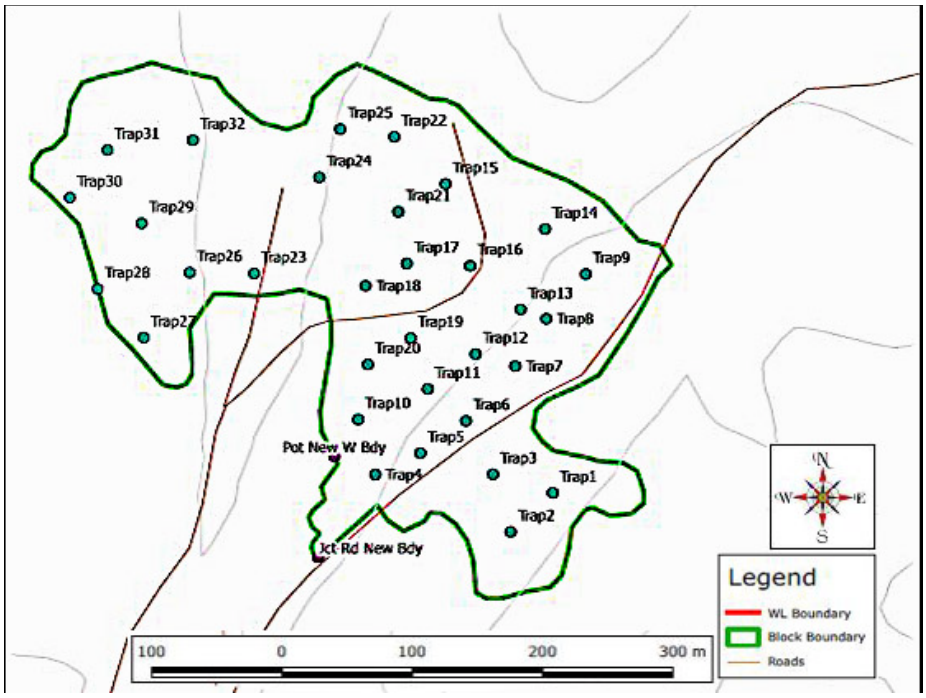

Figure 4. The map of Douglas-fir beetle trap locations

Starting on May 14, 2014, the Douglas-fir bark beetles in each funnel trap container were collected and counted on a weekly basis. After the beetles and other insects from each trap were killed by freezing overnight, the dead Douglas-fir beetles were separated from other insects and debris that had fallen into each trap container. The Douglas-fir beetles from each trap were weighed and the number of Douglas-fir beetles was estimated based on the predetermined average weight of 100 Douglas-fir beetles. Several samples of one-hundred Douglas-fir beetles were weighed and the average weight of one-hundred beetles was determined to be 1.175 grams. To maximize accuracy, if the total weight of Douglas-fir beetles in a trap was less than three grams, the actual number of Douglas-fir beetles was counted. The numbers of Douglas-fir beetles collected from each trap by date of collection, is summarized, (with other information), in Appendix 1.

At the end of August, ground surveys, such as walkthroughs and beetle probes, were completed in the susceptible Douglas-fir timber surrounding the clearcut to identify all new Douglas-fir bark beetle attacked trees. Based on the color of top foliage and the presence of reddish-brown boring dust in bark crevices, Douglas-fir bark beetle attacked trees were marked with orange spray paint for salvage harvesting. Then, two average sized Douglas-fir trees that were attacked in 2013 and one Douglas-fir tree which was attacked in 2014 were felled to examine the attack densities in an attempt to estimate the actual number of beetles that attacked each tree. Several bark samples, measuring 20cm by 25cm, were marked, cut and carefully wedged off

Figure 5. Bark sample removed from an attacked Douglas-fir

from the attacked trees (Figure 5). The number of entrance points of adult Douglas-fir bark beetles found on each bark sample were counted and recorded, as well as the life stages of any beetles present. The length from the bottom of the tree to the point on the tree where Douglas-fir beetle attacks stopped was measured along with the diameters at the top and bottom of the measured length. These measurements allowed the surface area of bark on each sample tree to be calculated so an estimate could be made of how many beetles attacked the average sized tree. The measurement and calculations are summarized in Table 2. In making the estimate of how many Douglas-fir bark beetles attacked an average sized tree, it was assumed that one male and one female Douglas-fir bark beetle would be associated with each entrance point at the bottom of an adult gallery.

Results

From May 8th to August 7th, there were an estimated total of 351,896 Douglas-fir beetles collected from the funnel traps (See Appendix1). During the second week (from May 14th to 22nd), most traps (27 of 32), were damaged by a bear who would break the container off the trap and eat the beetles and other insects in the container (Figure 6). Less severe amounts of bear damage continued until early July when berries began to ripen and the bear appeared to loose interest in the funnel traps. Douglas-fir bark beetle flying activities reached a peak (113,078 beetles) during the fourth week (May 29th to June 6th), and then the number dropped dramatically and remained at about the same level from June 6th to July 3rd. During the last few weeks of monitoring, the number of beetles collected were declining gradually, and in the last week (ending on August 6th), there were only 492 beetles collected from all traps (Figure 7).

Figure 6. A container damaged by bear

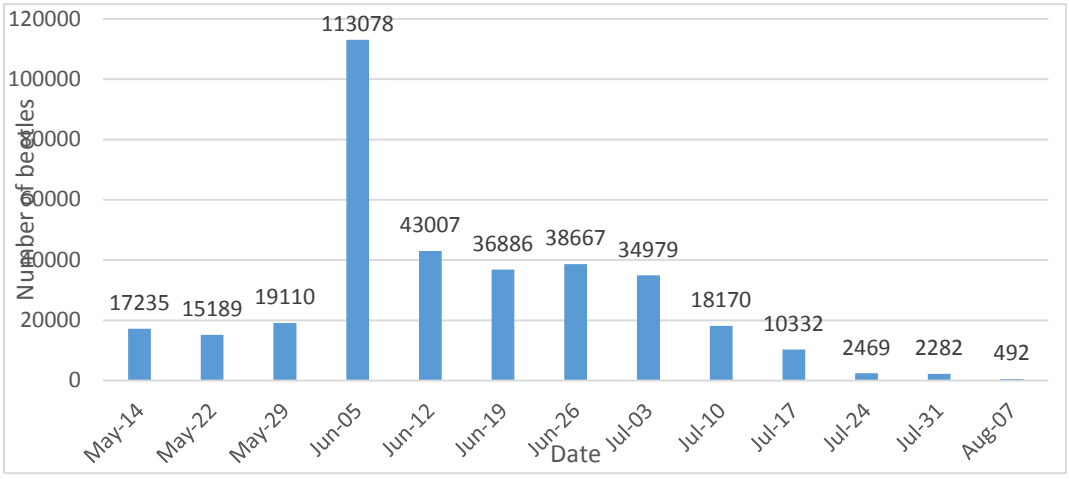

Figure 7. The total number of Douglas-fir bark beetles trapped during each week[3]

[3] During second week, 27 of the 32 traps were damaged by a bear. In the undamaged traps, roughly 5 times as many beetles collected in each trap during the second week; compared to the first week. This indicates that the bear may have eaten or released up to 100,000 beetles from the trap containers during the second week of collection.

The total number of beetles collected by each trap varies greatly as shown in Figure 8. Some traps, such #25 and #30, collected over 20,000 beetles, while other traps collected less than 5,000.

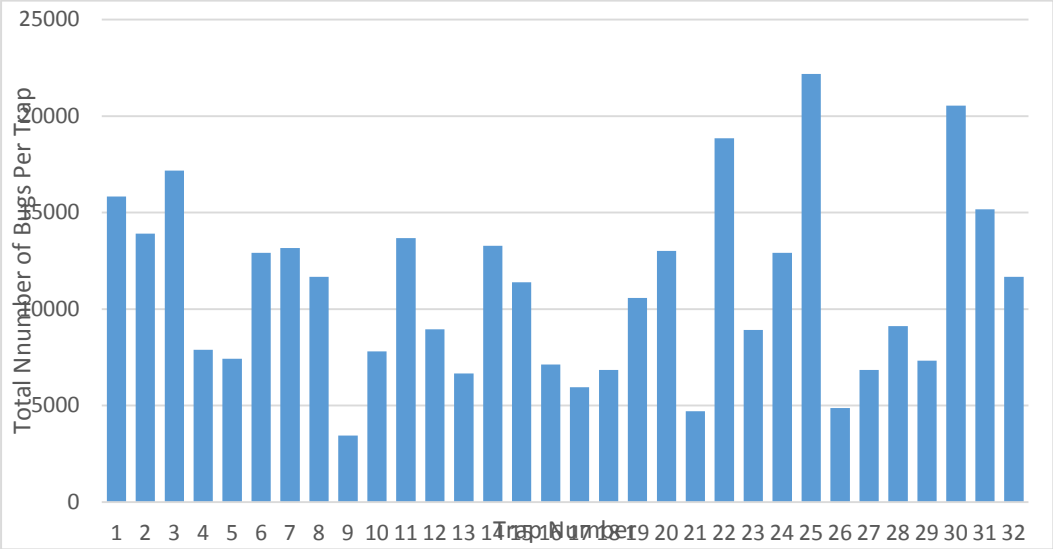

Figure 8. The total number of Douglas-fir bark beetle collected by each trap

The following process was undertaken in an effort to estimate how many Douglas-fir trees the 351,896 beetles captured in the traps may have attacked and killed. Seven bark samples were cut off from three attacked trees, and the number of entrance holes on each sample was determined and summarized in Table 1. There was an average of 2.86 entrance points on the 0.05m^2 bark samples. The bark surface area for the averaged sized Douglas-fir tree that was attacked was determined to be 9.1 m^2 (Table 2). The total number of entrance points on the average attacked tree is 520, and assuming that each entrance point is associated with two adult beetles, this means 1040 adult beetles attacked an average tree with a diameter at breast height of approximately 35 centimetres. Based on these rough calculations it is predicted that the 351,896 trapped Douglas-fir beetles might have attacked and killed 338 mature Douglas-fir trees.

Table 1. The number of entrance holes on bark samples

Bark sample #	1	2	3	4	5	6	7
Number of entrances	0	4	0	3	3	4	3
Average number of holes	**2.86**						
Bark Area (m^2)	**0.05**						

Table 2. The attacked bark area of sample logs

Log #	Top Diameter (cm)	Bottom Diameter (cm)	Length(m)	Bark Area(m^2)
1	25	47	13.4	15.1
2	20	30	6.6	5.2
3	22	35	7.8	7.0
Ave				**9.1**

As expected, the sample trees with red foliage that were attacked in 2013 had very few dead adult beetles remaining inside the bark. There was no sign of live larvae or pupae in bark samples from the Douglas-fir trees attacked in 2013. In contrast, the bark samples from the Douglas-fir trees attacked in 2014 contained mostly young adult beetles which were light-brown in color, a lesser number of pupa and a very few larvae (Figure 9).

Figure 9. Pupa and young adults underneath the bark

In the area surrounding the cutblock where the funnel traps were located, there were over two hundred Douglas-fir trees that were heavily attacked in 2014. The trees attacked in 2014 were concentrated in the area immediately adjacent to the clearcut boundary and in one area where some standing Douglas-fir trees had been attacked in 2013. The standing trees which were attacked in 2013 were within 40 meters of the clearcut boundary and probably produced significant number of emerging adult beetles which attacked adjacent trees in 2014. These healthy standing trees which were attacked in 2013 were not detected until their foliage started to turn red in mid July of 2014.

The attacked Douglas-fir trees were logged and shipped to the sawmill and plywood plant in Quesnel during the beginning of September (Figure 10) and the harvested area was further examined for health conditions. Root disease was found in very few of the over-mature firs. A heart-rot fungus, (*Fomes pini),* was well developed in a few Douglas-fir, so that these logs are not qualified for sawlogs or veneer logs. There was no significant evidence of diseases or other factors that were significantly stressing the beetle attacked trees.

Figure 10. Salvage logging on the attacked stand

Discussion

There are some limitations of this experiment. Since this is an uneven-aged stand, the average height, age, and density varies a lot. In this case, more logs should have been measured to estimate surface bark area of an average sized, beetle attacked tree. In addition, more bark samples need to be cut off in order to make the estimation of attack density more precise. Since the actual beetle attack varies greatly depending on the thickness of bark, exposure to direct sunlight, health conditions, and distance from the attack center, and other factors, the real number of trees protected could be quite different from the prediction. The bear feeding on the insects in the trap containers and to a lesser extent, windy weather during early summer resulted in some traps being damaged. The bear is believed to have eaten a significant number of beetles from the trap containers and therefore the data underestimates the number of Douglas-fir beetles that the traps removed from the attacking population.

Despite the limitations of the experiment, it did have some interesting findings. First, it shows that Douglas-fir beetle major flight occurred in early summer (before June 5th), though it may vary from year to year due to temperature and local environmental conditions. According to the record, it rained heavily during the third week (from May 22nd to 29th), and this may explain why there was only a few beetles collected during that week. More Douglas-fir beetles were trapped during warm and dry conditions, and it could be that the pheromone is not as effective when it is rainy.

Another finding is that the number of beetles varies from trap to trap, which means it is related to the location (Figure 8). From the map, it shows that those traps closer to over-mature Douglas-fir timber attract more beetles than those in the middle of the clearcut. This may indicate that the flying distance for Douglas-fir beetle is not very far and usually they attack the closest available host rather than flying a long way to find the most susceptible tree.

In this experiment, semiochemical funnel traps reduced Douglas-fir beetle damage and may have lured the beetles close to the clearcut boundary. All of the 2014 Douglas-fir beetle attacked trees were within 100 meters to the clearcut boundary (Figure 11). No Douglas-fir beetle attacked trees were found in susceptible timber types that were between 100 and 200 meters away from the clearcut boundary. Because of the existing roads going through the clear-cut block, it was easy to harvest the concentration of attacked trees.

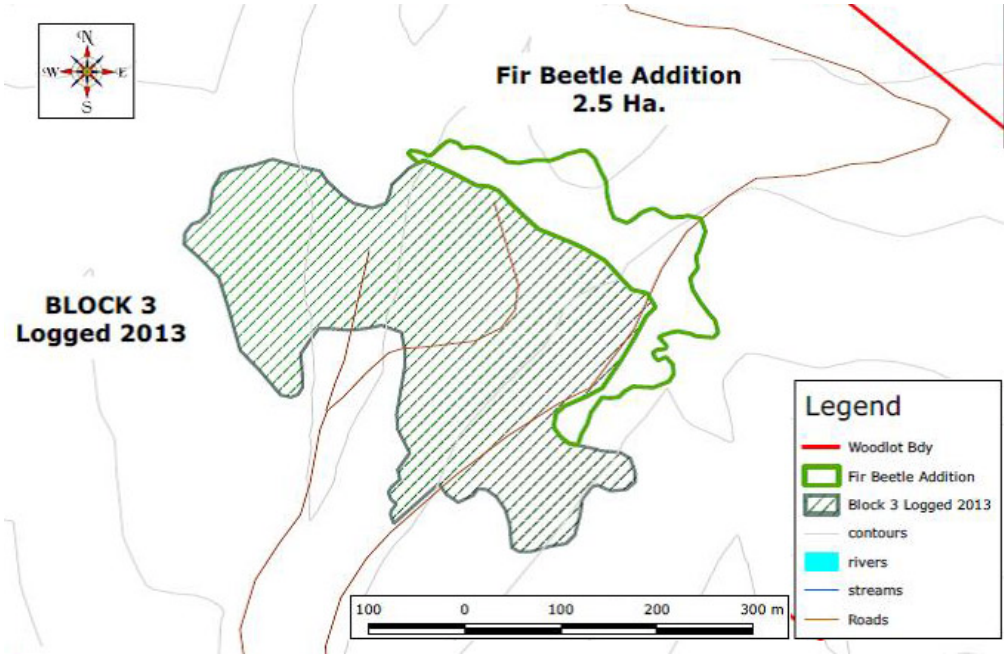

Figure 11. Map of Douglas-fir beetle salvage harvesting area

It is likely that some adult beetles had flown before the pheromone baited funnel traps were established on May 7th. These early emerging beetles successfully attacked standing trees, emitted pheromone and created centers of beetle attraction in competition with funnel traps. The fact that 17,235 beetles were collected from the traps in the first week suggests that the Douglas-fir beetle was actively attacking at this time. If the funnel traps had been set up 2 weeks earlier there should have been a trend of very few beetles captured during the first week followed by an increasing number of captured beetles in the second week. More importantly, if the funnel traps

had been set up one or two weeks earlier, there might have been less attack on adjacent, standing trees.

The main reason for using funnel traps instead of trap trees was to reduce the amount of salvage logging associated with the 2014 Douglas-fir beetle attack. The annual allowable cut for the woodlot licence is only 800 m^3/year and is already fully committed to the salvage of lodgepole pine that was killed almost 10 years ago. It was hoped that locating pheromone baited funnel traps in the clearcut area would minimize the attack on standing trees or concentrate the attack on standing trees that that were close to the existing cutblock.

Once a trap tree is fully attacked, the Douglas-fir beetles will almost always infest other susceptible trees in the immediate vicinity. With a decision to fall trap trees there is an expectation that salvage harvesting of the trap trees and any additional attacked trees will be required. Funnel traps never become "fully attacked" and continue capturing more beetles as long the trap collection containers are emptied on a regular basis and the trap is maintained in good working order. Each funnel trap captured between 4,800 and 34,000 Douglas-fir beetles which may be 5 to 50 times more beetles than a single trap tree would absorb. It would have been difficult to fall enough trap trees and keep them in shade to absorb all the beetles captured in the funnel traps. It can also be costly to harvest or destroy trap trees that are dispersed within a stand without damaging other healthy trees.

The population of Douglas-fir beetles that flew into the vicinity of the funnel traps in 2014 was larger than expected. Although some large stumps, slash and cull logs containing emerging adult beetles remained on the clearcut area, a considerable effort was made to burn as much beetle infested slash as possible. An excellent brood of Douglas-fir beetle developed because of the warm summer in 2013. A few blowdown fir trees caused by logging also provided excellent host material for Douglas-fir beetle. Once sufficient host material is unavailable, however, the Douglas-fir beetle attacked and killed vigorous healthy trees. Furthermore, ground survey indicates that some Douglas-fir had heart-rot fungus, which may have made them more susceptible to successful beetle attack. Usually, the outbreak of Douglas-fir beetle will be associated with other damaging factors such as wildfire, defoliation, root disease, or logging, but is also influenced by environmental factors such as drought stress or sunscald of the stems of large Douglas-fir wildlife trees retained in clearcut areas.

According to Table 3, the hazard level for Douglas-fir attack on this 120 year old stand is moderate to high. Therefore, harvesting and slash disposal activities need to be planned carefully to prevent the creation of large amounts of Douglas-fir slash or blowdown where the Douglas-fir beetle populations can expand quickly.

Table 3 Parameter values for hazard rating Douglas-fir stands[4]

[4] The table is from Bark Beetle Management Guidebook

Parameter	Hazard levels and values			
	Low (0.1)	Moderate (0.6)	High (0.8)	Very high (1.0)
D = mean dbh of Fd (cm)	≤25	26–35	36–45	>45
B = BGCZ	ESSF	ICH, SBPS	SBS	IDF
A = stand age (yrs)	≤80	81–120	121–140	>140
O = aspect	not applicable	north, east, flat	west	south
S = slope (%)	0–10	11–20	21–40	>40
T = density	0–399, ≥1,500	1,200–1,499	400–649	650–1,199
G = growth rate (mm)	>19	15–19	11–14	<11

Conclusion

In this experiment, the Douglas-fir beetle population, flight activities, and development stages were monitored by setting up semiochemical funnel traps. According to calculations, there would have been substantially more standing trees attacked if these funnel traps were not set up. The fact that the semiochemical funnel traps did not prevent adjacent timber from being attacked is somewhat disappointing. The use of semiochemical funnel traps was very successful in concentrating the Douglas-fir bark beetle attack in a location close to the existing roads where it could be easily harvested. The salvage harvest area was so heavily attacked it made sense to clearcut an opening which will allow the area to be most effectively reforested. Without the use of semiochemical funnel traps or trap trees, the 2014 flight may have resulted in Douglas-fir trees being attacked in scattered locations away from roads where it would have been expensive or impractical to conduct salvage harvesting.

Semiochemical funnel traps will reduce beetle damage on a local scale, such as a cut block and could be used to concentrate beetles emerging from a small infestation that can not be harvested before the beetle brood emerges. The need to maintain the traps in good working order and empty the trap containers on a regular basis makes the use of semiochemical funnel traps more costly than trap trees baited with semiochemicals.

Recommendations

To maintain a low Douglas-fir beetle population and reduce further infestation, there are some possible recommendations for management. First, logging slash piles consisting of large diameter, green Douglas-fir logs can be used as trap trees and should be examined in July or August to determine the extent of Douglas-fir beetle attack. The key to reducing the bark beetle population is to burn the infested Douglas-fir slash prior to the emergence of the beetle brood. Slash consisting of large diameter green Douglas-fir logs is preferred host material for Douglas-fir beetle, and can result in excellent brood development and dramatic increases in the local beetle population. The Douglas-fir stumps should be cut as low as possible to reduce suitable host material from which beetles will emerge.

In addition, fresh blow down Douglas-fir that has thick bark needs to be removed from the stand before the beetles emerge. Ground detection surveys need to be done in July or August to identify green Douglas-fir beetle attacked trees as early as possible so decisions can be made in time to deal with the situation before the beetle brood emerges to attack additional trees. Sanitation harvesting before the beetles emerge from the attacked trees is the best way to reduce

further expansion of the beetle population but may not always be possible. In small Douglas-fir beetle infections that can't be harvested before the beetles emerge; the infested blowdown or standing trees may be cut into pieces hand piled and burned. To avoid destroying this valuable infested timber it may be possible to use pheromone baited funnel traps or pheromone baited trap trees to concentrate the emerging Douglas-fir beetles in the vicinity so the area can be harvested during the summer or winter after the next beetle flight.

The Douglas-fir beetle population is expanding within the Quesnel Forest District as result of preoccupation with the salvage of extensive amounts of mountain pine beetle killed timber, wildfires that have pre-disposed Douglas-fir timber to bark beetle attack and restrictions on harvesting in highly susceptible Douglas-fir stands within old growth management areas and ungulate winter ranges. More active management of the Douglas-fir bark beetle needs to occur in the Quesnel Forest District to prevent and reduce losses of valuable timber and maintain other forest resource values.

References

Bark Beetle Management Guidebook. British Columbia Ministry of Forests and Range. 1995. URL: http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/beetle/betletoc.htm

Humphreys, N. 1995. Douglas-fir Beetle in British Columbia. Forest Pest Leaflet 14, Canadian Forest Service, Pacific Forestry Centre. ISBN 0-662-23498-7, Cat. No. Fo 29-6/14-1995E

Appendix 1. The number of Douglas-fir beetles collected from each trap during each week[5]

Trap Number	14/05/2014	22/05/2014	29/05/2014	05/06/2014	12/06/2014	19/06/2014	26/06/2014	03/07/2014	10/07/2014	17/07/2014	24/07/2014	31/07/2014	07/08/2014
01	535	**N/A**	3470	2893	2255	2894	2723	**N/A**	681	383	9	0	0
02	492	**N/A**	2042	6042	**N/A**	**N/A**	3319	**N/A**	1277	511	85	120	18
03	283	**N/A**	1020	3659	1574	3064	3064	2298	1021	936	170	75	13
04	655	**N/A**	1106	**N/A**	2255	**N/A**	1532	1532	426	213	82	90	0
05	**N/A**	**N/A**	230	4170	2000	**N/A**	**N/A**	**N/A**	511	340	70	105	6
06	225	**N/A**	395	3063	1234	2383	1702	2043	638	681	255	245	45
07	292	1361	500	4255	1319	2298	1447	1021	298	230	23	123	3
08	608	1872	760	**N/A**	1660	2809	1277	1362	1021	**N/A**	170	110	21
09	760	**N/A**	**65**	**N/A**	468	**N/A**	560	936	468	128	33	19	3
10	1008	**N/A**	105	1872	**N/A**	**N/A**	1787	2128	681	170	26	25	4
11	890	**N/A**	160	3744	**N/A**	4681	2213	1702	85	170	20	5	5
12	920	3320	510	325	1560	**N/A**	1872	**N/A**	340	85	4	15	2
13	490	**N/A**	505	**N/A**	1574	**N/A**	1021	1362	809	681	75	105	43
14	**N/A**	**N/A**	**55**	11659	**N/A**	**N/A**	**N/A**	851	596	85	14	8	9
15	180	**N/A**	245	4500	**N/A**	2723	1106	1106	511	851	122	12	28
16	228	**N/A**	240	2500	**N/A**	1021	1277	1106	468	213	45	35	0
17	101	**N/A**	185	1872	1319	1957	**N/A**	**N/A**	298	170	28	16	0
18	337	**N/A**	440	3063	1319	**N/A**	340	596	511	213	19	4	4
19	506	**N/A**	510	4000	1234	2298	1191	213	340	255	20	7	3
20	525	**N/A**	**N/A**	3063	3106	**N/A**	2298	2553	851	426	80	110	3
21	370	**N/A**	**150**	**N/A**	**N/A**	205	1702	1447	298	426	73	28	15
22	635	2382	625	3585	2766	3234	1957	1915	936	383	125	289	23
23	525	**N/A**	760	4510	**N/A**	**N/A**	2128	766	128	68	28	12	0
24	1910	**N/A**	595	8510	**N/A**	**N/A**	**N/A**	1277	340	170	23	38	56
25	2085	**N/A**	**120**	8680	6170	**N/A**	**N/A**	2553	1447	681	170	169	120
26	**N/A**	**N/A**	306	**N/A**	**N/A**	2213	511	681	255	426	340	145	3
27	265	**N/A**	**140**	5191	**N/A**	**N/A**	511	170	128	340	35	60	10
28	140	1531	240	3605	638	1702	851	255	85	34	0	34	2
29	430	**N/A**	695	3500	2340	**N/A**	150	170	43	0	0	0	0
30	565	4723	980	5200	2596	3404	2128	596	255	85	6	10	0
31	430	**N/A**	936	5617	3362	**N/A**	**N/A**	2638	1830	213	39	103	12
32	845	**N/A**	1020	4000	2255	**N/A**	**N/A**	1702	596	766	280	165	41
Total	**17235**	**15189**	**19110**	**113078**	**43007**	**36886**	**38667**	**34979**	**18170**	**10332**	**2469**	**2282**	**492**
Total damaged traps	3	27	6	6	11	17	7	5	0	1	0	0	0

[5] N/A means there is no data because the trap container was damaged by bear or weather.