Williamson's Sapsucker Boundary and East Kootenay Occupancy Monitoring, 2019

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ABSTRACT

Field data collection for effectiveness monitoring for the Endangered Williamson's Sapsucker (WISA) began in 2017. This report continues the occupancy portion of that monitoring for the Boundary and East Kootenay regions of BC for 2019. Including the results from 2018, occupancy in Boundary WHAs (n = 18) was 67% in April declining to 44% in June. Occupancy in East Kootenay WHAs (n = 35) was 33% in April, declining to 27% in June. Occupancy for unharvested control sites in the Boundary (n = 18) was 22% in April and 17% in June. In harvested areas where nesting was not previously known, where residual tree (≥17.5 cm dbh) densities in the harvested areas (n = 6) were >100 trees/ha WISA breeding occupancy in both April and June (67% and 50%) was much higher than where residual tree densities were <100 trees/ha (n = 19; 21% and 5%). In general, most harvested blocks do not seem to be meeting tree density guidelines of the BMPs, i.e., tree densities were far below 100 trees/ha, and consequently generally unsuitable for WISA. Nest tree survival was tabulated, but will be revisited when the Merritt region monitoring results are available later in 2019.

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INTRODUCTION

Williamson's Sapsucker (WISA) has been designated as Endangered in Canada (COSEWIC 2005, 2017), and is listed under Schedule 1 of the Species at Risk Act. Effectiveness monitoring protocols (Gyug 2016) were prepared to estimate the conservation effectiveness of Wildlife Habitat Areas (WHAs) and the Best Management Practices for timber harvesting in the Williamson's Sapsucker Area of Occupancy (AO). After choice of study sites, Level 1 monitoring determines if Williamson's Sapsucker are present at sites early in the breeding season, and if Level 2 monitoring is done, whether they are successfully breeding at these sites. Plots describing the habitat, or at least estimating tree densities, may or may not be done.

Study sites for the initial study year 2018 were chosen in early 2017 by Ministry of Forests, Land, Natural Resource Operations and Rural Development (FLNRORD). In 2017, only habitat plots were completed by FLNRORD. In 2018, Level 1 and Level 2 monitoring was completed in the Boundary and East Kootenay AO sites, as well as at extra sites added as forested controls on harvested sites. Additional sites were selected to add to the study for survey in 2019 for this ongoing multi-year project.

The purpose of this report was to:

1. report Level 1 and Level 2 WISA monitoring in the Boundary and East Kootenay AOs in WHAs, in sites harvested after 2014, and in control sites;
2. summarize and interpret these results in combination with the 2018 sites; and
3. conduct a preliminary assessment of the effectiveness of the BMPs (BC FLNRORD 2014a, 2014b) based primarily on observed WISA breeding occupancy in harvested blocks.

METHODS

Study Sites

The initial round of study sites were chosen in 2017 by FLNRORD in the Boundary and East Kootenay portions of the Williamson's Sapsucker AO (Gyug 2018). In the Boundary region, additional study sites were added in early 2018 to provide unharvested controls for harvested sites. These controls forests were nearby the harvested sites and were of similar habitat suitability for WISA.

In 2019, additional WHAs were chosen for sampling. In the East Kootenay this included all WHAs, which were sampled while doing the annual WISA monitoring there, funded by the Canadian Wildlife Service. In Boundary, nine WHAs were chosen for survey to add to the nine sampled in 2018. There are 19 remaining WHAs to be sampled in Boundary in future years. In Boundary, 12 cutblocks for which the cutting permits were issued after 2014,

and to which the 2014 BMPs would presumably apply, were selected for sampling. Twelve unharvested controls were selected near to each cutblock, in each case with similar WISA suitability before the cutblocks had been harvested.

Occupancy Field Methods

The study sites in the Boundary were sampled for Level 1 occupancy on five days from April 15-26, 2019, and for Level 2 occupancy on three days from June 10-16, 2019 (Figure 1). The winter of 2018-2019 was a low snowpack year with relatively quick snow melt, so only a few sites needed to be accessed on snowshoes in 2019, compared to almost all of the sites in 2018. Almost all sites required snowmachine access in 2018, but snowmachine access was not possible in 2019 as snowmelt had proceeded far more quickly than in 2018. However, some roads still had deep snow patches that prevented driving to every site.

The study sites in the East Kootenay were sampled for Level 1 occupancy from April 23-26, 2019, at the same time as annual WISA monitoring (Gyug 2019), and for Level 2 occupancy from June 23-25, 2019 (Figure 2). The winter of 2018-2019 was a low snowpack year with relatively quick snow melt, so snowshoes were not needed to access any sites in 2019, and all drivable roads were snow-free and dry and could be driven. In 2018, snowshoes were need to access many sites in the East Kootenay in late April, and many roads were not yet snow-free and drivable.

Methods have been described in Gyug (2016) and were slightly modified by Gyug (2018) in the first-year report of this particular project. These are summarized very briefly below.

Occupancy Level 1: WISA Presence during territory establishment phase (April to early May).

1. Visit the site any time from approximately April 1 to May 7.
2. Begin assessment at any previously known nests, should there be any.
3. If no WISA are detected there, use at least 5 CPB over 30 minutes moving around entire site and listening for responses. If sites are larger than 16 ha, this may take longer than 30 minutes.
4. The assessment can be terminated if any WISA are found.

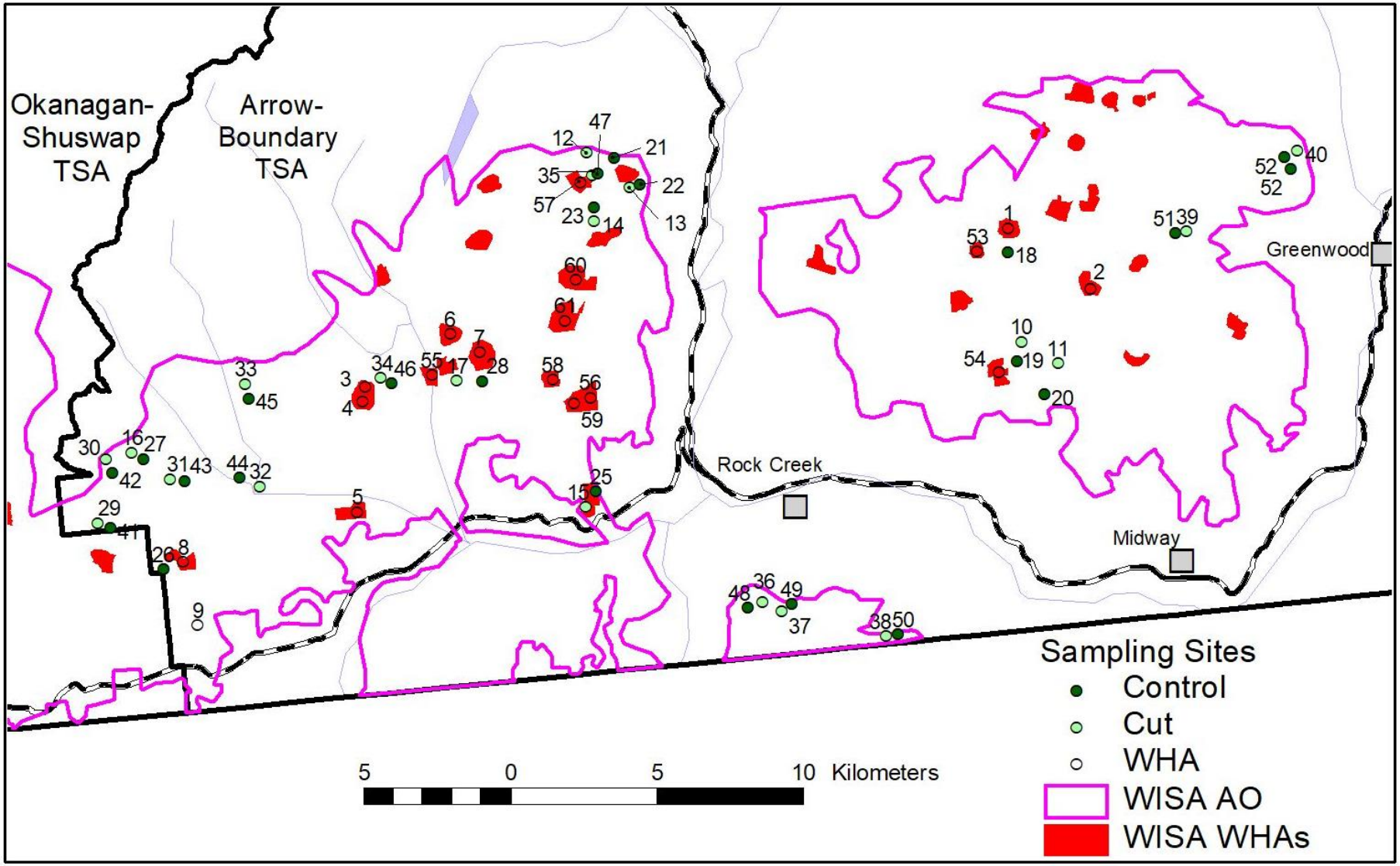

Figure 1. Overview map of 2018-2019 WHA and other WISA occupancy sampling sites in the Boundary region. Sampling sites numbered as in Appendix 1.

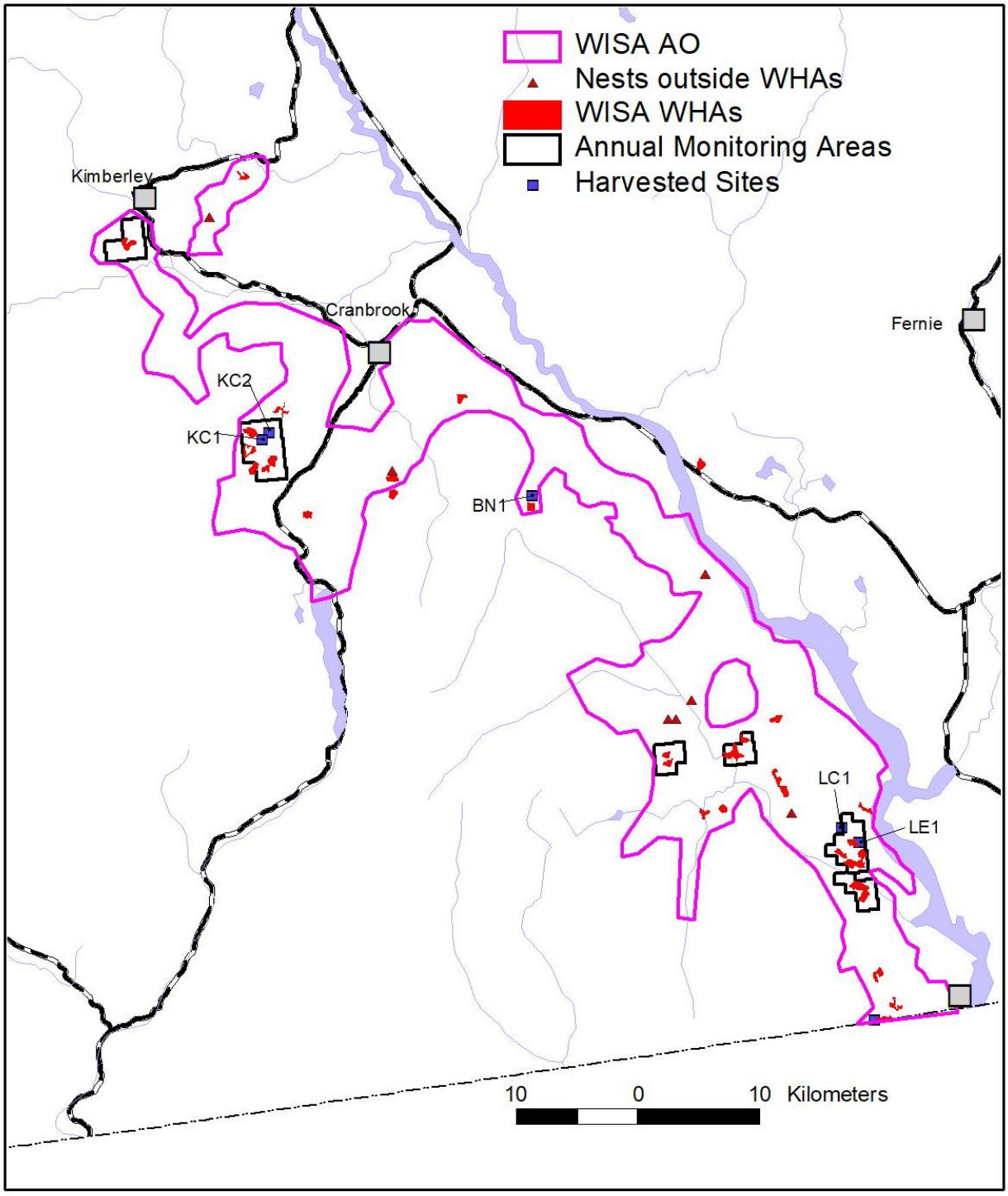

Figure 2. Overview map of 2018-2019 WHA and other WISA occupancy sampling sites in the East Kootenay region. All WHAs were checked in 2019. Harvested sample sites numbered as in Appendix 2.

Occupancy Level 2: Breeding Confirmation during nesting phase.

1. If no WISA were present on a prior Level 1 visit, then WISA will almost certainly not be present later in the breeding season. In that case, Level 2 surveys need not be conducted as WISA will be assumed absent.
2. Visit site approximately May 15 to June 25 although exact timing will depend on breeding conditions in any given year although mid-June is the most reliable time to confirm nesting.
3. Breeding confirmation will require:
    a. Visits of any old nests, and
    b. Up to 30 minutes on site of 16 ha including a series of CPB throughout the site, approaching most areas of the site to within at least 200 m, or until a response is detected.
    c. Sites larger than 16 ha may take considerably longer to survey properly for nesting activity.
4. Summarize breeding activity observed using the Breeding Bird Atlas breeding evidence codes (see Appendix 4).

Call playback equipment used included FoxPro electronic game caller units through large external FoxPro speakers with front bell dimensions of 25-cm x 17-cm or 21-cm diameter. When walking through the site with the intention of covering every area of the site to within at least 200 m, sometimes only a pocket call playback unit (FoxPro NX4 or equivalent) with a 14-cm diameter speaker was used.

In addition to the methods described above, whenever a nest tree from previous years was checked for current occupancy, the current status of the nest tree itself was recorded.

Each formal CPB point sample consisted of three broadcasts of a 10-15 second Williamson's Sapsucker drum and call combination repeated three times in three directions, and then a silent listening period of 3 minutes, for a total listening time of 4 minutes and 20 seconds. At least one formal CPB point was done during the initial survey at a site. We recorded location of each such point. For each WISA detection we recorded the time (seconds) of the initial response from the beginning of the CPB. We recorded the sex (male, female, unknown or pair), the number and the type of responses (visual, drum and/or call), the estimated distance (m) and direction (degrees from a compass reading) to each WISA. Both male and female WISA drum, so the type of response cannot be used to identify sex. While walking within a site where we were doing CPBs, we did not necessarily do the full CPB protocol because WISA would be heard while walking away from a site, or even at the next CPB point. In those cases, we recorded the GPS track showing the route taken, and for each

WISA detection we recorded WISA location by estimating distance and bearing from observer location, or by extrapolating WISA location directly on GPS unit using the cursor.

When returning to a site for the Level 2 occupancy check the methods were slightly different. The previous WISA detection label or previous nest label was used as the Design Component (i.e., the site), with a search undertaken to determine if WISA could be re-found at that site. CPB are assumed to be used, but these were not recorded as individual CPBs. The nest or site was searched until nesting was confirmed, or until the site had been covered well enough to confirm that there was no nesting. If no WISA were found on this revisit, the result was recorded as NULL. Location, sex, and type of observation were recorded for any WISA detections. The breeding evidence observed was recorded using the Breeding Bird Atlas breeding activity code (Appendix 4) along with any other observations, such as the location and nesting tree data for any newly-discovered nests. When an active nest was confirmed, other nearby WISA detections of the same pair were not usually recorded.

Field data was entered into a single WISA Excel file template designed in 2007 in consultation with the Wildlife Species Inventory (WSI) for submission to the WSI Species Inventory (SPI) system of the BC Ministry of Environment. Formal CPBs from the Level 1 (April-early May) surveys or later surveys were entered into the "CPB-DataEntry" sheet. Follow-up visits to WISA detections and old nests to check for continued occupancy or re-occupancy were usually entered into the "NestSearch_Visits-DigiDataEntry" sheet. There was a separate sheet for incidental detections of WISA or other species. This file was quality checked for formatting and for data entry errors, and submitted to SPI at the end of the field season along with WISA data from other projects..

Habitat Plots

Habitat plot data collection methods were described in Gyug (2018). In 2019, only reconnaissance-level tree plots were done in harvested cutblocks and some control forests at the same time as CPB surveys. Circular tree (>17.5-cm dbh) tally plots were placed at pre-planned CPB points, or at points placed during the surveys that appeared to typify the post-harvest conditions. Plot radii were generally very large, i.e., anywhere from 17.84 m (0.1-ha plot) to 56.42 m (1-ha plot) depending on tree density and sight lines. It was hoped that the large size of the plots would tend to minimize any bias resulting from irregular plot placement, i.e., there was no pre-determined sampling plan. The tree tallies were used to estimate the merchantable tree density remaining after timber harvest.

RESULTS and DISCUSSION

In the Boundary, April (Level 1) occupancy of WHAs in 2018-19 was 67% but only 44% by June (Level 2) (Table 1). Occupancy of WHAs was lower in the East Kootenay at 33% in April and 27% in June. There were too few harvested sites examined (n = 1) where WISA nesting was known before harvesting to conduct any analyses. Occupancy levels of harvested and control sites where previous WISA nesting was unknown, i.e., no surveys had been done, were very similar, at 28-33% for harvested blocks, and 22% for unharvested controls. However, the reduction in occupancy rates, i.e., the breeding territory failure and/or abandonment rate, was highest for harvested sites (48-61% of territories occupied in April were empty in June, Table 1), about half that rate for WHAs (32-34%) and even lower for unharvested forests (23%).

Merchantable tree densities in WHA and mature forest control sites (n = 19) averaged 258 trees/ha, within a range of 150 to 370 trees/ha. Many of these sites had undergone some timber harvest over the past century, whether very old heavy harvest (often >80 years ago) or more recent (i.e., from 1940s to 1970s) partial cuts or high-grading. Tree densities, where available, have been given in the appendices.

I separated cutblocks into harvested areas with >100 trees/ha (n = 6), and those with <100 trees/ha (n = 19). In the harvested areas with >100 trees/ha, average tree density was 166/ha (n = 5), within a range of 131-223 trees/ha. In the harvested areas with <100 trees/ha, average tree density was 37 trees/ha, within a range of 4-78 trees/ha. This only considered merchantable trees, i.e., trees >17.5-cm dbh.

WISA occupied cutblocks with higher leave-tree densities more often than cutblocks with lower tree densities. In April, WISA occupied four (67%) of the six cutblocks with >100 trees/ha and still WISA occupied three (50%) of the six cutblocks with >100 trees/ha by June. In April, WISA were found within four (21%) of the 19 cutblocks with <100 trees/ha within the harvested area but by June, WISA occupied only one (5%) of these 19 cutblocks. The WISA occupying that single low leave-tree density cutblock nested only 3 m from the cutblock boundary. While that pair were observed foraging within the cutblock, the immediate area around the nest had 36 veteran Western Larch retained per ha near the nest, which was very dissimilar to the remainder of the block (averaged 4 leave trees/ha). Clearly, harvested areas with leave tree densities >100 trees/ha were far more often associated with WISA breeding occupancy than when fewer than 100 trees/ha were retained.

Table 1. Williamson's Sapsucker occupancy summary, Boundary and East Kootenay, 2018-2019. See Appendices for detailed information on each site.

Type of Site	Occupancy Level 1 (April to early May)			Occupancy Level 2 (late-May to June)					% Reduction in Occupancy Level 1 to 2
	Total Sites (n)	Occupied Sites (n)	Occupancy Rate (%)	Total Sites (n)	Prob. and Conf. Nesting		Poss., Prob. and Conf. Nesting		
					Sites (n)	Rate (%)	Sites (n)	Rate (%)	
WHAs									
Boundary (17 of 38 WHAs)	[1]18	12	67	18	5	28	8	44	34
East Kootenay (All WHAs)	35	[2]11.5	33	35	3	9	9.5	27	32
Other Sites									
Prior Nests Known									
Harvested									
Boundary	1	1	100	1	1	100	1	100	-
Unharvested Controls									
Boundary	3	3	100	3	1	33	2	67	-
Prior Nesting Not Known									
Harvested									
Boundary	18	5	28	18	1	6	2	11	61
East Kootenay	6	2	33	6	1	17	1	17	48
Total	24	7	29	24	2	8	3	13	55
Unharvested Controls									
Boundary	18	4	22	18	2	11	3	17	23

[1] Lehman Springs conservation area was included in the WHA category.

[2] WHA 4-136 was surveyed in both years. It was unoccupied in 2018 but occupied in 2019, so was given half-weight for each year.

Table 2. Current suitability of previously known nest trees checked in 2018/19.

Region	Nest Tree Species[1]	Number Checked 2018/19	Number Remaining Suitable	% Remaining Suitable	Comments
Boundary	Lw	20	16	80	3 of the 4 unsuitable were nests discovered in 1996-97
	At	5	2	40	
	Py	1	0	0	
East Kootenay	Lw	36	33	92	
	At	7	6	86	
	Fd	4	2	50	
Total	Lw found from 2000 onwards	53	49	92	
	At	12	8	67	
	Fd/Py	5	2	40	

[1] Lw = Western Larch, At = Trembling Aspen, Fd = Douglas-fir; Py = Ponderosa Pine

I did not examine the cutting permits for the cutblocks examined, so it was not clear which ones were attempting to apply the WISA BMPs. Some of them were primarily Very Low habitat, which would not have been mapped as WISA Critical Habitat, so the BMPs may not have applied. At any rate, very few, i.e., 21% (5 of 24), appeared to actually meet the BMP tree retention guidelines of 100 trees retained per ha within the harvested area. Some may meet that level when the Wildlife Tree Patches area included in the overall block average, but we did not have the cutblock maps to be able to estimate tree densities in the WTPs or other reserve areas. A more complete assessment would include those estimates. However, some of the blocks did not even meet the minimum of 20 trees/ha on every hectare, as 6 of the 24 (25%) had 15 or fewer trees/ha on the majority of the harvested areas.

Most Western Larch nest trees remained suitable for nesting (Table 2). Significant exceptions were the three discovered in Boundary in the 1996-97 and checked in 2018/19, none of which remained standing and suitable for nesting (although there are other nest trees from the same years that have remained suitable). In the Boundary, only 40% of Trembling Aspen nest trees remained suitable, while the rate was higher in the East Kootenay at 86%. WISA tend to use Ponderosa Pine and Douglas-fir for nesting when the trees are already dead, so survival of nest trees was relatively low, but sample size was also fairly small. Nest tree survival will be re-visited and re-totaled when the Merritt area results are available later this year, and again in future years, particularly for the Boundary as more old nest sites get re-checked.

RECOMMENDATIONS

1. Integrate the results detailed in this report with the concurrent WISA occupancy surveys being undertaken in Region 3 (Merritt area) when the report for that project is written, and re-assess trends for occupancy and nest tree survival.
2. Continue effectiveness monitoring in the Boundary and East Kootenay by:
    a. Continuing to sample from the remainder of the WHAs (n = 21) in Boundary in 2020.
    b. Continuing annually to select potential sample sites from cutblocks approved after the publication of the WISA BMPs, and/or resampling some of the cutblocks that have already been sampled as WISA could colonize these later, and
    c. Examining the Cutting Permits of as many of these blocks as possible to determine if the WISA BMPs were considered in the Cutting Permits, and whether the actual harvest met the BMPs for tree densities in particular through a rigorous and reliable sampling plan and tree tally plots. Budget restrictions did not allow time for any of the Cutting Permits to be assessed in 2018 or 2019, so this would apply to all any new cutblocks as well as those already sampled in 2018/19.

LITERATURE CITED

B.C. Ministry of Forests, Lands and Natural Resource Operations. 2014a. Best management practices for timber harvesting, roads, and silviculture for Williamson's Sapsucker in British Columbia: East Kootenay Area of Occupancy. B.C. Ministry of Forests, Lands and Natural Resource Operations, Nelson, BC. 15 pp.

B.C. Ministry of Forests, Lands and Natural Resource Operations. 2014b. Best management practices for timber harvesting, roads, and silviculture for Williamson's Sapsucker in British Columbia: Okanagan-Boundary Area of Occupancy. B.C. Ministry of Forests, Lands and Natural Resource Operations, Nelson, BC. 15 pp.

COSEWIC. 2005. COSEWIC assessment and status report on the Williamson's Sapsucker, *Sphyrapicus thyroideus,* in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, Ontario, Canada. 45 p.

COSEWIC. 2017. COSEWIC assessment and status report on the Williamson's Sapsucker, *Sphyrapicus thyroideus,* in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa. xii + 53 pp.

Gyug, L.W. 2016. Draft Williamson's Sapsucker WHA and BMP effectiveness protocols. Report prepared for Thompson-Okanagan Region, Ministry of Forest, Lands and Natural Resource Operations, Kamloops, B.C.

Gyug, L.W. 2018. Williamson's Sapsucker Occupancy Monitoring, 2017-2018. Report prepared for Thompson-Okanagan Region, Ministry of Forest, Lands and Natural Resource Operations, Nelson, B.C.

Gyug, L.W. 2019. Williamson's Sapsucker relative abundance monitoring, East Kootenay 2019. Report prepared for Environment and Climate Change Canada – Canadian Wildlife Service, Delta, BC.

APPENDICES

Appendix 1. Boundary sites and WISA occupancy, 2018-2019. Sites 1-28 were sampled in 2018; sites 29-61 in 2019.

Site No.	Name	Site History	Comments	Tree Density	WISA nests Prior	N WISA found April	BBC June	WISA Occupancy in June
WHAs								
2	8-221	Forest		320	1	2	V	Old nest tree in WHA has fallen; Male found on new territory 100-200 m West of WHA; another WISA found in lightly partially harvested area about 100 m SE of WHA
3	8-379	Forest		240	1	1	-	No WISA found
4	8-213	Forest		206	2	1	-	No WISA found
5	8-202	Forest		151	1	2	NY	Old nest re-occupied (WNB058)
6	8-204	Forest		323	1	0	-	-
7	8-210	Forest		260	2	1	NY	Old nest re-occupied (WN317)
8	8-389	ST Cut 2000	Harvested before WHA designation; nests were found only in WTPs (241 trees/ha; 33 in ST Cut)	33	2	3	H	WNB059 F present, M found dead, WN047 not occupied
9	Lehman Springs	Forest	NCC Cons. Area	279	5	3	NY	New nest (WNB071) and non-nesting Male
15	8-312	Partial ER Cut	Ecosystem Restoration cut after WHA designation; 170 trees/ha in vicinity of nest that was not treated during ER Cut	113	2	2	NY	New nest (WNB070) in old WTY (old nest trees WNB010 WNB023 WNB048 have fallen)
53	8-315			223	1	0		-
54	8-366			NA	1	3	H	1 Male
55	8-387			NA	1	3	-	0
56	8-364			214	1	1	H	1 Male
57	8-206			NA	1	0		-
58	8-310			248	2	0		-
59	8-382			202	1	0		-
60	8-383			111	3	1	-	0
61	8-384			206	2	0		-

Site No.	Name	Site History	WISA Suitability before Harvest; Other Comments	Tree Density	WISA nests Prior	N WISA found April	BBC June	WISA Occupancy in June
Harvested Sites								
11	A91985-1	Partial Cut 2010		139	2	4	NY	Old nests re-occupied (WNB041 and WNB042)
10	A93215-1	Partial Cut 2001	Moderate before and after cut	178	Unk.	2	S	WISA present but no territory centre or nest found
12	A89003-5	ST Cut 2016	Low before; VL after cut	67	Unk.	0	-	-
13	A89003-6A	(Partial Cut 1996?), ST Cut 2016	Low before and after cut	78	Unk.	0	-	-
14	A89003-2A	ST Cut 2014	Moderate before; Low after cut	35	Unk.	1	-	No WISA found
16	A92598-3	ST Cut 2017	Low before, VL after cut	35	Unk.	0	-	-
28	A68715	Partial Cut 2005	Moderate	>100	Unk.	1	-	No WISA found
29	A92598-1	ST Cut 2017	Low; 36 trees/ha in harvested area near WISA nest	4	Unk.	1	NY	New nest; Lw veteran 3 m from block boundary
30	A92598-5	ST Cut 2017	Low; Tree density too patchy to estimate by reccy plots; est. does not include riparian reserves	<25	Unk.	0	-	-
31	A92599-1	ST Cut 2017	Some Low, mostly VL; Tree density does not include trees on narrow terrace slopes	15	Unk.	1	NY	New nest; Pair nesting and foraging only outside block
32	A92599-2	ST Cut 2017	Some Low, mostly VL; Tree density does not include trees on narrow terrace slopes	23	Unk.	0	-	-
33	A93521-4	ST Cut 2019	Low; Tree density too patchy to estimate by reccy plots; est. does not include riparian reserves	<50	Unk.	0	-	-
34	A92599-4	ST Cut 2017	Low	56	Unk.	0	-	-
35	A89003-1	ST Cut 2017	Low	70	Unk.	0	-	-
36	MY104	ST Cut 2015	Low	15	Unk.	0	-	-
37	MY103	ST Cut 2015	Very Low	13	Unk.	0	-	-
38	MY101	ST Cut 2015	Very Low	<20	Unk.	0	-	-
39	K4E008-01	ST Cut 2019	Low+VL	6	Unk.	0	-	-
40	06L-01	Partial Cut 2018	Mod+Low; Cut very dense but patchy; recce plots not reliable; This is the only cut that looks like the BMP had envisioned.	223	Unk.	0	-	-

Site No.	Name	Site History	Comments	Tree Density	WISA nests Prior	N WISA found April	BBC June	WISA Occupancy in June
Control Sites								
26	Control for 8	Forest/Edge		NA	1	2	NY	Old nest re-occupied (WNB061)
20	Control for 11	Partial Cut 2012?	Very light cut	NA	1	2	S	WISA present but no territory centre or nest found
25	Control for 15	Forest	Unharvested portion of WHA 8-312	150	1	2	-	No WISA found
19	Control for 10	Forest		NA	Unk.	3	NY	New nest found (WNB069)
21	Control for 12	Forest		NA	Unk.	0	-	-
22	Control for 13	Forest		NA	Unk.	1	-	No WISA found
23	Control for 14	Forest		NA	Unk.	0	-	-
27	Control for 16	Forest		NA	Unk.	0	-	-
18	Davis Lake N	Forest – but not Class 1 suitability because old high-grading had removed Lw vets		NA	NA	0	-	-
41	Control for No. 29	Forest		NA	NA	1	V	1 Female seen visiting possible nest tree, no nesting activity seen
42	Control for No. 30	Partial Cut	WL1623? (Klein)	NA	Unk.	1	S	1 Male foraging in area for >30 minutes; no nest found
43	Control for No. 31	Forest		NA	Unk.	0	-	-
44	Control for No. 32	Forest		130	Unk.	0	-	-
45	Control for No. 33	Forest		NA	Unk.	0	-	-
46	Control for No. 34	Forest		NA	Unk.	0	-	-
47	Control for No. 35	Forest		325	Unk.	0	-	-
48	Control for No. 36	Forest		370	Unk.	0	-	-
49	Control for No. 37	Forest		NA	Unk.	0	-	-
50	Control for No. 38	Forest		275	Unk.	0	-	-
51	Control for No. 39	Forest		NA	Unk.	0	-	-
52	Control for No. 40	Forest		NA	Unk.	0	-	-

Appendix 2. East Kootenay sites and occupancy, 2018-2019. The unnumbered WHAs were checked opportunistically for occupancy in 2019 during the annual EK monitoring program in April, and, for any occupied in April, again during additional surveys in June. All of the 35 WHAs in the EK were checked for occupancy in either 2018 or 2019. Tree densities from 2006-2008 and 2017 plots, where available.

Name	Habitat	Comments	Tree Density	WISA nests Known Prior	N WISA April	BBC June	WISA Occupancy June
WHAs							
4-108	Forest		319	2	0		-
4-110*	Forest (Partial Cut 1998)		191	(1)	2	P	WISA pair present, but nest not in B.C.; nest probably in U.S., just as it was in 2006
4-127	Forest and Old Cuts		129	2	0		-
4-128	Forest and Old Cuts		74	2	0		-
4-129	Forest and Cut 1999		124	1	1		0
* 4-136 2018	Forest and Cut 1999		229	1	0		-
2019				1	2	S	2 WISA
4-137	Forest and Cut 2001		62	2	1	S	1 WISA
4-138	Forest and Old Cuts		225	1	1	H	1 WISA
4-139	Forest and Old Cuts		212	2	0		0
4-141	Forest and Old Cut		362	1	0		-
4-142	Forest and Old Cut		208	1	0		-
4-143	Forest and Cut 2004		150	2	0		-
4-144	Forest and Old Cut		172	1	0		-
4-181	Forest and Cut 2005		NA	1	2	S	1 WISA
4-182	Forest and Old Cuts		NA	1	0		-
4-183	Forest and Old Cuts		93	2	0		-
4-184	Forest and Old Cuts		NA	1	0		-
4-185	Forest and Old Cuts		NA	1	0		-
4-186	Forest and Old Cuts		NA	1	0		-
4-187	Forest and Cut 2001		214	1	2	S	1 WISA
4-188	Forest and Cut 2001		111	1	1	H	1 WISA
4-189	Forest and Cut 2006		381	1	0		-
4-190	Forest and Cut 2005		100	2	2	S	2 WISA; likely pair
4-191	Forest and Old Cuts 1989-2002		234	1	0		-

Name		Habitat	Comments	Tree Density	WISA nests Known Prior	N WISA April	BBC June	WISA Occupancy June
	4-192	Light Partial Cut 1995		NA	1	0		-
	4-193	Forest and Cut 2000		144	2	0		0
	4-194	Forest and Old Cuts		NA	1	0		-
	4-195	Forest and Cut 2005		NA	1	0		-
	4-196	Burned 2003		87	1	2	NY	Active nest
	4-197	Burned 2003		NA	1	0		0
	4-198	Forest and Cut 2004		NA	1	0		-
	4-199	Forest and Cut 2004		NA	1	0		-
	4-200	Forest		NA	1	2	NY	Active nest
	4-201	Forest and Old Cuts		NA	1	0		-
	4-202	Forest and Cut 2000		43	1	2	NY	Active nest
Harvested Sites								
BN1	Baker North	Seed Tree Cut 2013		36	Unk.	0		-
BC1	W of WHA 4-110	Burned 2017	Regenerating Pl from 1994 cut was burned in 2017	33	Unk.	0		-
KC1	Kiahko Cut 1	Partial Cut 2015		157	Unk.	1		NY found in harvested area, 36 m from forest; occupied in 2018 & 2019
KC2	Kiahko Cut 2	Partial Cut 2015		131	Unk.	0		-
LC1	Linklater Cut 1	Seed Tree Cut 2010		41	Unk.	0		-
LE1	Linklater East Cut 1	Seed Tree Cut 2014		33	Unk.	2	P	Pair not within cut, only in adjacent forest

* Site checked for occupancy in 2018.

Appendix 3. WISA Nest Tree status for trees checked in 2019 and/or 2018.

Nest Tree GPS Mark	WHA	Year nesting first observed	Tree Sp.	Wildlife Tree Code (1-9) Status in Year first observed	Current Wildlife Tree Code Status	Tree Still suitable for Nesting?	Comments
Boundary (26 of 121 known nests were checked)							
WN011	8-382	1996	Lw	2	7	0	
WN016	8-387	1997	Lw	2	9	0	
WN019	8-389	1997	Lw	2	9	0	Cut down long ago for firewood
WN047	8-389	2003	Lw	2	4	1	Counted 78 cavity nest holes in tree
WN212	8-383	2004	Lw	6	6	1	
WN213	8-383	2004	At	6	7	1	
WN223	8-208	2004	Lw	2	2	1	
WN311	8-213	2005	Lw	2	2	1	
WN317	8-210	2005	Lw	2	2	1	
WNB010	8-312	2006	At	2	9	0	
WNB014		2006	Lw	2	2	1	
WNB015		2006	Lw	2	2	1	
WNB016		2007	Lw	2	2	1	
WNB017		2007	Lw	2	2	1	
WNB021	8-383	2007	At	3	7	0	
WNB023	8-312	2007	At	6	9	0	
WNB033		2008	Lw	2	2	1	
WNB035	8-366	2008	Lw	2	2	1	
WNB038	8-379	2008	Lw	2	2	1	
WNB041		2012	Lw	2	2	1	
WNB042		2012	Lw	2	2	1	
WNB048		2012	Py	3	9	0	
WNB058	8-202	2012	At	2	2	1	
WNB059	8-389	2012	Lw	2	9	0	
WNB061		2012	Lw	2	2	1	
WNB065		2012	Lw	2	2	1	
East Kootenay (all known nests listed here, n = 61)							
WNE501	4-108	2004	Lw	5	6	1	
WNE502	4-108	2005	Lw	2	2	1	
WNE001	4-141	2006	Lw	2	2	1	
WNE002	4-144	2006	Lw	2	2	1	
WNE003	4-142	2006	Lw	2	2	1	
WNE004	4-143	2006	Lw	2	2	1	
WNE005		2006	Lw	2	2	1	
WNE006	(4-110)	2006	Lw	3			Nest in U.S. – not checked
WNE007	4-127	2006	Lw	2	2	1	
WNE008		2006	Py	3			Not checked in 2018/19
WNE009		2007	Lw	2			Not checked in 2018/19
WNE010	4-138	2007	Fd	3	4	1	
WNE011	4-129	2007	Fd	2	7	0	
WNE012	4-136	2007	Fd	2	2	1	
WNE013	4-137	2007	Lw	2	2	1	
WNE014	4-128	2007	Lw	2	2	1	
WNE015	4-143	2007	Lw	2			Not checked in 2018/19

Nest Tree GPS Mark	WHA	Year nesting first observed	Tree Sp.	Wildlife Tree Code (1-9) Status in Year first observed	Current Wildlife Tree Code Status	Tree Still suitable for Nesting?	Comments
WNE016	4-139	2008	Lw	2	4	1	
WNE017	4-188	2008	Lw	3	3	1	
WNE018	4-187	2008	Lw	2	2	1	
WNE019	4-190	2008	Lw	3	3	0	Cut stub- nest hole filled with grass
WNE020	4-183	2008	Lw	2			Not checked in 2018/19
WNE021	4-183	2008	Lw	2			Not checked in 2018/19
WNE022	4-202	2008	Lw	2	2	1	
WNE023	4-193	2008	Fd	5	7	0	
WNE024	4-191	2008	At	2	2?	1?	Could not determine which At the tree was; -presumed Okay
WNE025	4-190	2008	Lw	2	2	1	
WNE026		2008	Lw	2	2	1	
WNE027	4-128	2008	Lw	2	2	1	
WNE028	4-137	2008	Lw	2	8	0	
WNE029	4-127	2008	Lw	2	2	1	
WNE030	4-196	2008	Lw	2	2	1	
WNE031	4-201	2009	Lw	2	2	1	
WNE032	4-186	2009	Lw	2	2	1	
WNE033	4-200	2009	At	2	2	1	
WNE034	4-198	2009	At	3	2	1	
WNE035	4-189	2009	At	2	2	1	
WNE036	4-195	2009	At	2	6	0	
WNE037	4-194	2009	At	2	2	1	
WNE038		2009	At	2			On private land, not checked
WNE039	4-192	2009	At	2	5	1	NOFL in tree
WNE040	4-182	2009	Lw	2	2	1	
WNE041	4-184	2009	Lw	3	3	1	
WNE042	4-185	2009	Lw	2	2	1	
WNE043		2009	Lw	2		?	Not checked in 2018/19
WNE044	4-193	2011	Lw	2	7	0	
WNE045	4-181	2011	Lw	2	2	1	
WNE046	4-197	2011	Lw	2	2	1	
WNE047	4-199	2011	At	2	?	?	No notes made on tree status
WNE048		2012	At	2	2	1	
WNE049	4-139	2012	Lw	2	2	1	
WNE050		2012	Lw	2	2	1	
WNE051		2012	Lw	2	2	1	
WNE052		2013	Lw	2	2	1	
WNE053		2013	Lw	2	2	1	
WNE054		2018	Lw	2	2	1	
WNE055		2015	Lw	2	2	1	Unsure if location exact.
WNE056	4-200	2019	At	2		1	New nest 2019
WNE057		2019	Lw	2		1	New nest 2019
WNE058	4-202	2019	Py	2		1	New nest 2019
WNE059	4-196	2019	Lw	2		1	New nest 2019
WNE060		2019	Py	5		1	New nest 2019

Appendix 4. Breeding Bird Atlas codes used for WISA breeding evidence. .

OBSERVED	
X	Species observed in its breeding season (no breeding evidence)
POSSIBLE	
H	Species observed in its breeding season in suitable nesting habitat
S	Singing male(s) present, or breeding calls heard, in suitable nesting habitat in breeding season
PROBABLE	
M	Multiple singing males (7 or more) found during one visit within the same square, during the breeding period in suitable nesting habitat. Most species listed as (M) can be upgraded during other visits. Use with caution to avoid counting migrants.
P	Pair observed in suitable nesting habitat in nesting season
T	Permanent territory presumed through registration of territorial song, or the occurrence of an adult bird, at the same place, in breeding habitat, on at least two days a week or more apart, during its breeding season. Use discretion when using this code. "T" is not to be used for colonial birds, or species that might forage or loaf a long distance from their nesting site e.g. Kingfisher, Turkey Vulture, and male waterfowl
D	Courtship or display, including interaction between a male and a female or two males, including courtship feeding or copulation
V	Visiting probable nest site
A	Agitated behaviour or anxiety calls of an adult
B	Brood Patch on adult female or cloacal protuberance on adult male
N	Nest-building or excavation of nest hole by wrens and woodpeckers
CONFIRMED	
NB	Nest building or carrying nest materials, for all species except wrens and woodpeckers
DD	Distraction display or injury feigning
NU	Used nest or egg shells found (occupied or laid within the period of the survey)
FY	Recently fledged young (nidicolous species) or downy young (nidifugous species), including incapable of sustained flight
AE	Adult leaving, occupying or entering nest sites in circumstances indicating occupied nest (eg. sitting on nest)
FS	Adult carrying fecal sac
CF	Adult carrying food for young
NE	Nest containing eggs
NY	Nest with young seen or heard