

Williamson's Sapsucker Habitat Analysis For the East Kootenay: Field Data Collection

by

Les W. Gyug, R.P.Bio.
Okanagan Wildlife Consulting
3130 Ensign Way
Westbank, B.C. V4T 1T9

Prepared for

Environment Canada
Canadian Wildlife Service
5421 Robertson Road
Delta, B.C. V4K 3N2

June 24, 2009

TABLE OF CONTENTS

INTRODUCTION	3
METHODS	4
RESULTS	6
DISCUSSION	10
LITERATURE CITED	12
Appendix 1. Call/Drum Playback Point Results for Censused Sites in the East Kootenay, 2009.	13

List of Figures

Figure 1. Williamson's Sapsucker Moderate or High Suitability sites (based on Boundary TSA habitat model), >175 ha in size, and previously unsampled in the East Kootenay, 2009.	5
--	---

List of Tables

Table 1. Tree, snag and stump densities by size class in censused forested sites in the East Kootenay, 2009, contrasting sites where Williamson's Sapsucker (WISA) were found to sites where they were not found.	7
Table 2. Tree, snag and stump densities by size class within censused forested sites where Williamson's Sapsucker (WISA) were found (09, 11, 24) in the East Kootenay, 2009, contrasting plots where they were found to plots where they were not found.	7
Table 3. Density of suitable Williamson's Sapsucker nest trees in censused forested sites in the East Kootenay, 2009.	8

Acknowledgements

This project and report was completed under contract K2F51-09-4014 from Environment Canada. Kevin Fort acted as contract monitor, provided guidance, and was instrumental in setting up this project.

INTRODUCTION

Williamson's Sapsucker is a species of woodpecker that has been designated as Endangered by the Committee on the Status of Wildlife in Canada (COSEWIC 2005) primarily because of its low population numbers in Canada and the tendency to use old western larch stands as nesting habitat which are being altered by timber harvesting and private land clearing.

Field work characterizing breeding habitat at known nest sites has been underway from 2006-2008 supported by FIA through a number of forest licensees and Ministry of Environment, as well as Environment Canada. This has been complemented by field work at randomly chosen non-used sites within the Williamson's Sapsucker's Area of Occupancy (AO), supported by Environment Canada and several FIA sources in 2008. These habitat data and all Williamson's Sapsucker nest and occurrence records were used to develop a spatial habitat model for Williamson's Sapsucker in the Boundary Timber Supply Area in March, 2009 (Gyug 2009). This habitat modeling has yet to be completed for the Williamson's Sapsucker AO in the East Kootenay, Okanagan or Western regions. While the AO has yet to be completely defined for the East Kootenay, a provisional AO was defined in early 2009 based on existing occurrence data, and habitat preferences shown in the Boundary TSA western larch habitats. As of 2008, about 25% of the East Kootenay provisional AO had been sampled for Williamson's Sapsucker using call playbacks (Ohanjanian et al. 2009).

Preliminary analyses of the East Kootenay data showed that habitat use may differ between the East Kootenay and Okanagan-Boundary. In particular, a higher proportion of Williamson's Sapsucker nests in the East Kootenay (65%) were found in relatively open partial cuts (average of <125 trees/ha) than in the Okanagan-Boundary (22%), or even the Western region (27%). It was apparent that habitat selection was different in the East Kootenay than in the Okanagan-Boundary, even though tree species composition was very similar in the two areas. It was also clear that a habitat model developed for the forests of the Okanagan-Boundary was not likely going to apply to the East Kootenay. Forest stands in the two regions, even though they may have been assigned similar ages in Forest Cover mapping, may be quite different in stand structure and habitat quality for Williamson's Sapsucker.

This project was designed to:

1. Test whether Williamson's Sapsuckers occurred in previously un-sampled forests of the East Kootenay that would have been assigned a Moderate or High suitability rating using the Boundary TSA habitat model,
2. Determine the stand histories and structure of the sampled forested stands in the East Kootenay,
3. Provide stand structure data to correlate with mapped Forest Cover data for inclusion in later spatial modeling of Williamson's Sapsucker habitat suitability in the East Kootenay.

In 2008, a similar exercise was undertaken in previously unsampled forests in the Okanagan-Boundary (Gyug 2008a). However the intent of that project was to discover previously unknown nesting sites so that they could be protected within Wildlife Habitat Areas. In that project, previously un-sampled sites averaging 300 ha in size were identified where the

primary stand type was forests mapped as >170 years old (n = 6) or where there were relatively abundant veteran western larch trees that could be seen from a distance (n = 1). Williamson's Sapsucker were detected in 5 of the 7 sites censused, providing a baseline to compare to the East Kootenay sampling in 2009. However, no specific stand structure data were collected in these areas in the Okanagan-Boundary in 2008, although stand structure was available from forested sites from random plots (Gyug 2008b) or other nest plots which will be analyzed and compared to the East Kootenay data during later habitat modeling.

METHODS

Study sites were chosen within the provisional (April 2009) Williamson's Sapsucker AO in the East Kootenay. Moderate and High suitability forest polygons were identified using the same algorithm as for the Boundary TSA (Table 8 of Gyug 2009). Briefly, this identified sites where the dominant canopy layer was >120 years, and which contained a layer (dominant or veteran) >125 years, contained Fd and Lw, Cw was <10%, sum of Pl and Bl % was <30, and slope was <30%. From these sites, groups of polygons that were >175 ha in size, and had not been previously sampled for Williamson's Sapsucker were selected as potential study sites.

Of the 33 potential sites, sampling was limited to 10 study sites, or a total of 300 ha. Sample sites <175 ha were excluded (n = 16), sample sites outside the IDFdm2 were excluded (n = 4), one site that had been recently highly fragmented with small patch cuts was excluded, leaving 12 potential sampling sites. These sites were ordered randomly to determine which sites to sample. One site (#03) was found to have been logged the previous winter, so the next nearest potential study site (#24) was substituted, even though it had been partially sampled for Williamson's Sapsucker in 2008. One site sampled (#5) ended up being only 160 ha in size because a portion of the site had been very recently harvested as a seed tree cut. Only potential sample site (#13) was not sampled at all as its random number was higher than all other sampled sites.

Sampling was conducted from May 5-12, 2009. Each site was treated as a census area and sampled at the present – not detected level using call and drum playbacks (CPB) on a 400-m grid spacing and using the protocol outlined in FIA (2006). Grid points were shifted slightly prior to sampling so that almost every point was in a Moderate or High suitability polygon since tree count plots were conducted at each CPB point, and these were the polygons of interest. Locations of all CPB points are contained in Appendix 1. Additional CPBs were done about halfway between most CPB grid points to provide additional coverage. No follow-up nest searches were conducted so these were not considered to be census areas. CPB data was entered into the Excel template developed by the Wildlife Species Inventory section of B.C. Ministry of Environment specifically to record Williamson's Sapsucker inventory data.

At each CPB point that was not on a road, live trees were tallied to species and broad DBH class. Trees 8-17 cm DBH were tallied within 0.02-ha circular plots (7.98-m radius), trees in the 18-22, 23-37, and 38-57 cm DBH classes were tallied within 0.04-ha circular plots (11.28-m radius) and live trees, snags and stumps >57-cm DBH were tallied within a 0.25-ha circular plot (28.2-m radius).

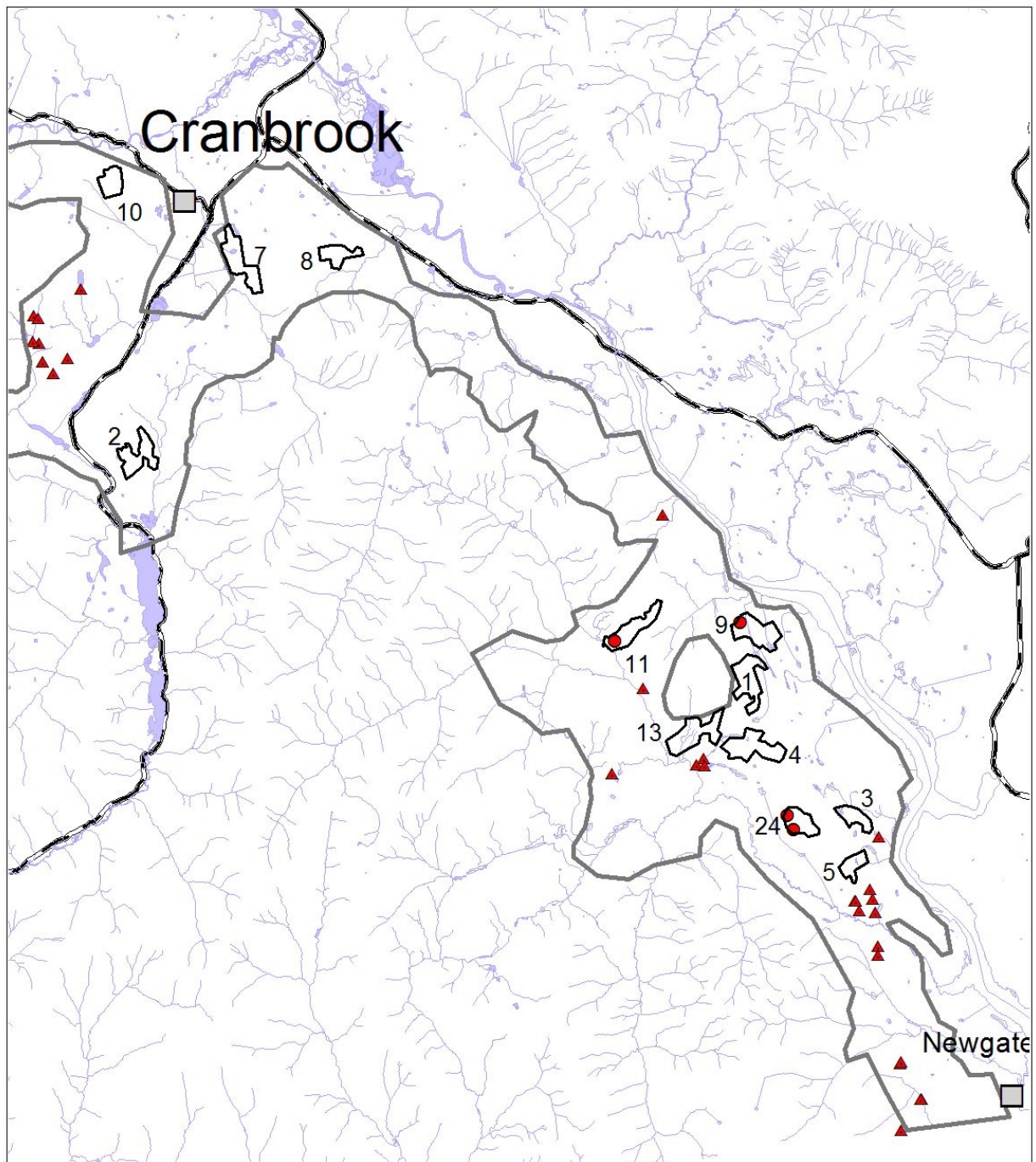


Figure 1. Williamson's Sapsucker Moderate or High Suitability sites (based on Boundary TSA habitat model), >175 ha in size, and previously un-sampled in the East Kootenay, 2009. The four Williamson's Sapsucker detections within sites are shown as red circles. Provisional Area of Occupancy shown in grey outline, and previously known nests as red triangles.

Suitable nest trees were tallied either in a 1-ha circular plot (56.4-m radius) or within linear plots on the routes travelled between CPB points. The linear plots included distances of 20 to 35 m from each side of the transect centreline depending on the visibility within the habitat. Suitable nest trees had been previously defined as trees containing both old and recent nest cavities of a size used by sapsuckers (3-5-cm diameter entrances). We also included trees or snags with Pileated Woodpecker nest/roost cavities in the East Kootenay.

Notes on the stand history and disturbance type were taken at each CPB point. This included whether the site had been logged or burned, the type or intensity of the logging or fire, and an estimate of the approximate time since the disturbance. In a few cases, tree rings were counted from stumps or live trees to assist in determining time since disturbance. These data will be used to assist application and interpretation of forest cover GIS data in relation to stand structure plot data during later habitat modelling.

Tree data was entered into an Excel file (WISA EK Habitat Plot Data 2009.xls) that has been submitted along with this report. Only simple summaries and analyses of these data are provided here since complete analyses will be undertaken when habitat modelling and mapping is done. Contrasts made here using Analysis of Variance (ANOVA) were for:

1. tree, snag and stump densities contrasted between sites where Williamson's Sapsucker were present, and were not detected, and
2. within the sites where Williamson's Sapsucker were present, tree, snag and stump densities were contrasted between plots where they were present, and were not detected.

RESULTS

A total of 176 CPB points (see Appendix 1) were conducted in 10 sites ranging in size from 160 to 413 ha, and covering a total of 3002 ha. Plots were completed at 157 of these points. Williamson's Sapsuckers were detected in only 3 of the 10 sites (Figure 1). No Williamson's Sapsuckers were detected on any of the 4 sites close to Cranbrook, while they were detected on 3 of the 6 sites further south (sites 9, 11 and 24).

There was no significant statistical difference in the proportion of sites where Williamson's Sapsucker occurred in the East Kootenay (3 of 10 sites), and in the Okanagan (5 of 7 sites) ($\chi^2_{(1 \text{ df})} = 2.84$, $p = 0.09$). However, given the relatively low sample sizes the test is of relatively low power (about 20%) given a specified Type I Error rate of 5% ($\alpha = 0.05$). This makes the probability of a Type II Error (accepting the null hypothesis when it is actually false) very high (about 80%). Therefore any comparison of presence-not detected rates in forested sites between regions should not be considered conclusive. Especially since stand structures at the sites in the Okanagan-Boundary appeared to differ from those in the East Kootenay, comparisons of stand structure between and within sites where Williamson's Sapsucker were present/not detected will likely be a more useful avenue of analysis that can be directly applied to habitat modelling.

Densities of live trees >22-cm DBH (Table 1) were generally very close to the upper limit (i.e. about 350 stems/ha (unpublished data)) of what would be considered typical of Williamson's Sapsucker nesting habitat. However, the only factor significantly differing between sites where Williamson's Sapsucker occurred and did not occur was the density of very large stumps (Table 1). Other factors that differed between sites were both related to this density of stumps. Within sites where they occurred, the only significantly different factor was the density of standing very large (veteran) live trees (Table 2).

Table 1. Tree, snag and stump densities by size class in censused forested sites >175 ha in size in the East Kootenay, 2009, contrasting sites where Williamson's Sapsucker (WISA) were found to sites where they were not detected.

Site Number	Plots (n)	D_LT_S ¹	D_LT	D_LT_VL	D_SN_VL	D_ST_VL	D_VL_UP	D_VL_UP_LW
Sites where WISA not present								
01	23	391	337	2.1	1.2	2.6	5.9	3.0
02	17	276	279	5.3	0.3	3.2	8.8	4.1
04	16	622	441	0.8	0.0	6.3	7.0	2.0
05	10	170	350	5.2	1.6	4.8	11.6	3.2
07	22	300	270	1.1	0.0	1.4	2.5	0.7
08	10	415	276	0.5	0.0	1.5	2.0	1.0
10	12	329	325	4.6	0.0	1.7	6.3	0.8
Mean		358	326	2.8	0.4	3.1	6.3	2.1
Sites where WISA present								
09	23	372	331	5.2	0.2	10.3	15.7	7.5
11	13	185	362	0.6	0.6	9.2	10.5	6.5
24	11	255	368	2.5	0.4	8.7	11.6	5.8
Mean		270	354	2.8	0.4	9.4	12.6	6.6
Column-wise ANOVA Statistics								
F _(1,8)		0.929	0.600	0.000	0.021	30.87	8.011	27.44
p		0.36	0.46	1.00	0.89	0.001	0.022	0.001

¹Data are presented as densities (per ha) using the following acronyms:

D_LT_S = Live Trees 8-17 cm DBH

D_LT = Density of Live Trees >17-cm DBH

D_LT_VL = Live Trees >57-cm DBH

D_SN_VL = Snags >57-cm DBH

D_ST_VL = Stumps >57-cm Diameter at Stump Height (DSH)

D_VL_UP = Sum of Live Trees, Snags and Stumps >57-cm DBH or DSH

D_VL_UP_LW = Western Larch live trees, snags and stumps >57-cm DBH or DSH

Table 2. Tree, snag and stump densities by size class within censused forested sites where Williamson's Sapsucker (WISA) were found (09, 11, 24) in the East Kootenay, 2009, contrasting plots where they were found to plots where they were not detected. Acronyms as in Table 1.

Plot Type	Plots (n)	D_LT_S	D_LT	D_LT_VL	D_SN_VL	D_ST_VL	D_VL_UP	D_VL_UP_LW
WISA not found	43	300	346	2.7	0.3	9.6	12.6	6.3
WISA found	4	213	379	10.0	1.0	10.0	21.0	12.0
ANOVA Statistics								
F _(1,45)		0.32	0.44	8.02	1.51	0.007	2.07	1.78
p		0.57	0.51	0.007	0.23	0.94	0.16	0.19

Table 3. Density of suitable Williamson's Sapsucker nest trees in censused forested sites in the East Kootenay, 2009. Means where present and where not detected were not significantly different ($F_{(1,8)} = 0.33$, $p = 0.58$).

Site Number	Area Sampled for Suitable Nest Trees (ha)	Suitable Nest Trees (n)	Suitable Nest Tree Density (/ha)
Sites where WISA not detected			
01	42.93	6	0.14
02	29.75	8	0.27
04	31.95	1	0.03
05	17.60	6	0.34
07	36.44	3	0.08
08	22.58	2	0.09
10	19.85	2	0.10
Mean			0.15
Sites where WISA present			
09	41.25	10	0.24
11	14.00	1	0.07
24	21.50	0	0.00
Mean			0.10

Densities of suitable nest trees within censused forested sites in the East Kootenay did not differ between sites where Williamson's Sapsucker were found or not found (Table 3). The mean densities of 0.1-0.15/ha (Table 1) were much lower than in high density habitat (mean of 0.8) in the Okanagan-Boundary, and lower even than low nest density habitat (mean of 0.2) (unpublished results).

Of the 157 plots completed, high-grading or clearcutting had taken place at 145 (92%) of the plots. Based on stand structure, and a few trees aged using a tree borer, or stumps cut within the past 2-5 years, most of the cutting took place between 1910 and 1940. Almost no healthy standing timber had been left standing. Only understory trees and cull trees (defective trees) appeared to have been left behind. Typical understory trees left behind appeared to have been <20-25 cm DBH. Cull trees were sometimes very large (>57-cm DBH) veterans, but were often smaller trees with fire scars or other defects as well.

Typical current stand structure at these sites intensively logged between 1910 and 1940 consisted of:

1. Highly variable densities of trees that had germinated and grown since logging, and that were mostly <25 cm DBH, and almost always <35-cm DBH (see Table 1 for average densities, but plot densities ranged from 0-1750/ha);
2. Healthy understory trees that had released since logging, and were anywhere from 25-60 cm DBH, and formed the current co-dominant layer;

3. Unhealthy trees that were understory or co-dominant trees (usually Lw) when first logged, and had not released well after logging. The sidebar photo is a typical example of an Lw of that class that had been recently cut down. It had been about 30-cm DBH and 60-80 years old when scarred and when heartrots had entered the tree. These trees were typically Lw, and most appeared to have been scarred by low or moderate intensity fires prior to the 1910-1940 logging. These scars were not always apparent on the outside bark, either having healed over, or being scarred only at the duff layer. Density of this layer was highly variable, but up to 200-300/ha at some sites (which would exclude logging damage as the likely source of disturbance). This layer was not present at all sites, and was only recognized as a distinct layer well into the sampling, so was not identified uniquely in most of the data. Most of the current Williamson's Sapsucker nesting in co-dominant Lw trees (either in the forest or in recent partial cuts) would be in trees of this layer. The few trees in this layer that were seen appeared to have much larger holes than typical for Williamson's Sapsucker, and I suspect that they are re-using older nest holes excavated in these trees by Black-backed, Hairy or American Three-toed Woodpeckers;



4. Veteran trees that had survived many fires, and were considered cull trees in 1910-1940, i.e., were unacceptable as timber. Many very large stumps from the 1910-1940 period had prior fire scars, so the presence of scars alone did not dictate that a tree would have been a cull tree, and I suspect that only trees fairly riddled with heart rots would not have been cut down.

The structure of these logged stands was not very well described by the application of a single age value. One typical understory Fd was 90 years old at breast height, and 16-cm DBH prior to release by clearcutting 95 years ago (1914). After release, the tree had grown to 45-cm DBH, and by 2009 was 185 years old at breast height. The projected age (as of 2007) given to this stand in the Forest Cover mapping was 185 years. Another Fd stump (recently cut in the past 2-3 years) was 97 years old at stump height, and 15-cm DSH prior to release by clearcutting 75 years ago (1934). After release, the tree had grown to 60-cm DBH, and by 2007 would have been 169 years old at breast height. The projected age (as of 2007) given to this stand in the Forest Cover mapping was 179 years. However, the time since major disturbance on these sites (removal of entire dominant layer, and release of suppressed understory trees) was only 75-95 years, and the sites would not be equivalent structurally to a site that would have generated since a stand-replacing disturbance 180-190 years ago.

Only 12 of 157 plots (8%) had not been logged. Three of these plots were about 70-100 years old, and had burned completely in stand-replacing fires before they had a chance to be logged in the 1910-1940 period. Two other of these plots were on rocky, sparsely treed (sites

dominated by veteran Fd that were probably of no interest for timber. Trees on these sites were fire-scarred indicating the density had been maintained by low intensity fires. The remainder of the sites (7 of 157, 4%) had mixed severity fire events in the past 100-200 years that had maintained some veteran Lw and/or Fd trees. Most of these sites appeared to have been of little interest for timber in the 1900-1940 period because the dominant canopy trees at the time appeared to have been either sparse or small, and the few veteran trees were mostly (67%) Lw with heart rots and little timber value. Of the stand structure variables examined, only densities of live trees >17-cm DBH, and of very large live trees >57-cm DBH differed significantly at $p = 0.05$ between the sites logged ($n = 145$) and unlogged ($n = 7$) in the 1910-1940 period. Densities of live trees were higher (338 vs 249/ha), and densities of very large live trees were lower (2.5 vs 9.7) on these logged sites.

DISCUSSION

The key determinant of Williamson's Sapsucker occurrence in forested stands in the East Kootenay appeared to be the type of original stand prior to logging in the 1910-1940 period, and particularly the amount of very large cull trees that were not felled during that period. At the site level, the biggest difference was the density of very large stumps. I do not think that these stumps themselves are key, although that would be possible if they were a major contributor to ant nest densities. We did not measure CWD at these sites, but generally CWD was found to be at relatively low levels, i.e. the sites were easy to walk through as most of the logs generated during the time of harvest (1910-1940) had rotted beyond the point of suitability for ants, and most had been incorporated into the duff layer. Rather, I suspect that sites that had generally relatively high densities of veteran Lw prior to original logging, also appeared more likely to have higher densities of cull trees after logging. Within sites, Williamson's Sapsucker appeared to key on densities of very large standing trees. These trees both provide some nesting opportunities, and were generally suitable for colonization by carpenter ants.

Similarly-aged stands (according to the forest cover layers) in the East Kootenay and in the Okanagan-Boundary appeared to be very dissimilar in stand structure because of the very different stand histories. Logging in the East Kootenay in the 1910-1940 period appeared to have been both very extensive, and very intensive, i.e. very little mature structure was left. Logging in the same period in the Okanagan-Boundary was much less extensive, and in areas that had been logged, there appeared to have been much more mature and old structure left behind. In the forested stands we examined in this small study, Williamson's Sapsucker appeared to key in on both general sites, and specific stands with higher levels of both Lw, and higher levels of residual mature and old structure. Interpretations of similar stand ages with different remnant stand structures in the two regions will have to be reflected in the habitat suitability mapping for Williamson's Sapsucker in the two regions.

Stand age is generally inversely correlated with density of trees, and neither is completely separable from the other. Therefore these stands recovering from "near clearcutting" 70-100 years ago, should not be treated as if they were really 125-195 years old, even if that is the actual age of the co-dominant layer. As far as Williamson's Sapsucker habitat needs are concerned, most of these stands are more similar to 70-100 year old stands recovering from clearcutting, where suitable nest tree density is very low, and CWD levels (i.e. ant nest habitat) appeared to be very low. The intensive and extensive logging from 1910-1940 was largely blamed for the apparent demise of Williamson's Sapsucker in the East Kootenay after

1940 (see Gyug et al. 2007). These stands recovering from that logging still appear to hold very few suitable habitat features for Williamson's Sapsucker excepting a very small proportion of the area that was not as intensively logged.

This data, and this preliminary analysis, will provide direction to final analyses that will be used to guide habitat suitability modelling for Williamson's Sapsucker in the East Kootenay. This study did not directly address why Williamson's Sapsucker should be found nesting more often in relatively open partial cuts in the East Kootenay than in the Okanagan-Boundary as it was not designed specifically to address that. Such a study would need to compare occurrence rates in different partially cut stands similar to the study undertaken here for forested sites. Such a study would likely be able to provide specific management or retention guidelines for partial cutting in the East Kootenay as Williamson's Sapsucker do not occur in every partial cut there, and (based on only cursory looks at occupied and unoccupied sites) appeared to be absent from extensive cuts where very little stand structure had been maintained. Such a study would only require very basic plot data at a similar level to this study. The partially cut sites that are unoccupied by Williamson's Sapsucker have already been determined by the extensive call/drum playback inventories from 2006-2008, so that additional sampling for presence-absence of Williamson's Sapsucker would not be required.

Two of the sites where we found Williamson's Sapsucker in the forest were adjacent to more recent partial cuts, and they were seen using those habitats as well. Given the current state of fragmentation in stands in the East Kootenay, it is also very difficult to separate how different habitats adjacent to each other may be providing different habitat needs. We do not yet have data on fine-scale habitat use by Williamson's Sapsucker in these types of stands, or mosaics of stands, and so cannot definitively state why one habitat should appear to be used in preference to another at this time.

However, I suspect that CWD (and therefore ant) levels are relatively low in the forests mapped as 125-190 years in the East Kootenay because the forests are relatively uniform in structure, and more similar to stands of 70-100 years age. In these younger stands, CWD from the previous stand has usually rotted away, and very little CWD has developed from self-thinning with the current stand. The existence of suitable nesting structures, while generally low, would not be altered when these forested stands are partially cut, so this is not likely to be a causative factor in use of partially cut stands rather than forested stands.

The basic result from this small study, i.e., that Williamson's Sapsucker associate on a stand level with relatively high densities of very large western larch, independently supports the results from the other studies using data from nests and random unoccupied points from 2006-2008 (unpublished results). A broader treatment of this dataset comparing it to the nest data set and unoccupied random data set in the East Kootenay, and all the different habitat types that those data sets encompass, would be undertaken as part of the habitat modelling, and the habitat model validation process.

LITERATURE CITED

- COSEWIC 2005. COSEWIC Status Report on Williamson's Sapsucker *Sphyrapicus thyroideus*. Prepared for the Committee on the Status of Endangered Wildlife in Canada, Environment Canada, Ottawa, ON.
- Forest Investment Account. 2006. Information Gathering and Management Component, Resource Inventories Activity Area, Wildlife and Wildlife Habitat Activities, specifically Williamson's Sapsucker Inventory, Stand-level Habitat Assessment and Nest Productivity Assessment Standards. Ministry of Forests and Range, Victoria, BC.
- Gyug, L.W. 2008a. Williamson's Sapsucker Wildlife Habitat Areas 2008. BC Conservation Foundation, Surrey, BC, and Ecosystems Branch, Ministry of Environment, Victoria, BC.
- Gyug, L.W. 2008b. Williamson's Sapsucker Critical Habitat Phase 1: Random Plot Occupancy in the West and Okanagan-Boundary. Environment Canada, Delta, BC.
- Gyug, L.W. 2009. Final species account for species-habitat model for Williamson's Sapsucker in the Boundary. Report prepared for BC Timber Sales, Nelson, BC.
- Ohanjanian, P., P. Davidson, S. Hansen, and J. Beare. 2009. The Williamson's Sapsucker in the East Kootenay Region of British Columbia: Results of 2008 Inventory. Tembec, Cranbrook, BC, Galloway Lumber Co. Ltd., BC Timber Sales, Nelson, BC.

Appendix 1. Call/Drum Playback Point Results for Censused Sites in the East Kootenay, 2009.
Note that WISA ID numbers are temporary until final unduplicated numbers can be assigned.

Site Number	Date	Plot Number	Zone	Easting	Northing	WISA ID	WISA Easting	WISA Northing	Comments
01	9-May-2009	01P01	11	619951	5456256				
01	9-May-2009	01P02	11	619900	5455860				
01	9-May-2009	01P04	11	619797	5455066				
01	10-May-2009	01P05	11	619708	5457498				
01	9-May-2009	01P06	11	619503	5455910				
01	10-May-2009	01P07	11	619657	5457101				
01	9-May-2009	01P08	11	619464	5455057				
01	10-May-2009	01P09	11	618851	5457513				
01	10-May-2009	01P10	11	618768	5457238				
01	9-May-2009	01P11	11	618836	5455961				
01	10-May-2009	01P12	11	619759	5457895				
01	10-May-2009	01P13	11	618896	5456839				
01	9-May-2009	01P14	11	619361	5454809				
01	9-May-2009	01P15	11	619159	5456359				
01	9-May-2009	01P16	11	618660	5455616				
01	9-May-2009	01P17	11	619154	5455930				
01	10-May-2009	01F18	11	620173	5457857				
01	10-May-2009	01P19	11	619312	5457550				
01	10-May-2009	01P21	11	619324	5457130				
01	9-May-2009	01P22	11	619554	5456307				
01	9-May-2009	01P23	11	619849	5455463				
01	9-May-2009	01P24	11	619606	5456704				
01	10-May-2009	01P25	11	620501	5457396				
02	6-May-2009	02P01	11	585509	5475118				
02	6-May-2009	02P03	11	584413	5474416				
02	6-May-2009	02P04	11	584200	5474847				
02	6-May-2009	02P05	11	584527	5474923				
02	6-May-2009	02P07	11	585488	5474705				
02	6-May-2009	02P08	11	584647	5475193				
02	6-May-2009	02P09	11	585957	5474147				
02	6-May-2009	02F10	11	584497	5473513				
02	6-May-2009	02P11	11	584494	5474002				
02	6-May-2009	02P12	11	585542	5475884				
02	6-May-2009	02F13	11	585674	5475593				
02	6-May-2009	02P14	11	584839	5473554				
02	6-May-2009	02P15	11	584941	5474348				
02	6-May-2009	02P16	11	584890	5473951				
02	6-May-2009	02P17	11	585338	5474296				
02	6-May-2009	02P18	11	585223	5473872				
02	6-May-2009	02P19	11	585887	5475436				
02	6-May-2009	02P20	11	586079	5473797				
02	6-May-2009	02P21	11	585994	5474587				
04	8-May-2009	04P01	11	617888	5452328				
04	8-May-2009	04P02	11	618285	5452200				
04	8-May-2009	04P03	11	619979	5452391				
04	8-May-2009	04P04	11	618681	5452149				
04	8-May-2009	04P05	11	619870	5451996				

Site Number	Date	Plot Number	Zone	Easting	Northing	WISA ID	WISA Easting	WISA Northing	Comments
04	8-May-2009	04P06	11	620266	5451944				
04	8-May-2009	04P07	11	620663	5451893				
04	8-May-2009	04P08	11	620714	5452290				
04	8-May-2009	04F10	11	618057	5453057				
04	8-May-2009	04F11A	11	617574	5453042				
04	8-May-2009	04F13	11	618698	5453361				
04	8-May-2009	04F13A	11	619111	5453426				
04	8-May-2009	04F14	11	619339	5453310				
04	8-May-2009	04F16	11	617991	5452703				
04	8-May-2009	04F18	11	618381	5453083				
04	8-May-2009	04P19	11	619628	5453238				
04	8-May-2009	04P20	11	618337	5452597				
04	8-May-2009	04F22	11	618764	5452957				
04	8-May-2009	04P25	11	618733	5452546				
04	8-May-2009	04F26	11	619176	5452885				
04	8-May-2009	04F28	11	619594	5452902				
04	8-May-2009	04P29	11	619186	5452493				
04	8-May-2009	04P30	11	619525	5452444				
04	8-May-2009	04F31	11	620091	5452935				
04	8-May-2009	04P31	11	619932	5452749				
04	8-May-2009	04P32	11	620318	5452341				
05	8-May-2009	05P01	11	624929	5445079				
05	8-May-2009	05P02	11	624478	5445309				
05	8-May-2009	05P03	11	624206	5444072				
05	8-May-2009	05P04	11	624635	5444954				
05	8-May-2009	05P05	11	624147	5444841				
05	8-May-2009	05P06	11	623804	5444936				
05	8-May-2009	05P09	11	623695	5444498				
05	8-May-2009	05P10	11	624099	5444510				
05	8-May-2009	05P11	11	623937	5445169				
05	8-May-2009	05P12	11	624850	5445411				
07	7-May-2009	07P01	11	592472	5486088				
07	5-May-2009	07P02	11	593406	5483951				
07	5-May-2009	07P03	11	593009	5484002				
07	5-May-2009	07P04	11	593457	5484347				
07	5-May-2009	07P05	11	593061	5484399				
07	5-May-2009	07P07	11	593508	5484744				
07	7-May-2009	07P08	11	592523	5486485				
07	7-May-2009	07P09	11	592319	5484898				
07	7-May-2009	07P10	11	592076	5486139				
07	7-May-2009	07P11	11	591974	5485346				
07	7-May-2009	07P12	11	592229	5487330				
07	7-May-2009	07P13	11	592025	5485743				
07	7-May-2009	07P14	11	592178	5486933				
07	5-May-2009	07P15	11	592715	5484847				
07	5-May-2009	07P16	11	593355	5483554				
07	7-May-2009	07P17	11	592421	5485691				
07	7-May-2009	07P18	11	592370	5485295				
07	7-May-2009	07P19	11	592869	5486037				
07	5-May-2009	07P20	11	593112	5484795				
07	5-May-2009	07P21	11	592766	5485243				

Site Number	Date	Plot Number	Zone	Easting	Northing	WISA ID	WISA Easting	WISA Northing	Comments
07	7-May-2009	07P22	11	592127	5486536				
07	7-May-2009	07F23	11	592792	5485646				
08	5-May-2009	08P02	11	599194	5484623				
08	5-May-2009	08P03	11	598798	5484674				
08	5-May-2009	08P04	11	598453	5485122				
08	5-May-2009	08P05	11	598401	5484725				
08	5-May-2009	08P06	11	598056	5485173				
08	5-May-2009	08P07	11	598849	5485071				
08	5-May-2009	08P08	11	599642	5484969				
08	5-May-2009	08P09	11	597660	5485225				
08	5-May-2009	08P10	11	598350	5484329				
08	5-May-2009	08P11	11	597609	5484828				
08	5-May-2009	08P13	11	598005	5484777				
09	12-May-2009	09P01	11	620817	5459421				
09	10-May-2009	09P02	11	621213	5459370				
09	10-May-2009	09P03	11	621312	5459024				
09	10-May-2009	09P04	11	621264	5459767				
09	12-May-2009	09P05	11	620765	5459024				
09	11-May-2009	09P06	11	620472	5459869				
09	12-May-2009	09P07	11	620413	5459382				
09	12-May-2009	09P08	11	620369	5459075				
09	12-May-2009	09P09	11	619180	5459230				
09	12-May-2009	09P10	11	620915	5458241				
09	12-May-2009	09P11	11	619283	5460024	W12	619451	5460076	Male came from partial cut, but then stayed in forest patch, another one possibly called from northwest
09	12-May-2009	09P12	11	620318	5458679				
09	11-May-2009	09P13	11	619730	5460369				
09	12-May-2009	09P14	11	619034	5459818				
09	12-May-2009	09P15	11	619679	5459972				
09	12-May-2009	09P16	11	619367	5459644				
09	11-May-2009	09P17	11	620041	5460329				
09	12-May-2009	09P18	11	619576	5459178				
09	12-May-2009	09P19	11	620714	5458628				
09	11-May-2009	09P20	11	620075	5459921				
09	12-May-2009	09P21	11	620024	5459524				
09	12-May-2009	09P22	11	619973	5459127				
09	12-May-2009	09P23	11	621111	5458577				
09	10-May-2009	09P24	11	621634	5458903				
10	6-May-2009	10P01	11	586165	5490918				
10	6-May-2009	10P02	11	585321	5490624				
10	6-May-2009	10P03	11	585718	5490572				
10	6-May-2009	10P05	11	586114	5490521				
10	6-May-2009	10P06	11	585270	5490227				
10	6-May-2009	10P07	11	585666	5490176				
10	6-May-2009	10P09	11	585372	5491020				
10	6-May-2009	10P10	11	584976	5491072				
10	6-May-2009	10P12	11	586216	5491315				
10	6-May-2009	10P13	11	585820	5491366				
10	6-May-2009	10P14	11	585423	5491417				
10	6-May-2009	10P16	11	585871	5491763				

Site Number	Date	Plot Number	Zone	Easting	Northing	WISA ID	WISA Easting	WISA Northing	Comments
11	10-May-2009	11F01	11	612922	5460355				
11	10-May-2009	11F02	11	613795	5460608				
11	10-May-2009	11F04	11	614206	5460662				
11	10-May-2009	11F05	11	613281	5460357				
11	10-May-2009	11F07	11	614319	5461099				
11	10-May-2009	11F11	11	614640	5461466				
11	10-May-2009	11F11A	11	614936	5461644				
11	10-May-2009	11F11B	11	614908	5461801				
11	10-May-2009	11F17	11	612747	5460769				
11	10-May-2009	11F18	11	611630	5459885	W09	611637	5460010	Male
11	10-May-2009	11F21	11	612693	5460514				
11	10-May-2009	11F22	11	612105	5459719				
11	10-May-2009	11F24	11	613307	5460841				
11	10-May-2009	11F25	11	612063	5460026				
11	10-May-2009	11F26	11	612483	5459473				
11	10-May-2009	11F26A	11	612781	5459288				
11	10-May-2009	11F27	11	612469	5460169				
11	10-May-2009	11F29	11	611252	5460080				
24	9-May-2009	24P01	11	622092	5447593				
24	9-May-2009	24P02	11	621747	5448042				
24	9-May-2009	24F03	11	622387	5447151				
24	9-May-2009	24P04	11	621695	5447645				
24	9-May-2009	24P05	11	621644	5447248				
24	9-May-2009	24P06	11	621351	5448093				
24	9-May-2009	24P09	11	621402	5448490				
24	9-May-2009	24P10	11	621248	5447299				
24	9-May-2009	24P11	11	620852	5447350	W01	620775	5447355	Pair present on site
24	9-May-2009	24P13	11	621006	5448542	W03	620966	5448555	Not sure if same bird as male of W01
24	9-May-2009	24P15	11	622041	5447196				