

Williamson's Sapsucker Boundary Occupancy Monitoring and Best Management Practices Assessment 2020

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ABSTRACT

Field data collection for Wildlife Habitat Area (WHA) and Best Management Practices (BMP) effectiveness monitoring for the Endangered Williamson's Sapsucker (WISA) began in 2017. This report continues the occupancy monitoring for the Boundary portion of the WISA Area of Occupancy (AO) for 2020. From 2018-2020, WISA breeding occupancy was assessed for all 38 Wildlife Habitat Areas (WHAs) in the Boundary, for 57 harvested cutblocks, and one census area.

WISA occupancy at 38 WHAs was 65% in April, with confirmed or probable breeding at 26% in June and 35% when possible breeding was included. These levels in June were similar to those of the Okanagan, but when including possible breeding, were slightly lower than in the Merritt area.

When BMP tree retention targets were applied just to the harvested area, they appeared effective at maintaining breeding habitat. 95% of 19 cutblocks for which target tree retention densities were specified in the Site Plan met the target. Breeding occupancy was correlated with increasing tree density in cutblocks. While many cutblocks were occupied in April, by June there was a pronounced inflection point with very low breeding occupancy (6%) in cutblocks with <95 retained trees/ha, that was significantly higher (31%) in cutblocks with >95 trees retained/ha. This finding of the tree density effect confirmed similar findings from three previous independent data sets (nest success 2006-2008, nest vs unused random sites 2008, preferred foraging stands from radio-telemetry 2014-2015).

The same 95 trees/ha inflection point was also noted for snag densities (1.6/ha vs 9.8/ha) in the cutblocks. Large Woody Debris (LWD) levels averaged 38 m³/ha, although there was a wide spread in levels, and about one-third of cutblocks had <30 m³/ha, which was less than usually required to maintain carpenter ants at suitable levels. Stumps were generally cut much closer to the ground than in the past, so it is not certain if stumps will be able to make up LWD carpenter ant habitat deficiencies.

The WISA breeding population of the Woodlot 411-1 census area has increased since last checked in 1997-1999 and 2006-2007 from an average of 0.92 nests & pairs/km² to 1.69 nests & pairs/km² in 2020. Light removal (20%) timber management while maintaining veteran Western Larch for nesting appeared to be successful at maintaining or improving WISA breeding habitat.

The majority of WISA nest trees in Boundary were Western Larch, 89% of which found after 2003 were still suitable for nesting (combining data from all regions). Nest tree survival rates of Trembling Aspen, Water Birch and other conifers were lower.

Recommendations were made to:

1. Revise the WISA BMPs to make them clearer and simpler by revising "average" tree retention targets to only include harvested areas, simplifying four levels of retention to two, and revising how Very Low habitat should be considered.
2. Continue annual desktop assessment of newly approved cutblocks.
3. Continue field assessments of cutblocks where the BMPs have been applied, including re-assessments of at least some blocks as occupancy may change over time.
4. Revise the Okanagan-Boundary WISA Area of Occupancy boundaries in areas to reflect current observations.
5. Create and implement a long-term WISA habitat monitoring plan, as there is currently no such plan.
6. Continue to monitor WISA nest tree survival to predict long-term habitat needs because current nest trees (veteran Lw) are unlikely to be easily or quickly replaced.

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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 (BMPs) (BC FLNRORD 2014) for timber harvesting in the Williamson's Sapsucker Area of Occupancy (AO). Application of the BMPs to cutblocks is voluntary for licensees, i.e., there is no Government Action Regulation or other regulation stipulating that they must be applied. However, the provincial WISA Recovery Plan (BC MOE 2012) and the federal Recovery Plan (Environment Canada 2014, Environment and Climate Change Canada 2016) both rely on the application of the BMPs to provincial crown forest to attain their objectives of maintaining current population abundance through maintenance of current habitat suitability.

To assess effectiveness of WHAs and BMPs, surveys were started in 2017 by Ministry of Forests, Land, Natural Resource Operations and Rural Development (FLNRORD) including some habitat plots. This project in 2020 continued previous effectiveness assessments in the Boundary (Gyug 2019a).

The purpose of this report for the was to:

1. Report Level 1 (April-early May) and Level 2 (June) WISA breeding occupancy monitoring for the Boundary portion of the WISA AO in:
 - a. the remaining 21 WHAs (of 38 total) that had not been monitored in 2018 or 2019;
 - b. 37 cutblocks approved and harvested after 2014 that overlapped with WISA Critical Habitat and the block had already been harvested, and that had not already been monitored or assessed in 2018-2019, and
 - c. conduct a nest census in Woodlot 411-1 that had been originally censused in 1997-1999 and in 2006-2007,
2. Summarize and interpret the occupancy results from 2018-2020 in the Boundary;
3. Summarize current nest tree condition while doing occupancy checks of old nests to estimate long-term nest tree survivorship; and
4. Assess the effectiveness of the BMPs in harvested cutblocks based on observed WISA breeding occupancy and the suitability of habitat remaining in the blocks.

METHODS

Study Sites

Study sites were identified previously under a separate contract to FLNRORD in March 2020 (Figures 1-2). First, these included the remaining 21 WHAs (of the total 38 WHAs) that had not been monitored in 2018-2019. Secondly, these included 37 cutblocks which had been submitted or approved after April 2014, i.e., when the BMPs were published, and to which the BMPs therefore may have been applied. During surveys, we found four other cutblocks not in the initial selection which had been harvested and were added to the surveys. The results from the 41 cutblocks surveyed in 2020 were added to the results from 16 cutblocks monitored in 2018-2019. Site Plans for most blocks were obtained to assess if the prescriptions included reference to WISA and the BMPs, and if so, how they had been applied. Woodlots were not included in the assessment, with the exception of Woodlot 411 which was a long-term population monitoring site where a re-census of nests was undertaken.

Occupancy Field Methods

The WHAs and cutblocks (see Figures 1-2) were sampled for Level 1 occupancy from April 22 to May 5, 2020, and for Level 2 occupancy from June 10-28, 2020. Survey sampling effort was 3.5 person-days preparation time and training, 19.5 person-days for Level 1 field surveys, and 19 person-days for Level 2 field surveys. Snow prevented access to most sites prior to April 22. Snowmobile access may have been possible in the first week of April, but by the time the contract started on April 17, conditions were no longer suitable for snowmobile access. Field methods have been described in Gyug (2016) but have been since slightly modified based on field experience. The updated methods have been summarized below.

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

1. Visit the site any time from approximately April 1 to May 7.
2. At any given site, begin assessment at any previously known nests (if any).
3. If no WISA are detected at known nest sites, use at least 5 Call Playbacks (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 when any WISA are found, although additional observations of possible territory centers or possible nest sites can be helpful for later (Level 2) surveys.

Occupancy Level 2: Breeding Confirmation during nesting phase (mid-May to late-June).

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, and Level 2 surveys need not be conducted as WISA will be assumed absent.
2. Breeding confirmation requires:
 - a. firstly, visits to any old nests to check for occupancy, with the current status of any previously known nest trees recorded,
 - b. secondly, up to 30 minutes spent on sites of 16 ha or smaller including a series of CPB throughout the site, approaching any potential breeding areas of the site to within at least 200 m, or until a response is detected, and
 - c. should a site be larger than 16 ha, surveys will take proportionately longer.
3. Wherever WISA are present within a site, the breeding activity will be assessed using the Breeding Bird Atlas breeding evidence codes (see Appendix 4). This may take considerably longer than 30 minutes even for a 16-ha site, and may require re-visits to confirm the exact state of breeding occupancy on the site.

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.

Each formal CPB point sample consisted of three broadcasts of a 10-15 second Williamson's Sapsucker drum and call combination repeated in each of 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 cutblock. 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 of birds, 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 doing CPBs, we did not necessarily do the full CPB protocol because WISA would sometimes be heard while walking away from a CPB point or before arriving 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.

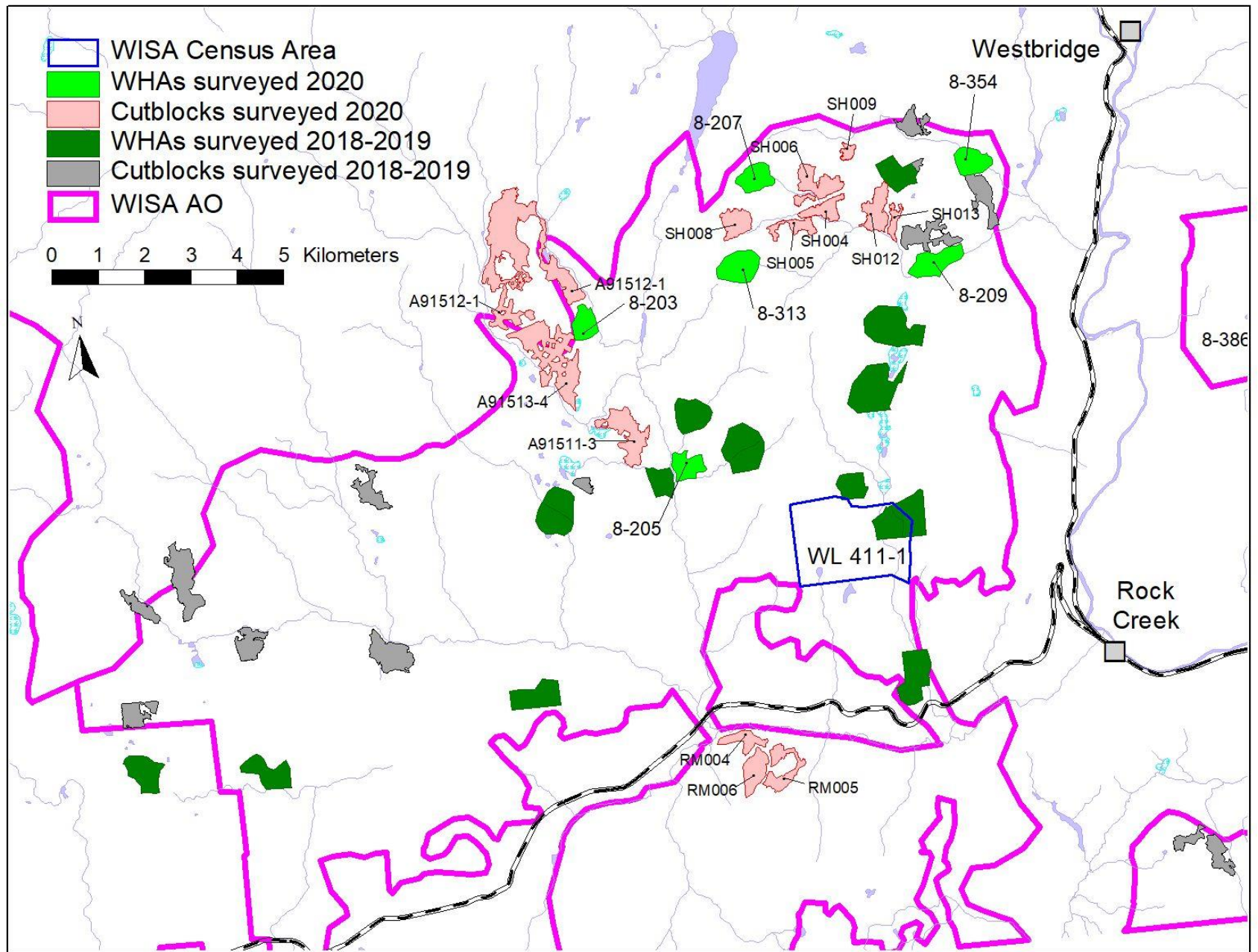


Figure 1. Locations of Cutblocks and WHAs for sampling in 2020 in the Boundary AO west of Rock Creek.

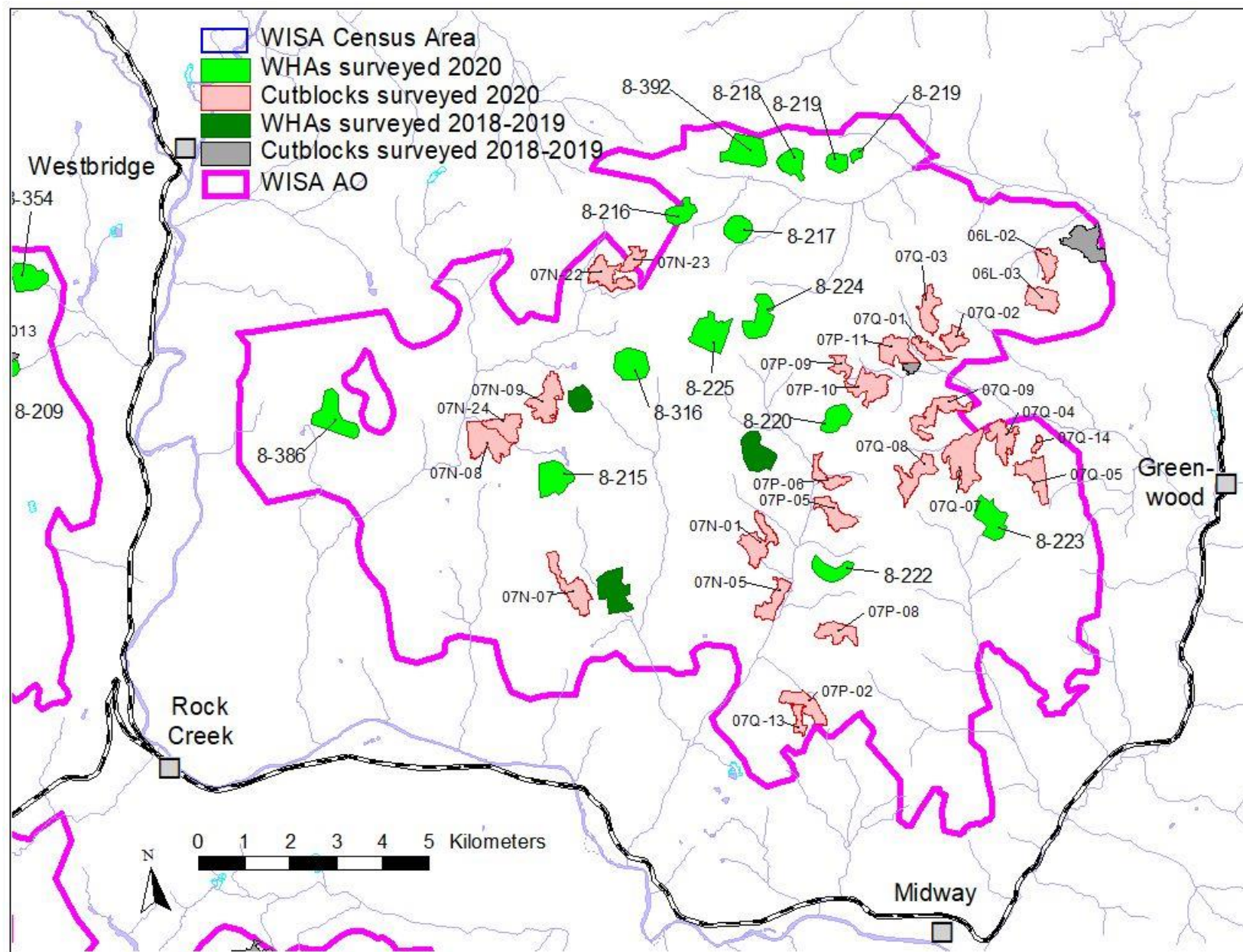


Figure 2. Locations of cutblocks and WHAs for sampling in 2020 in the Boundary AO east of Rock Creek. WHA 8-386 on Phoenix Mt. east of Greenwood not shown on map.

Where WISA were detected in the Level 1 occupancy checks, we returned to the WHA or cutblock in June for a Level 2 occupancy check. Wherever WISA were detected on the Level 2 check, a nest search was undertaken. If no WISA were detected, then we searched the site until we had confidence WISA were absent during the survey period. Location, type of observation and sex (if observed) 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 entered into the final observation file.

Re-census of a single long-term census area, Woodlot 411-1, was included in 2020 (see Figure 3) as an additional recommended monitoring method (Gyug 2016). Census survey effort was one person-day in April and three person-days in June. Description of site and results of the original censuses had been published by Gyug et al. (2007). Ten additional habitat plots were done around two new nesting areas found in 2020.

Data Analysis and Management

Level 1 and 2 occupancy results were first summarized for the Boundary for 2020, then grouped by all monitoring survey years in the Boundary, and then compared to other regions. The cutblocks were assessed for WISA occupancy first in relation to whether WISA were previously known from the area and then to remaining tree densities on cutblocks for each region, and then regions compared. The Boundary census area (Woodlot 411-1) results were compared to other long-term census area results from the Okanagan region.

Nest tree survival rates were based on re-checks of known nest trees. Survival was indicated if the known nest tree remained suitable for nesting, i.e., usually standing, and with the portion of the tree where nesting occurred, or could occur, still intact. Nest tree survivorship was first estimated regionally by species, by time since discovery and by live or dead status at discovery (if there was sufficient sample size), and then estimated for all regions of B.C. combined.

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. This Excel template was updated and slightly modified for 2020. Formal CPBs 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 entered into the *WHAs, Cutblocks, Revisits* sheet. Surveys within census areas in April were in a separate sheet, and there was also a separate sheet for incidental detections of WISA or other species. These files were quality checked for formatting and for data entry errors, and the excel file submitted to SPI at the end of the field season along with WISA data

from any other regions or projects. Each WISA observation in the Excel file was assigned a unique identifier so that all 2020 observations could be combined with the GIS shapefiles used for archiving all WISA call-playbacks and observations since 1994 of the FLNRORD- (formerly MOE, MELP or MWLAP) and CWS-sponsored inventory and monitoring projects, as well as some other WISA surveys conducted concurrently.

Habitat Plots

Habitat plots were only done in the harvested portions of cutblocks in this project to estimate remaining tree and snag densities after harvest, and to estimate stand structure before harvest based on stump tallies. Site Plans and block maps were obtained from licensees. Points were randomly placed using GIS within the cutblocks such that each point was at least 25 m from the block edge and at least 50 m from any other point. Circular tree, snag and stump tally plots and coarse woody debris (CWD) transects were done at each of the random points. Ten random points were established in most blocks, but where blocks were <10 ha in size the number of plots were reduced proportionately to a minimum of 5 per block. Blocks with significant WISA presence (mainly nests) had up to 6 additional plots randomly placed near the nesting sites or territory centers to determine if local tree densities may have influenced nest use. Where roads and landings were a separate treatment unit in the Site Plan, i.e., with no reserved trees, these were not sampled with plots but instead assigned as having no trees in the harvested block area. For seven blocks in the Deadwood area, no plots were placed in the lower portions of the blocks that were dominated by Western Redcedar since these areas were not Low or better suitable WISA habitat.

Habitat plot data collection methods were described in Gyug (2018) but have been altered slightly based on field experience for 2020 (see Appendix 5). Trees, snags and stumps ≥ 17.5 -cm in diameter were tallied by species in 5-cm classes, e.g., 17.5-22.4 cm, 22.5-27.4 cm, etc. For trees and snags, diameter at breast height (dbh) was used, but for stumps, the diameter at stump height (dsh) was used. Plots were nested so that smaller trees were counted in smaller radius plots around plot centers. The actual radii used at any given plot depended on tree density. Where trees were scarce, very large plots were used (17.84 m or larger radius); where trees were dense, smaller plots were used (11.28 m or 12.62 m radius). As much as possible, we used the same plot sizes for all plots in a given block. Stumps were usually tallied within smaller plots (9.77 m or 11.28 m radius) than for trees. Stumps were classified as from old logging, or from the most recent harvest. Snags >22.4 cm dbh were tallied within 17.84-m radius (or larger radius) from plot centers. A laser hypsometer/distance measurer was used to check whether trees, snags or stumps were in or out of plot.

CWD volume was estimated on 25-m transects in north and east directions from the plot center using the transect-intercept method. CWD was classed based on the size of the Large End Diameter (LED) as 7.5-22.4 cm (Small Woody Debris; SWD) or >22.4 cm (Large Woody Debris; LWD). LED was measured on downed logs where the dbh would have been measured if that could be determined, i.e., the base of the tree could be found, or the end of the log if it was not possible to determine where dbh may have been measured, or if the log was broken. To estimate LWD density, if the LED of a piece of LWD was within 2 m either side of the transect, it was tallied. This included LWD pieces that may not have crossed the transect.

WISA Suitable Nest Trees (see Gyug 2018 and Appendix 5) were tallied in a large circular plot with at least 25 m radius. Large thatch ant nests (usually *Formica rufa* species group) were tallied within 11.28 m radius plots for 186 of the 347 plots.

Habitat plot data from 2020 was entered into an Excel template file that had been developed specifically for this WISA habitat plot data. The summarized results of those plots were added to the WISA habitat plot master shapefile. Some of the results were also summarized in Appendix 2 of this report.

RESULTS and DISCUSSION

WISA Occupancy Surveys

Using the sample of all Boundary WHAs from 2018-2020, Level 1 occupancy of WHAs was 65% while Level 2 occupancy was 24% Probable and Confirmed and 35% when including Possible breeding (Table 1). Level 1 WHA occupancy was not assessed in the Okanagan and Merritt areas so could not be compared. Level 2 occupancy in the Okanagan WHAs was very similar (21% and 32%; Gyug 2020). The 32-35% occupancy rate found in Okanagan and Boundary WHAs in 2018-2020 was very similar to the long-term (7-12 years) 31% occupancy rate of WISA breeding territories estimated in 2016 (Gyug 2016). The levels of WHA occupancy found in the Merritt area in 2019 was similar for Probable and Confirmed (21%) but was higher when Possible was included (48%) (Gyug 2019b).

Of the 57 Boundary cutblocks that have been surveyed from 2018-2020, 45 had previously had at least some surveys within or nearby for WISA prior to 2017 (Table 2). Overall, cutblocks had a 38% Level 1 occupancy rate. The overall Level 2 occupancy rate of 11% was much lower (considering just Probably and Confirmed nesting), which increased to 18% when Possible nesting was included. Level 2 breeding occupancy was twice as high in blocks where WISA had previously been detected in or near the blocks prior to harvest but ultimately Level 2 breeding occupancy appeared more related to tree density than other factors (see later in this report).

Table 1. Williamson's Sapsucker Boundary WHA occupancy summary, 2018-2020. See Appendices for detailed information on each site and Appendix 4 for the definitions of Possible, Probable and Confirmed nesting.

Year Checked	Sites (n)	Occupancy Level 1 (April to early May)		Occupancy Level 2 (late-May to June)			
		Occ. Sites (n)	Occ. Rate (%)	Prob. and Conf. Nesting		Poss., Prob. and Conf. Nesting	
				Sites (n)	Rate (%)	Sites (n)	Rate (%)
2018	9	8	89	3	33	4	33
2019	9	4	44	0	0	2	22
2020	28	18	64	9	32	10	36
Total*	38	-	65	-	26	-	35

* WHAs checked in >1 year (n = 8 rechecked in 2020) given proportional weight for each year

The falloff in occupancy from April to June was similar for WHAs and for cutblocks, i.e., about 50% of WHAs where WISA were detected in April/early May were not occupied in June (63% to 32%, Table 1), and about 50% of cutblocks where WISA were detected in April/early May were not occupied in June (39% to 18%, Table 2)

Confirmed breeding, i.e., active WISA nests, were found within only four of the 57 cutblocks (1 in 2019, 3 in 2020). In 2019, WISA nested within A92598-1 but in a veteran Lw only 3 m from the cutblock boundary. The local tree density in the hectare of the block nearest the nest was 36 veteran Lw/ha while the remainder of the block averaged only 4 trees/ha. In 2020, WISA nested in three cutblocks. In 07P-02, tree density was 216/ha overall and 243/ha in the nest area. In 07Q-03 tree density was 153/ha overall and 148/ha in the nest area. Tree density was very low in 07N-23 (6/ha) where WISA nested in a veteran Lw 120 m from the block boundary. This nest did not appear to be successful as no WISA were seen there on June 28 and it would not have been possible for the young to have fledged by then since they were estimated to be <14 days old when the nest was discovered on June 19. The original (May 1) detection that prompted the nest search in 07N-23 was not in the block, instead being about 85 m outside the block, and 230 m from the nest that was found later in June. Block 07N-23 did not appear to be suitable foraging habitat with only 6 trees/ha, and the pair must have relied upon the adjacent forest. This nest was also 70 m outside the WISA AO, indicating the AO boundaries probably need to be adjusted, as was found in the Okanagan in 2020 as well (Gyug 2020).

Table 2. Williamson's Sapsucker Boundary cutblock occupancy summary, 2018-2020.

Type of Site	Sites (n)	Occupancy Level 1 (April to early May)		Occupancy Level 2 (late-May to June)			
		Occ. Sites (n)	Occ. Rate (%)	Prob. and Conf. Nesting		Poss., Prob. and Conf. Nesting	
				Occ. Sites (n)	Occ. Rate (%)	Occ. Sites (n)	Occ. Rate (%)
Harvested Cutblocks 2020							
<i>Previously Surveyed for WISA*</i>							
WISA presence known in or near block	9	4	44	1	11	2	22
Previously surveyed but no WISA detected	24	11	46	2	8	4	17
<i>Not previously Surveyed</i>	<u>8</u>	<u>4</u>	50	<u>2</u>	25	<u>3</u>	38
Total	41	18	44	5	12	9	22
Harvested Cutblocks Total (2018-2020)							
<i>Previously Surveyed for WISA*</i>							
WISA presence known in or near block	15	7	47	2	13	3	20
Previously surveyed but no WISA detected	30	11	37	2	7	4	13
<i>Not previously Surveyed</i>	<u>12</u>	<u>4</u>	33	<u>2</u>	17	<u>3</u>	25
Total	57	22	39	6	11	10	18

* Prior surveys in or near cutblocks may have consisted of as little as one CPB within 200 m of block, see Appendix 2 for individual block details.

There were two other cutblocks with Probable nesting. In 07Q-13 there was a pair (plus possible other WISA) but no nests could be found. In 07N-01 a male was foraging in the block but the nest was 50 m outside the block. Since the male was using the block for foraging, this was considered to be Probable nesting. A second male in 07N-01 was foraging both inside and outside a separate part of the block but no nest could be found there. A male was also seen on a sapwell tree in this same second area of 07N-01 in September when habitat plots were being done.

Four other cutblocks had Possible nesting (07N-07, 07N-08, 07Q-02 and 07Q-08). Each of these had males present consistently within the blocks whenever they were visited, but no nests could be found within or nearby the blocks.

Table 3. Boundary WISA Census Area (Woodlot 411-1) results for WISA Level 2 (June) breeding activity.

Year	Area (km ²)	N Active Nests	N Pairs (Probable nesting)	Confirmed Nest Density	Confirmed plus Probable Nest Density	Comments
1997	4.14	3	0	0.72	0.72	Plus one other male
1998	4.14	4	0	0.97	0.97	
1999	4.14	3	0	0.72	0.72	
2006	4.14	4	1	0.97	1.21	Plus several other “floaters”
2007	4.14	4	0	0.97	0.97	
2020	4.14	5	2	1.21	1.69	Plus a few other “floaters”

Census Area

WISA breeding density in Woodlot 411-1 (Table 3, Figure 3) was higher in 2020 than when previously censused in the 1990’s and 2000’s. This compared favourably to the three Okanagan census areas re-censused in 2020 where WISA breeding density decreased from the original censuses. See Gyug (2020) for further discussion of the three Okanagan census areas.

The management regime of Woodlot 411-1 has been 20% removal of trees with purposeful maintenance of large veteran Lw wherever they occurred throughout the woodlot without using designated Wildlife Tree Patches (George Delisle, woodlot operator, pers. comm. to L. Gyug). This site was originally logged in the 1950’s with the woodlot established later. Based on the 49 habitat plots from 2007, and the additional 10 plots from 2020 within the woodlot portion of the census area, average density of trees >17.4-cm dbh was 259/ha (95% Conf. Interval 50/ha) and the average density of trees >52.4 cm dbh was 9.2/ha (95% Conf. Interval 3.5/ha). This management regime has appeared to maintain or enhance suitable WISA breeding habitat over the past 23 years.

Of note is that the census area was drawn in 1997 and did not include the southern pan-handle portion of the woodlot where three other known WISA nests were not checked in 2020. However, the annual road monitoring surveys in 2020 did find WISA presence near each of the those three previously known nest trees this year.

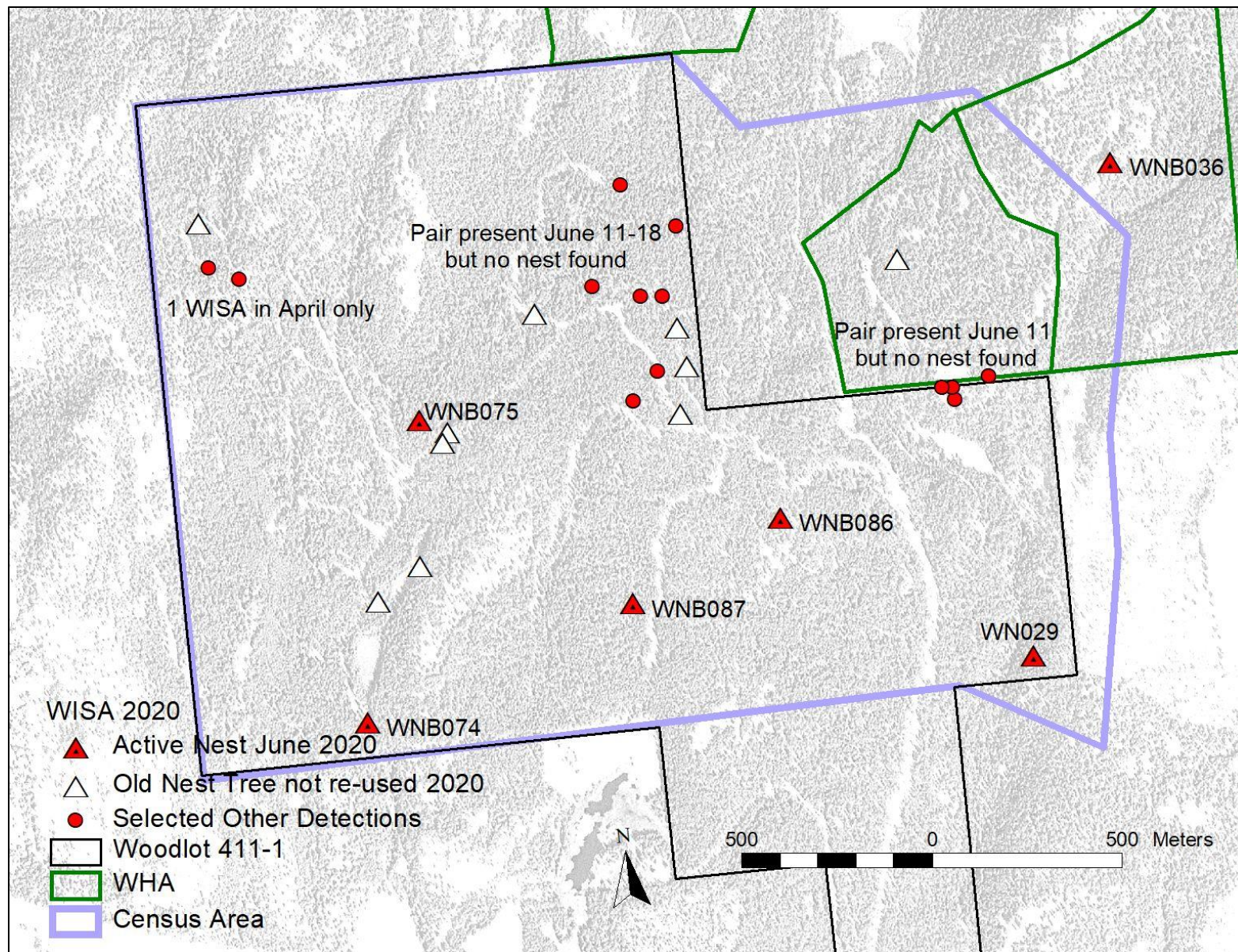


Figure 3. Woodlot 411-1 WISA nest census of 2020. Census area boundaries were established on paper maps in 1997 and do not include the entire woodlot, and include portions of two WHAs established later outside the woodlot. WISA Nest Trees WNB074, 075, 086 and 087 were first found active in 2020.

Occupancy and Tree Density

The breeding occupancy of cutblocks increased with increasing retained tree density (Figure 4). For Level 1 (April-early May), the logarithmic function ($r^2 = 0.45$, $p = 0.05$) was a better fit than linear. For Level 2 (June) a sigmoid function appeared to be a better fit than linear or log functions. Notably, while a number of cutblocks with 20-90 leave trees/ha were occupied in April (mean occupancy in the range of 0.2-0.4), most of these blocks were not occupied in June for actual nesting. Looking at the two levels of the sigmoid function in Fig. 4, both had no significant slope (<95 trees/ha $p = 0.29$; >95 trees/ha $p = 0.69$), i.e., there was no significant correlation of occupancy rate with tree density within either the lower or upper tree density group.

The two leave tree density groups had significantly different occupancy rates in both time periods using ANOVA comparisons. The Level 1 occupancy for blocks with <95 leave trees/ha (mean 0.25, SE = 0.08, $n = 32$) was significantly lower ($p = 0.02$) than for blocks with >95 leave trees/ha (mean 0.54, SE 0.10, $n = 26$). The Level 2 occupancy for blocks with <95 leave trees/ha (mean 0.06, SE 0.04, $n = 32$) was significantly lower ($p = 0.01$) than for blocks with >95 leave trees/ha (mean 0.31, SE 0.09, $n = 26$). Higher occupancy with >95 trees/ha found here was consistent with the relationship of nesting success with average tree density (Gyug et al. 2010), with the tree densities in nest sites vs random unused sites (Drever et al. 2015, see also Appendix 3 of Gyug and St-Amand 2020) and with preferred foraging habitat (>100 trees/ha in the Okanagan, Gyug and St-Amand, 2020).

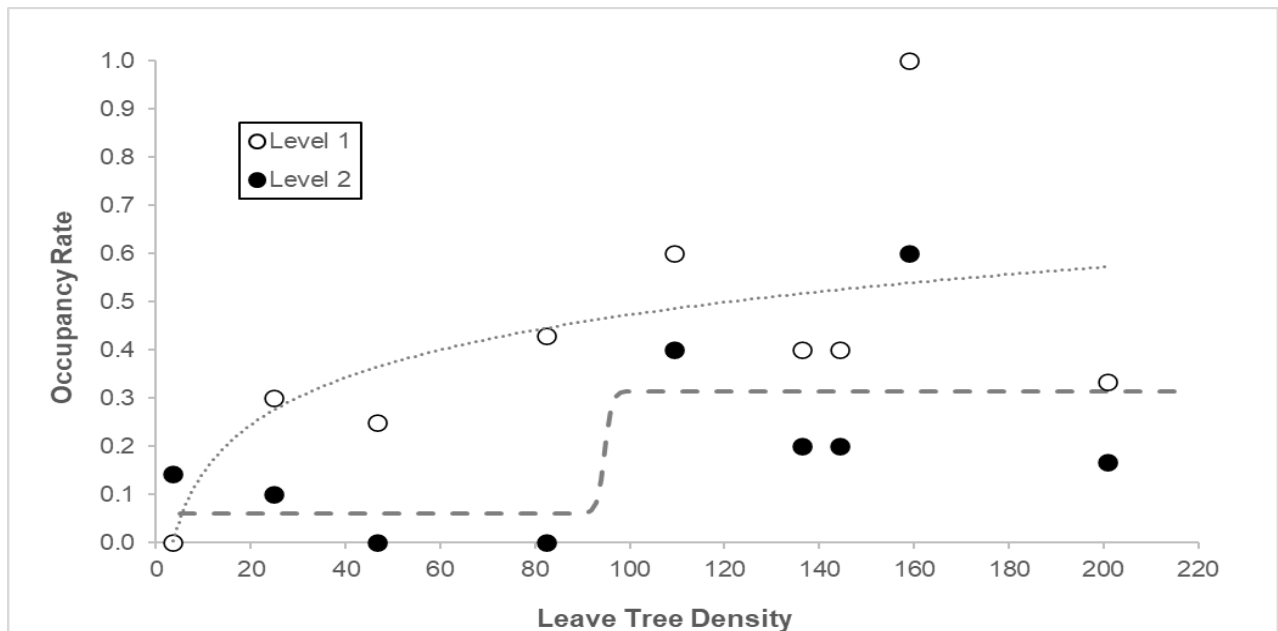


Figure 4. WISA Level 1 (April-early May) and Level 2 (June: Possible, Probable + Confirmed) occupancy rates of cutblocks in the Boundary (2018-2020) regressed against leave tree (>17.4 cm dbh) density in the harvested areas of the cutblocks. Cutblocks have been grouped by similar leave tree densities so there were at least 5 in each sample.

Other Habitat Elements

Suitable nest trees were generally scarce (mean 0.17/ha, SE 0.05, n = 36) in the cutblocks where habitat plots were done in 2020 (see data in Appendix 2). This was far below the recommended target of 1.36/ha recommended by Gyug et al. (2009) but about twice as much as the average 0.08/ha found in the Okanagan-Boundary not including plots centered on known nest trees (Gyug 2016).

Snag densities, not including Wildlife Tree Code 8 (soft, short) snags, which are not used by sapsuckers for nesting, were significantly lower ($p < 0.001$) when there were <95 trees/ha (mean 1.6/ha, SE 1.2, n = 11) retained after harvest than when >95 trees/ha were retained (mean 9.8/ha, SE 1.2, n = 25). Retaining more live trees after harvest has the side-benefit, i.e., without being specifically mentioned in the BMPs, of also maintaining more dead standing trees, which can be an important foraging source (St-Amand 2017) as well as potential future nest trees.

LWD volume in the cutblocks averaged 37.9 m³/ha (SE 3.4, n = 36), which was higher than the minimum 30 m³/ha typically found where WISA rely mainly upon carpenter ants to feed their nestlings (unpublished data, not included in BMPs). However, 13 of the 36 cutblocks had <30 m³/ha LWD indicating a possible carpenter ant nest substrate deficit. All but 4 of the 36 cutblocks had at least 15 m³/ha, which was the minimum recommended by the BMPs, but which was far below the 40-50 m³/ha considered ideal. Where LWD is in short supply, large thatch ant nests (*F. rufa* sp. group) can make up the difference, but such nests were very uncommon in the Okanagan-Boundary in general, and also very uncommon in the 36 cutblocks (mean 0.06/ha), which matches the average of the all regional Okanagan-Boundary habitat plots (mean 0.054/ha, n = 2672). Okanagan-Boundary WISA tended to rely on carpenter ants for feeding nestlings, rather than *F. rufa* sp. group ants. *F. rufa* sp. group thatch nests were much more common in the Merritt area (mean 2.9/ha, n = 1893) where LWD is generally in shorter supply (mean 27 m³/ha) than in the Okanagan-Boundary (mean 36 m³/ha) (unpublished data).

In these recently harvested sites, stumps were generally cut as low as possible to the ground, in contrast to old hand logging that would often leave Lw stumps 1-m tall, or even more recent feller-buncher harvesting that would often cut stumps 30-40 cm above ground level. We found almost no larger stumps recently cut and left at >40 cm height as recommended in the BMPs. Lw stumps of ~1-m height in particular form suitable ant habitat for 50 or even up to 100 years after cutting, but the current practice of cutting all stumps at or very near ground level will not leave such ant habitat. The relationship between LWD, stumps and suitable carpenter ant densities is not entirely clear as wood decays over time, and requires either constant or episodic new inputs to be maintained on the long-term.

Nest tree survival

We examined 39 WISA nest trees in the Boundary that had been discovered between 1995 and 2017 for current status in 2020 (Table 4). This was in addition to 29 WISA nest trees that had been checked in 2018-2019. Full details for each tree are in Appendix 3. The results and discussion below were also included in the Okanagan report for 2020 (Gyug 2020).

For Western Larch (Lw), nest tree survival varied by time since discovery with only 69% of Lw discovered 20-25 years ago still suitable for nesting, but 89% discovered 5-17 years ago still suitable for nesting (Table 4). Extrapolating the survivorship regression against years since nest discovery (Figure 5), none of these nest trees would be predicted to be still standing after 97 years. However, we do not know the real shape of the survivorship curve, i.e., it is probably not linear, and the confidence limits around the extrapolation of the available points to 97 years were very large (90% prediction interval of 57 years to infinity). Managing for suitable WISA Lw nest trees will require retention and protection of existing nest trees, and recruitment on a very long time-scale because Lw generally become suitable WISA nest trees only when they get older than 300 years and the tops start dying back.

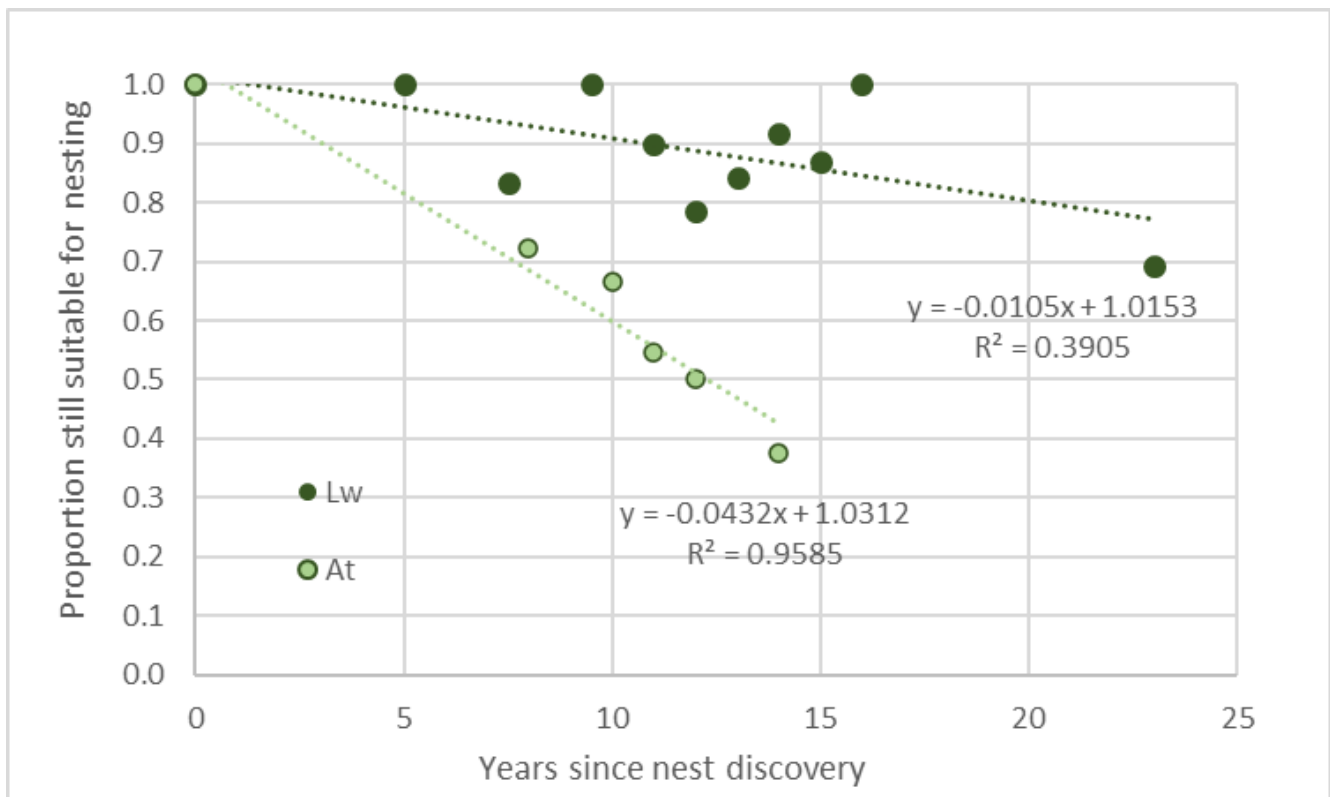


Figure 5. Proportion of WISA nest trees still suitable for nesting depending on years since nest discovery. Lw = Western Larch, At = Trembling Aspen. Linear regression used with points added for Proportion = 1 at time = 0. Total sample sizes were the same as in Table 3, with years since discovery grouped so that each point represents at least nine WISA nest trees.

Table 4. Current suitability of previously known nest trees checked in 2018-2020 from all regions occupied by WISA in B.C.

Region	Nest Tree Species ¹	Number Checked 2018-20	Number Remaining Suitable	% Remaining Suitable
Boundary	Lw found 1995-1998	11	7	64
	Lw found 2003 or later	38	34	89
	At found live 2004-2009	4	3	75
	At found dead 2004-2009	5	3	60
	At found live 2010-2015	1	1	100
	Ew	5	0	0
	Other Conifer	3	0	0
Okanagan	Lw found 1995-1998	2	2	100
	Lw found 2003 or later	59	52	88
	At found live 2004-2009	6	4	67
	At found dead 2004-2009	1	0	0
	Ew	4	3	75
	Other Conifer	4	1	25
East Kootenay	Lw	35	32	91
	At found live 2004-2009	7	6	86
	At found dead 2004-2009	1	1	100
	At found live 2010-2015	1	1	100
	Fd	4	2	50
Merritt Area	At found live 2004-2009	15	5	33
	At found dead 2004-2009	7	1	14
	At found live 2010-2015	9	8	89
	At found dead 2010-2015	7	3	43
	Py	11	6	55
	Fd	4	4	100
Totals	Lw found 1995-1998	13	9	69
	Lw found 2003 or later	132	118	89
	At found live 2004-2009	32	18	56
	At found dead 2004-2009	14	5	36
	At found live 2010-2015	11	10	91
	At found dead 2010-2015	7	3	43
	Ew	9	3	33
	Py	9	6	67
	Fd	15	7	47
	Sx	2	0	0

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

² At Total is higher than sum of above because includes trees for which initial status was not recorded.

For Trembling Aspen (At) nest tree survival varied by both time since discovery and by status (live or dead) at time of discovery. At nest trees discovered as dead 10-15 years ago had lower current survival rate of than live aspen nest trees discovered in the same period (36% vs 56%). Extrapolating the survivorship regression against years since nest discovery (Figure 5), none of these nest trees would be predicted to be still standing after 24 years (95% prediction interval of 19-31 years). However, as for Lw, we do not know the true shape of the survivorship curve, although the confidence limits are extrapolated over a much shorter time frame, and more reliable. Based on these results relatively continuous recruitment of new aspen nest trees will be required for the At stands to retain value for WISA nesting.

Survival of Water Birch (Ew) nest trees (33%) was even lower than for At (Table 4). Ew tend to be used for nesting when the largest central stem is already dead, and therefore not expected to stand for very long.

WISA tend to use Ponderosa Pine (Py) and Douglas-fir (Fd) for nesting when the trees are already dead (Gyug et al. 2009). Survival of Py (67%) and Fd (47%) was similar to survival of At nest trees. Most of the Py used for nesting had been killed by pine beetles during the epidemic of 2005-2010. Their survival as nest trees appears to be relatively limited in time to a few decades at best.

Best Management Practices ASSESSMENT

The following table (Table 1 excerpted from the Okanagan-Boundary BMPs, BC FLNRORD 2014), summarizes the BMP live tree residual density expectations on timber harvest blocks in the Boundary AO. These were to be averaged over the entire block area, including any Wildlife Tree Patches or other reserves.

The WISA BMPs had been applied to all or portions of at least 47 of the 57 harvested cutblocks examined for this project (see Appendix 2). The retained tree densities covered the entire range from almost none to over 200/ha. For the 19 blocks that had specified retention

Table 1. Live tree retention targets (> 17.5 cm dbh) and the percent area of new blocks (blocks established after April 1, 2014) to be retained in the target classes for each licensee within moderate and low suitability habitat.

Average live tree retention target (trees/ha)	% area of new blocks for each licensee
85–125	5–15
126–175	25–35
176–225	40–50
> 225	10–20

Neither OGMAs nor WHAs for any species are to be included in the live tree retention target averaging.

density targets in the Site Plans, and where we also estimated residual tree densities with plots, 18 of the blocks met their specified targets, i.e., the field-determined retained tree density 95% confidence interval contained or was lower than the Site Plan target.

Based primarily on tree densities, 23 of the blocks did not meet appear to meet the intent of the BMPs (see Appendix 2), i.e. did not retain suitable WISA foraging habitat that could support breeding. In most of these blocks, WISA foraging habitat could probably have been retained with a different prescription.

The analyses previously presented in this report of WISA breeding occupancy rate of >20% when retained trees in the harvested area exceeded 95/ha indicated that the BMP retention targets can be effective when applied to just the harvested area. Based upon the evaluation of Boundary cutblocks reported here, and preliminary evaluation of Merritt (Gyug 2019b) and Okanagan (Gyug 2020) cutblocks, I believe the principal problem with the BMPs was a mistaken reliance upon averaging tree densities to maintain suitable WISA habitat. The BMPs were based on the analyses of Gyug et al. (2010), which appeared to ask the wrong question. The question addressed in that paper was: under what conditions will a suitable nest tree have nesting success? The question was answered by averaging tree densities in a post-hoc fashion, without regard to what actually formed suitable foraging habitat, nor the spatial configuration of that habitat. As discussed in Gyug and St-Amand (2020), such nests in cutblocks will only be used (or successful) when they are within easy commuting distance of suitable foraging habitat (i.e., forest), or are within cutblocks with >100 trees/ha retained.

The importance of tree densities on forming suitable WISA breeding habitat has now been confirmed by analyses of four independent data sets, giving us more confidence in the results, i.e., WISA breeding habitat requires greater than or equal to about 100 trees/ha. The four data sets were: nesting success (Gyug et al. 2010), used vs random sites (Drever et al. 2015), preferred foraging habitat from radio-telemetry data (St-Amand 2017, and Gyug and St-Amand 2020), and now the data reported here for 57 recent cutblocks in the Boundary. Previous examination of the effectiveness of the BMPs (Gyug 2019a, 2019b) were not conclusive because too few cutblocks were available where the BMPs had been applied. This study reported here, and the congruence of these results with the other studies referred to above, now give us some confidence that the BMPs can work if applied to more than the base minimum recommended levels.

The minimum 20 trees/ha on every hectare of a block as specified in the BMPs, with higher average targets that include unharvested patches, did not achieve the goal of maintaining suitable habitat in the few blocks where it was applied (see Appendix 2). This minimum goal had been based on the absolute minimum tree density found around any nest up to 2008, and now with more recent data has been shown to be far too low. In cases where the minimum of 20 trees/ha might be met, the unharvested patches may be suitable foraging

habitat, but the harvested patches with very low tree densities will simply be unsuitable foraging habitat. Creating large portions of a block with very low tree densities reduces the suitability of those areas, i.e., averaging does not apply because while very open habitat may be acceptable in very small patches (e.g., <1 ha) within a block, the very open habitat will not be suitable for WISA if scaled up to an entire block.

Consequently, to maintain habitat suitability, the tree densities of the BMPs need to be either revised or re-interpreted to apply just to the harvested areas, as spatial configuration has been found to be important. Very low tree densities in harvested areas will not maintain breeding habitat suitability so the minimum of at least 20 trees on every hectare also needs to be revised upward.

Sometimes the BMPs were only applied to portions of cutblocks that were modeled as Low or better habitat and other times they were applied to the entire block, including any Very Low habitat. In several cases, the forester simply decided the model was wrong and applied the Very Low prescription, i.e. no retention, to modeled Low habitat. In other places, the BMPs were applied (and applied properly based on our field results) where the stand was mapped (probably incorrectly) as Very Low. So, while there must be some latitude for on-the-ground habitat assessments because VRI-based models will not correctly describe every stand, there are currently no guidelines to address that.

Some Very Low sites, which were only Very Low because of a few (changeable) characteristics of the current stand, could very easily have been converted to Low or better habitat by effective stand management. Very Low is not a single stand type, but encompasses many stand types. While options may be very limited in PI-dominated or wet cedar or spruce stands, most other Very Low stands have potential to be Low or better habitat given suitable management. The BMPs need to address this issue for Very Low habitat because otherwise potentially suitable habitat will be lost. The Very Low guidelines need to be applied to more than just near known nests (as the current BMPs recommend) because there are no ongoing inventories to find nests other than the few already known. A rough estimate is that we know about only a third of all nest locations. Unless there are regular inventories to find nests, the BMPs for Very Low habitat cannot be effective.

There has already been considerable Low and better habitat where the suitability has been reduced or eliminated by timber harvesting since WISA was assessed as Endangered in 2005. Enhancement of some currently Very Low habitat or other degraded habitat will be required to maintain the extent of suitable habitat that was present in 2005. There is no ongoing assessment quantifying habitat gains or losses, nor quantifying any possible effects on the population. A long-term habitat management plan, along with revised and effective BMPs, will be needed to address this issue.

It was beyond the scope of this assessment to perform an analysis of retained tree density by area for each licensee to see if the % area targets for each licensee had been met but such an assessment would be required to fully assess the effectiveness of the BMPs. That assessment would probably go best hand-in-hand with a long-term habitat management plan.

RECOMMENDATIONS

The following recommendations are made based on the results of the assessments reported here.

1. Revise the WISA BMPs to make them clearer and simpler.
 - a. Revise and/or re-interpret “average live tree retention targets” to the average within the harvested area, i.e. not including Wildlife Tree Patches or other reserves,
 - b. Simplify the four levels to just two (e.g., 100-150 trees/ha, and >150 trees/ha),
 - c. Revise how Very Low habitat should be addressed and what retention would be suitable depending on stand conditions (How much habitat and what portion of the population could be effectively eliminated with the current BMPs?)
2. Continue annual desktop assessment of newly approved cutblocks within the AO for application of the WISA BMPs, and assess whether the plans meet the existing BMP targets, and whether the area targets for each tree density area being met.
3. Continue field assessments of cutblocks where the BMPs have been applied, including re-assessments of at least some blocks as occupancy may change over time.
4. Revise the Okanagan-Boundary WISA Area of Occupancy boundaries in areas to reflect current observations where few or no surveys were done prior to when the boundaries were drawn in 2006, using current survey data and using biophysical parameters, e.g. elevation, precipitation, temperature and BEC variant (see Gyug and St-Amand 2020).
5. Create and implement a long-term WISA habitat monitoring plan, as there is currently no such plan.
6. Continue to monitor WISA nest tree survival to predict long-term habitat needs because current nest trees (veteran Lw) are unlikely to be easily or quickly replaced.

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APPENDICES

Appendix 1. WHA WISA occupancy survey results, Boundary WISA AO, 2018-2020.

WHA Name	Year	WHA Area (ha)	N WISA nest trees known in WHA	Level 1 WISA found (April-early May)	WISA results for Level 2 Occupancy (June)
8-202	2018	50	1	2	Old nest re-occupied (WNB058)
8-203	2020	30.7	1	0	-
8-204	2018	45.7	1	0	-
	2020			2 (pair)	1 Active nest
8-205	2020	31.9	1	0	-
8-206	2019	40.3	1	0	-
8-207	2020	36.3	1	2	Probable pair but could not confirm nesting
8-208	2018	32.7	1	1	No WISA found
	2020			0	-
8-209	2020	46.5	2	1	Pair but could not confirm nesting
8-210	2018	40.1	2	1	Old nest re-occupied (WN317)
	2020			1	No WISA found
8-213	2018	36.5	2	1	No WISA found
8-215	2020	42.8	1	2	Pair but could not confirm nesting
8-216	2020	23.6	1	0	-
8-217	2020	27	1	0	-
8-218	2020	26.6	1	0	-
8-219	2020	21.9	1	0	-
8-220	2020	27.2	2	2	No WISA found
					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
8-221	2018	42.9	1	2	
8-222	2020	27.3	1	1	Female plus 1 unknown, could not confirm nesting
8-223	2020	41	1	2 (pair)	No WISA found
8-224	2020	39.3	1	1	No WISA found
8-225	2020	48.1	2	2 (pair)	No WISA found
8-310	2019	30.2	2	0	-
	2020			1	No WISA found
8-312	2018	61.4	2	2	New nest (WNB070) in old WTY (old nest trees WNB010 WNB023 WNB048 have fallen)
	2020			2	1 Active nest
8-313	2020	49.1	2	2	No WISA in WHA; 1 WISA 90 m N of WHA
8-315	2019	22.7	1	0	-
8-316	2020	41.1	2	1	No WISA found

WHA Name	Year	WHA Area (ha)	N WISA nest trees known in WHA	Level 1 WISA found (April-early May)	WISA results for Level 2 Occupancy (June)
8-354	2020	36.3	3	2	Pair but could not confirm nesting
8-364	2019	48.8	1	1	1 Male, nesting could not be confirmed
	2020			-	1 Active nest
8-366	2019	49.4	1	3	1 Male, did not appear to be nesting in WHA
	2020			Pair+1	1 Active nest
8-367	2020	46.9	2	0	-
8-379	2018	30.7	1	1	No WISA found
8-382	2019	32	1	0	-
	2020			1	Pair but could not confirm nesting
8-383	2019	82.3	3	1	No WISA found
8-384	2019	84.5	2	0	-
8-386	2020	49.4	1	0	-
8-387	2019	28.7	1	3	No WISA found
8-389	2018	46.2	2	3	WNB059 F present, M found dead, WN047 not occupied
8-392	2020	49.6	1	0	-

Appendix 2. Cutblock specifics and WISA occupancy results, Boundary 2018-2020.

Cut Block	≥Mod. (ha)	Low (ha)	Area (ha) within WISA AO	Reten- tion Target (/ha)	Leave Tree Spec summary	Previous CPB Surveys		WISA Obsns April-May 2020	WISA Obsns June 2020	Trees (>17.4 cm dbh) /ha				Comments
						N Pts	WISA Results			Mean Reten- tion	95% CI	Density Prior to Harvest (stumps+ retained Trees)	% Remo- val	
INTERFOR TFL 8														
06L-02	3.3	12.5	20.6	na	10 st/ha for nest tree + 100-120/ha over other diameter classes + retain decid	4	0	0	-	87.0	27.0	220.3	61	Cut fairly evenly throughout block
06L-03	2.5	25.1	29.3	na	10 st/ha for nest tree + 100-120/ha over other diameter classes + retain decid	4	0	0	-	113.0	18.2	316.3	64	Cut fairly evenly throughout block
07N-01	11.0	25.7	41.8	na	retain 50% FdLw 17.4-47.5, retain 95% FdLw >47.4, retain 90% PI snags >12.4, retain 90% other snags>17.4, retain 95% decid	8	3 near block	3 WISA inside block	1 active nest 50 m NE of block, male from nest foraging inside block; Other male mostly outside NW corner of block but drawn into block by CPB	157.5	52.4	370.0	57	Cut fairly evenly throughout block
07N-05	0.0	26.1	28.8	na	retain 50% FdLw 17.4-47.5, retain 95% FdLw >47.4, retain 90% PI snags >12.4, retain 90% other snags>17.4, retain 95% decid	5	0	0	-	144.0	39.2	194.0	26	Steeper portions of block cut in lanes used as skidder trails.
07N-07	0.4	42.4	42.7	na	retain 50% FdLw 17.4-47.5, retain 95% FdLw >47.4, retain 90% PI snags >12.4, retain 90% other snags>17.4, retain 95% decid	5	0	1 WISA in block, 3 WISA outside block	2 WISA in block, but nesting, if any, was outside block	105.5	35.9	233.2	55	Probably logged in 1950's and then logged again in 1980's resulting in very little LWD.
07N-08	10.6	38.0	52.6	na	retain 50% FdLw 22.4-52.5, retain 95% FdLw >52.4, retain 90% PI snags >12.4, retain 90% other snags>17.4, retain 95% decid	2	1	Several WISA inside block	2 Male WISA, no nesting	97.0	14.7	240.3	60	Cut fairly evenly with many remnant veteran trees.
07N-09	0.0	44.6	45.7	na	retain 50% FdLw 17.4-47.5, retain 95% FdLw >47.4, retain 90% PI snags >12.4, retain 90% other snags>17.4, retain 95% decid	1	0	Pair plus other WISA in block	No WISA found	169.0	52.9	312.3	46	
07N-22	0.0	16.6	37.8	na	retain 50% FdLw 22.4-52.5, retain 95% FdLw >52.4, retain 90% PI snags >12.4, retain 90% other snags>17.4, retain 95% decid	3	1 near block	0	-	142.8	40.6	361.3	60	
07N-23	0.0	5.7	5.8	na	retain 95% FdLw >62.4; retain 95% decid	0	-	1 WISA outside block	1 active nest 120 m inside block on June 19 with yg >2 weeks away from fledging but nest probably not successful, inactive on June 28	5.6	6.9	325.6	98	Block partially outside AO, so BMPs apparently not applied, even though the SP states that they were applied.
07N-24	14.3	14.1	29.7	na	retain 50% FdLw 17.4-47.5, retain 95% Fd >47.4, retain 95% Lw >17.4, retain 90% PI snags >12.4, retain 90% other snags>17.4, retain 95% decid	1	0	Pair WISA in block	No WISA found	172.0	73.6	302.0	43	
07P-02	9.8	14.9	32.1	115	SU1: retain 95% FdLw >52.4, retain 30% <52.4; SU2: retain 95%>52.4, retain 40% <52.5, retain 95% decid	6	0	Pair plus other WISA inside block	1 active nest inside block + 1 other Male in separate area of block	216.0	44.0	324.9	34	Cut fairly evenly.
07P-05	14.9	15.8	32.0	108	retain 95% FdLw >57.4, retain 40% <57.4; retain 95% decid	5	0	Pair + 1 WISA	No WISA found	133.0	35.2	179.7	26	North slope of block very thick, cut in skidder lanes
07P-06	9.5	11.7	22.2	116	retain 95% FdLw >57.4, retain 40% <57.4; retain 95% decid	8	0	1 WISA outside	No WISA found	138.0	29.6	201.3	31	
07P-08	10.0	18.0	28.3	125	retain 95% FdLw >52.4, retain 30% <52.4; retain 95% decid	0	-	1 WISA outside	No WISA found	134.0	61.0	284.0	53	Skidder lanes appear to be very wide and are effectively non-habitat.
07P-09	3.8	4.0	13.1	101	retain 95% FdLw >57.4, retain 40% <57.4; retain 95% decid	2	0	0	-	188.3	53.3	299.4	37	
07P-10	7.3	0.9	39.7	131	retain 95% FdLw >52.4, retain 50% <52.4; retain 95% decid	4	0	0	-	144.3	45.9	258.6	44	Lower portion cedar – not suitable habitat, no plots
07P-11	1.4	9.8	35.4	136	retain 95% FdLw >52.4, retain 50% <52.4; retain 95% decid	4	0	0	-	136.0	41.7	236.0	42	Lower portion cedar – not suitable habitat, no plots
07Q-01	0.0	5.2	18.7	180	retain 95% FdLw >52.4, retain 30% <52.4; retain 95% decid	0	-	1 WISA	Same non-breeding male as in 07Q-02; only drawn into block by CPB, but also foraged there	105.0	62.9	316.1	67	Harvesting not complete; plots only done where harvesting completed (3 plots dropped)
07Q-02	1.8	14.0	17.4	180	retain 95% FdLw >52.4, retain 50% <52.4; retain 95% decid	0	-	1 WISA	1 non-breeding male	161.0	64.4	244.3	34	Fairly evenly cut; male consistently in block
07Q-03	0.7	22.4	28.3	172	retain 95% FdLw >52.4, retain 50% <52.4; retain 95% decid	1	0	At least 2 males in separate areas of block	1 active nest + 1 other male in separate area (going in and out of block) for which nesting could not be confirmed	153.3	23.9	271.1	43	Fairly evenly cut throughout.
07Q-04	0.1	11.4	32.1	130	retain 95% FdLwCw >52.4, retain 30% <52.4; retain 95% decid	1	0	0	-	126.0	16.7	299.3	58	Lower portion wet and was probably heavy to cedar, almost clearcut (no plots done there)
07Q-05	7.3	3.3	35.7	160	retain 95% FdLwCw >52.4, retain FdLwCw 50% <52.4; retain 95% decid	1	0	2 males + 1 unk	No WISA found	154.0	42.3	260.7	41	
07Q-07	10.9	17.0	63.5	150	retain 95% FdLwCw >52.4, retain FdLwCw 50% <52.4; retain 95% decid	5	0	0	-	208.0	43.9	291.3	29	Lower portion cedar – not suitable habitat, no plots

Cut Block	≥Mod. (ha)	Low (ha)	Area (ha) within WISA AO	Retention Target (/ha)	Leave Tree Spec summary	Previous CPB Surveys		WISA Obsns April-May 2020	WISA Obsns June 2020	Trees (>17.4 cm dbh) /ha				Comments
						N Pts	WISA Results			Mean Retention	95% CI	Density Prior to Harvest (stumps+ retained Trees)	% Removal	
07Q-08	4.9	20.8	37.4	110	retain 95% FdLwCw >52.4, retain 60% FdLw <52.4; retain 95% decid; retain 90% of snags	4	0	2 WISA	1 Male but not nesting	147.0	37.3	220.3	33	Many veteran Lw on lower portion of block, but male was on upper portion
07Q-09	6.2	22.6	41.6	180	retain 95% FdLwCw >52.4, retain FdLwCw 50% <52.4; retain 95% decid	2	0	At least 1 WISA inside block	1 active nest 73 m outside block (WISA also seen in block in Sept)	143.3	51.6	285.0	50	Some parts of block lighter cut than others (high variance)
07Q-13	0.0	11.8	12.1	140	retain 95% FdLw >52.4, retain 30% <52.4; retain 95% decid	0	-	Pair plus possible others inside block	Pair in block but could not confirm nesting	141.0	76.4	267.7	47	1. Overall 2. Close to and including Road (no stump count possible because most pulled) 3. Further from Road Post-stratified because area near road very heavily cut compared to areas further from road. Areas near road are unsuitable habitat.
										37.5	45.7		Est 90	
										210.0	79.6	393.3	47	
07Q-14	0.0	2.7	4.8	195	retain 95% FdLw >52.4, retain 50% <52.4; retain 95% decid	0	-	0	-	198.0	55.8	304.7	35	Very small block, cut fairly evenly.
NK'MIP FORESTRY N2R (for all Nk'mip and Osoyoos blocks, TU B is for roads and landings with no leave trees)-														
101-RM004	0.0	0.0	24.1	13/ha >50 cm dbh, 86/ha 20-50 cm dbh	TU A: retain 95% >49, retain 25% 20-50 (N.B. Updated 2018 WISA Suitability mapping identified more L in this block)	0	-	0	-					No habitat plots, density similar to RM005/006 but fewer large trees
101-RM005	12.4	18.6	35.2	31/ha >50 cm dbh, 63/ha 20-50 cm dbh	TU A: retain 95% >49, retain 20% 20-50	3	1 near block	M + 1 other, + 1 WISA outside	M from nest near RM006 was only drawn into block by CPB	88.0	13.8	321.3	73	Observed breakdown by dbh as in SP: 18/ha >50 cm, 70/ha 20-50 cm; Cut fairly evenly (low variance) but could have retained more regen and small trees to improve WISA habitat suitability.
101-RM006	0.8	1.2	35.4	42/ha >50 cm dbh, 57/ha 20-50 cm dbh	TU A: retain 95% >49, retain 20% 20-50 (N.B. Updated 2018 WISA Suitability mapping identified more L in this block)	1	1 near block	M + 2 pairs	2 active nests but not inside block, pair from 1 nest right on the boundary doing little foraging inside block	89.0	20.1	208.0	57	Observed breakdown by dbh as in SP: 17/ha >50 cm, 71/ha 20-50 cm; Same habitat comments as for RM005
OSOYOOS A93051														
89-SH004	0.0	2.5	25.7	na	TU A (east part of block): retain 90% Lw; TU C (west part of block): retain 90% Lw >24 cm 90% Fd >30 cm, retain 90% decid	3	0	At least 1 WISA inside block	No WISA in block; possible nest (pair seen near nest hole) 280 m NE of block	74.2	96.7	460.3	84	Overall TU A – was mostly PI stand – but WISA habitat suitability not maintained on portion of TU A where Fd dominant TU C; (highly variable density – young stand)
										24.3	18.2	433.8	94	
										233.3	466.1	522.2	55	
89-SH005	0.0	5.5	21.2	na	TU A: retain 90% FdLw >49 cm; TU C: retain 90% Lw >24 cm, retain 90% Fd "live over utilization", retain 90% decid; see block map for TU locations	4	0	0	No WISA found	32.1	31.8	394.0	92	Overall (Cutting too heavy, does not retain WISA habitat suitability or appear to meet BMPs) TU A TU C
										46.7	114.7	346.7	87	
										28.6	42.9	414.3	93	
89-SH006	6.9	31.1	39.4	na	TU A: retain 90% Fd >29, 50% Fd <30, 90% Lw >24, retain 90% decid	12	4 total	No WISA within block (1 WISA W of block)	No WISA found	37.7	17.2	402.8	91	Does not retain WISA habitat suitability or appear to meet BMPs- cutting too heavy over most of block
89-SH007	0.0	5.7	6.0	na	TU A: retain 90% FdSx over utilization, 90% Lw >29, retain 90% decid	2	0	WISA at W edge of block	No WISA found	38.1	39.7	480.0	92	Same as for SH006
89-SH008				na	Not in CH, BMPs not applied	0	-	1 drawn into block by CPB	No WISA found	Very Low				BMPs not applied, no habitat plots done.
89-SH009	0.0	6.0	8.5	na	TU A: retain 90% FdSx over utilization, 90% Lw >29, 25% Lw <30, retain 90% decid	6	1	0	No WISA found	46.7	53.7	465.0	90	Same as for SH006
89-SH012	3.1	32.8	38.8	na	TU A: retain 90% live FdLwPI >29 cm, retain 90% decid	7	0	1 WISA in block	No WISA found	40.1	31.8	451.0	91	Same as for SH006
89-SH013	0.0	11.8	12.6	na	TU A: retain 90% FdLw >34, 50% Fd 30-35, retain 90% decid	10	0	1 WISA near NW corner	No WISA found	38.1	36.8	403.5	91	Same as for SH006
BCTS														
A91511-3	0.0	2.3	60.5	na	Only 2.3 ha of block managed as TU 2: retain all Lw >27.4 cm dbh.	3	1 outside block	0	-	<5				No plots done, very low retention in WISA harvested area
A91512-1	0.0	1.7	41.6	na	The LOW WISA habitat was put into a Wildlife Tree Retention Area.	1	0	0	-	<5				No plots done, very low retention throughout block, 100% retention in WISA Low habitat.
A91513-4	0.0	2.1	79.8	na	The LOW WISA habitat was put into a Wildlife Tree Retention Area.	6	2 outside block	0	-	<5				No plots done, very low retention throughout block, 100% retention in WISA Low habitat.

Cut Block	≥Mod. (ha)	Low (ha)	Area (ha) within WISA AO	Retention Target (/ha)	Leave Tree Spec summary	Previous CPB Surveys		WISA Obsns April	WISA Obsns June	Trees (>17.4 cm dbh) /ha				Comments
						N Pts	WISA Results			Mean Retention	-	-	-	
2018-2019 Cutblocks										Tree density estimated in 2018-2019 from limited number of plots at CPB points in April, or from 100-m grid plots in 2017.				
NK'MIP FORESTRY														
A89003-2A	31.2	10.7	42.1	na	SP not requested	≥1	Many near block	1 in WTP	No WISA found	35				(Does not appear to meet BMPs)
A89003-6A	2.3	29.3	38.9	na	SP not requested	≥1	0	0	-	<35 est.				(Does not appear to meet BMPs)
A89003-1	0.0	3.6	15.0	na	SP not requested	0	-	0	-	70				Partial Cutting appears suitable for WISA
A89003-5	0.0	14.0	15.6	na	SP not requested	≥1	1 near block	0		<35 est.				(Does not appear to meet BMPs)
BCTS														
A92598-1	0.0	24.4	29.6	68	SP judged habitat to be Very Low, rather than Low as mapped, so did not apply the BMPs.	≥1	1 near block	1 in block	Nest in block, 3 m from edge	4				4/ha throughout block, 36/ha in the single ha near WISA nest; (Does not meet BMPs)
A92598-3	0.0	26.9	29.8	na	Retain 20/ha plus some additional retention to meet overall average of 85-125/ha including wildlife tree reserves.	≥1	1 near block	0	-	35				(Does not appear to meet BMPs)
A92598-5	0.1	10.5	10.7	na	Retain 20/ha plus some additional retention to meet overall average of 85-125/ha including wildlife tree reserves.	0	-	0	-	25				Tree density does not include riparian strips; (Does not appear to meet BMPs)
A92599-1	0.0	17.2	32.9	40	SP judged habitat to be Very Low, rather than Low as mapped, so did not apply the BMPs.	≥1	1 near block	1 drawn into block by CPB	Nest in forest near block, not foraging in block	15				Tree density does not include sparse trees retained on narrow terrace slopes; (Does not appear to meet BMPs)
A92599-2	2.5	6.4	51.9	na	Retain 20/ha plus some additional retention to meet overall average of 85-125/ha including wildlife tree reserves.	≥1	1 near block	0	-	23				Tree density does not include sparse trees retained on narrow terrace slopes; (Does not appear to meet BMPs)
A92599-4	0.0	9.3	9.3	na	Retain 20/ha plus some additional retention to meet overall average of 85-125/ha including wildlife tree reserves.	≥1	0	0	-	56				(Does not appear to meet BMPs)
A93521-4	0.0	23.7	29.5	48-52	Retain 25-29/ha FdLw and 23/ha deciduous	≥1	0	0	-	50				Tree density very patchy, does not include riparian strips (Does not appear to meet BMPs)
West Boundary Community Forest														
K4E008-01	0.0	3.2	6.6	na	No WISA habitat noted in SP, so BMPs not applied	0	-	0	-	6				(Does not appear to meet BMPs)
MY104	0.0	6.0	6.1	na	SP not requested	≥1	0	0	-	15				(Does not appear to meet BMPs)
MY103	0.0	0.3	25.9	na	SP not requested	≥1	0	0	-	13				(Does not appear to meet BMPs)
MY101	0.0	1.1	14.8	na	SP not requested	0	-	0	-	20				(Does not appear to meet BMPs)
Interfor TFL 8														
06L-01	9.5	21.2	41.1	na	SU 1: 10 st/ha for nest tree + 100-120 over other diameter classes + retain decid SU 2: Very Low so BMPs not applied	≥1	0	0	-	223				Density is for SU 1 only.

Partial summary of Habitat Plot results in cutblocks 2020.

Cut Block	N Plots 2020	Density (/ha) in the harvested areas*								Basal Area Leave Trees >17.5-cm dbh (m²/ha)	Volume (m³/ha)		
		Leave Trees >17.4-cm dbh	Leave Trees >52.4-cm dbh	Snags >22.4 cm dbh (WTC 3-7)	Snags >52.4 cm dbh (WTC 3-7)	Recent Stumps >17.4-cm dsh	Suitable Nest Trees	Large Thatch Ant Nests (<i>F. rufa</i> sp group)	LWD		SWD	LWD	CWD
06L-02	10	87	7.0	5.0	2.0	133	0.0		0.0	9.8	35	78	113
06L-03	10	113	9.0	2.0	0.0	203	0.1		5.0	12.9	36	22	58
07N-01	16	158	13.1	7.5	0.6	212	0.0	0.0	37.5	15.8	25	55	80
07N-05	10	144	4.0	13.0	3.0	50	0.1		10.0	15.1	32	7	38
07N-07	10	107	3.0	2.0	1.0	127	0.0	0.0	10.0	9.6	19	42	62
07N-08	10	97	14.0	8.0	3.0	143	0.5	0.0	50.0	12.3	25	54	79
07N-09	10	169	1.0	7.0	2.0	143	0.0	0.0	50.0	11.7	34	17	51
07N-22	9	143	7.8	1.1	0.0	219	0.2	0.0	33.3	12.7	24	23	48
07N-23	5	6	4.8	0.4	0.0	320	1.0	0.0	80.0	1.5	33	43	76
07N-24	10	172	9.0	13.0	3.0	130	0.0	0.0	35.0	16.6	23	33	56
07P-02	15	216	16.0	2.0	0.7	109	0.1	0.0	13.3	19.1	30	53	83
07P-05	10	133	3.0	6.0	1.0	47	0.0		15.0	12.3	39	75	114
07P-06	10	138	14.0	7.0	2.0	63	1.5		30.0	16.9	32	84	116
07P-08	10	134	4.0	9.0	0.0	150	0.2		20.0	11.5	60	31	91
07P-09	6	188	1.7	1.7	0.0	111	0.0		0.0	15.8	20	50	70
07P-10	7	144	10.0	10.0	2.9	114	0.0		0.0	17.4	36	28	65
07P-11	5	136	4.0	0.0	0.0	100	0.0		10.0	11.9	33	19	53
07Q-01	6	105	1.7	0.0	0.0	211	0.0		0.0	9.4	23	56	79
07Q-02	10	161	3.0	10.0	1.0	83	0.1		15.0	12.2	56	60	116
07Q-03	15	153	2.7	6.7	0.7	118	0.3		13.3	11.2	50	45	95
07Q-04	5	126	2.0	4.0	0.0	173	0.0		0.0	12.3	36	32	68
07Q-05	10	154	12.0	9.0	1.0	107	0.0		5.0	17.4	29	58	88
07Q-07	10	208	14.0	4.0	0.0	83	0.0		0.0	20.9	36	70	106
07Q-08	10	147	11.0	19.0	1.0	73	0.6		5.0	15.7	22	51	72
07Q-09	12	143	6.7	6.7	0.8	142	0.2		4.2	12.5	30	38	68
07Q-13	10	141	7.0	6.0	1.0	127	0.3	0.0	50.0	12.4	45	21	66
07Q-14	5	198	2.0	8.0	0.0	107	0.0		0.0	16.9	55	15	70
101-RM005	10	88	18.0	0.0	0.0	233	0.0	0.0	15.0	12.8	22	9	31
101-RM006	10	88	17.0	2.0	0.0	120	0.0	1.0	25.0	12.4	22	42	64
89-SH004	10	87	1.0	0.0	0.0	373	0.0	0.0	30.0	5.0	38	25	63
89-SH005	10	34	7.0	0.0	0.0	360	0.0	0.0	25.0	5.5	36	25	61
89-SH006	10	40	3.0	0.0	0.0	363	0.0	0.0	35.0	3.8	32	24	55
89-SH007	5	40	4.0	0.0	0.0	440	0.0	0.0	40.0	3.6	32	33	65
89-SH009	6	90	1.7	0.0	0.0	375	0.0	0.0	58.3	5.8	39	12	51
89-SH012	10	41	3.5	0.3	0.3	410	0.5	0.0	40.0	5.4	22	8	29
89-SH013	10	46	9.0	0.0	0.0	358	0.5	0.0	25.0	8.2	14	27	42
WL411-1	10	433	8.0	0.0	0.0	83	0.0	0.0	25.0	38.6	13	0	13

* not including roads and landings for RM and SH blocks

Appendix 3. WISA Nest Tree status for trees checked in 2018-2020 9 for Wildlife Tree Code means tree has fallen.

Nest Tree GPS Mark	Year Checked	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 (2018-2020; 66 nests checked of 118 known prior to 2018)								
WN006	2020	8-216	1995	Lw	2	2	1	
WN007	2020	8-217	1995	Lw	4	4	1	
WN008	2020	8-218	1995	Lw	2	2	1	
WN011	2018&20	8-382	1996	Lw	2	7	0	
WN013	2020	8-219	1996	Lw	6	6	1	
WN016	2019	8-387	1997	Lw	2	9	0	
WN017	2020		1997	Lw	2	2	1	
WN019	2018	8-389	1997	Lw	2	9	0	Cut down ~2003 for firewood
WN020	2020		1997	Ew	4	9	0	Fallen by 2008
WN025	2020	8-205	1998	Lw	5	NR	0	Tree decayed beyond suitability by 2006
WN026	2020		1998	Ew	6	9	0	Fallen by 2008
WN028	2020		1998	Lw	2	2	1	
WN029	2020		1998	Lw	2	2	1	
WN033	2020		1999	Sx	4	9	0	Fell by 2005
WN045	2020		2003	Lw	2	2	1	
WN046	2020	8-215	2003	Lw	2	5	1	
WN047	2018&19	8-389	2003	Lw	2	4	1	Counted 78 cavity nest holes in tree
WN205	2020		2004	Lw	2	2	1	
WN212	2019	8-383	2004	Lw	6	6	1	
WN213	2019	8-383	2004	At	6	7	1	
WN214	2020	8-354	2004	Ew	6	9	0	
WN215	2020	8-209	2004	Lw	2	7	0	Broken in half
WN217	2020	8-207	2004	Lw	2	5	1	
WN218	2020	8-209	2004	Lw	5	9	0	
WN221	2020	8-223	2004	Lw	3	3	1	Pair interested in different tree
WN222	2020	8-220	2004	At	2	6	1	
WN223	2018	8-208	2004	Lw	2	2	1	
WN237	2020	8-225	2004	Lw	2	2	1	
WN238	2020	8-224	2004	Lw	6	9	0	
WN310	2020	8-203	2005	Lw	2	2	1	
WN311	2018	8-213	2005	Lw	2	2	1	
WN317	2018	8-210	2005	Lw	2	2	1	
WN318	2020	8-354	2005	Ew	6	9	0	
WN320	2020	8-222	2005	Lw	2	2	1	
WNB002	2020	8-316	2006	Lw	2	2	1	
WNB003	2020	8-392	2006	Lw	2	2	1	
WNB004	2020	8-313	2006	Fd	6	9	0	
WNB005	2018	8-312	2006	Lw	6	6	1	
WNB006	2020	8-220	2006	At	3	6	1	
WNB009	2020		2006	Ew	2	9	0	
WNB010	2018	8-312	2006	At	2	9	0	
WNB014	2019		2006	Lw	2	2	1	
WNB015	2018		2006	Lw	2	4	1	
WNB016	2018&19		2007	Lw	2	2	1	

Nest Tree GPS Mark	Year Checked	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
WNB017	2018		2007	Lw	2	2	1	
WNB018	2020	8-313	2007	Lw	2	6	1	
WNB021	2018	8-383	2007	At	3	7	0	
WNB022	2020	8-354	2007	Lw	4	4	1	
WNB023	2018	8-312	2007	At	6	9	0	
WNB024	2020	8-367	2007	At	5	6	1	
WNB028	2020	8-225	2007	At	2	7	1	
WNB030	2018		2007	Lw	2	2	1	
WNB031	2020		2007	Lw	2	2	1	
WNB032	2020	8-316	2007	Lw	4	4	1	
WNB033	2018		2008	Lw	2	2	1	
WNB034	2020	8-367	2008	At	2	5	1	
WNB035	2019	8-366	2008	Lw	2	2	1	
WNB036	2020	8-364	2008	Lw	2	2	1	Trunk broken half-way at old nest cavity, still nesting below that point
WNB038	2018	8-379	2008	Lw	2	2	1	
WNB040	2020	8-386	2010	Lw	NR	6	1	
WNB041	2018		2012	Lw	2	2	1	
WNB042	2018		2012	Lw	2	2	1	
WNB048	2018		2012	Py	3	9	0	
WNB058	2018	8-202	2012	At	2	2	1	
WNB059	2018&19	8-389	2012	Lw	2	9	0	
WNB061	2018&19		2012	Lw	2	2	1	
WNB065	2018		2012	Lw	2	2	1	
East Kootenay (all known nests listed here, n = 61)								
WNE501	2018/19	4-108	2004	Lw	5	6	1	
WNE502	2018/19	4-108	2005	Lw	2	2	1	
WNE001	2018/19	4-141	2006	Lw	2	2	1	
WNE002	2018/19	4-144	2006	Lw	2	2	1	
WNE003	2018/19	4-142	2006	Lw	2	2	1	
WNE004	2018/19	4-143	2006	Lw	2	2	1	
WNE005	2018/19		2006	Lw	2	2	1	
WNE006		(4-110)	2006	Lw	3			Nest in U.S. – not checked
WNE007	2018/19	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	2018/19	4-138	2007	Fd	3	4	1	
WNE011	2018/19	4-129	2007	Fd	2	7	0	
WNE012	2018/19	4-136	2007	Fd	2	2	1	
WNE013	2018/19	4-137	2007	Lw	2	2	1	
WNE014	2018/19	4-128	2007	Lw	2	2	1	
WNE015		4-143	2007	Lw	2			Not checked in 2018/19
WNE016	2018/19	4-139	2008	Lw	2	4	1	
WNE017	2018/19	4-188	2008	Lw	3	3	1	
WNE018	2018/19	4-187	2008	Lw	2	2	1	
WNE019	2018/19	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

Nest Tree GPS Mark	Year Checked	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
WNE021		4-183	2008	Lw	2			Not checked in 2018/19
WNE022	2018/19	4-202	2008	Lw	2	2	1	
WNE023	2018/19	4-193	2008	Fd	5	7	0	
WNE024	2018/19	4-191	2008	At	2	2?	1?	Could not determine which At the tree was; -presumed Okay
WNE025	2018/19	4-190	2008	Lw	2	2	1	
WNE026	2018/19		2008	Lw	2	2	1	
WNE027	2018/19	4-128	2008	Lw	2	2	1	
WNE028	2018/19	4-137	2008	Lw	2	8	0	
WNE029	2018/19	4-127	2008	Lw	2	2	1	
WNE030	2018/19	4-196	2008	Lw	2	2	1	
WNE031	2018/19	4-201	2009	Lw	2	2	1	
WNE032	2018/19	4-186	2009	Lw	2	2	1	
WNE033	2018/19	4-200	2009	At	2	2	1	
WNE034	2018/19	4-198	2009	At	3	2	1	
WNE035	2018/19	4-189	2009	At	2	2	1	
WNE036	2018/19	4-195	2009	At	2	6	0	
WNE037	2018/19	4-194	2009	At	2	2	1	
WNE038	2020		2009	At	2	2	1	(Checked February 2020)
WNE039	2018/19	4-192	2009	At	2	5	1	NOFL in tree
WNE040	2018/19	4-182	2009	Lw	2	2	1	
WNE041	2018/19	4-184	2009	Lw	3	3	1	
WNE042	2018/19	4-185	2009	Lw	2	2	1	
WNE043			2009	Lw	2		?	Not checked in 2018/19
WNE044	2018/19	4-193	2011	Lw	2	7	0	
WNE045	2018/19	4-181	2011	Lw	2	2	1	
WNE046	2018/19	4-197	2011	Lw	2	2	1	
WNE047		4-199	2011	At	2	?	?	No notes made on tree status
WNE048	2018/19		2012	At	2	2	1	
WNE049	2018/19	4-139	2012	Lw	2	2	1	
WNE050	2018/19		2012	Lw	2	2	1	
WNE051	2018/19		2012	Lw	2	2	1	
WNE052	2018/19		2013	Lw	2	2	1	
WNE053	2018/19		2013	Lw	2	2	1	
WNE054	2018/19		2018	Lw	2	2	1	
WNE055	2018/19		2015	Lw	2	2	1	Location corrected in 2019.
WNE056	2018/19	4-200	2019	At	2		1	New nest 2019
WNE057	2018/19		2019	Lw	2		1	New nest 2019
WNE058	2018/19	4-202	2019	Py	2		1	New nest 2019
WNE059	2018/19	4-196	2019	Lw	2		1	New nest 2019
WNE060	2018/19		2019	Py	5		1	New nest 2019
Merritt area WHA Nests (n = 59 nest trees checked in 42 WHAs)								
WN204	2019	3-094	2004	At	3	3	1	
WN304	2019	3-095	2005	At	3	7	0	
WNA002	2019	3-096	1994	Ac[?]		?	?	Nest tree location not exact
WNA004	2019	3-096	1996	At		?	?	"
WNA005	2019	3-096	2003	At		?	?	"
WNL001	2019	3-127	2007	At		9	0	
WNM003	2019	3-090	2006	At	4	9	0	

Nest Tree GPS Mark	Year Checked	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
WNM004	2019	3-092	2006	At	2	9	0	
WNM005	2019	3-093	2006	At	3	9	0	
WNM007	2019	3-091	2006	At	2	7	0	
WNM014	2019	3-130	2006	At	2	9	0	
WNM016	2019	3-168	2007	At	2	9	0	
WNM020	2019	3-093	2007	At	2	2	1	
WNM023	2019	3-129	2007	At	6	9	0	
WNM028	2019	3-143	2007	At	2	2	1	
WNM029	2019	3-133	2008	At	3	9	0	
WNM030	2019	3-131	2008	Py	3	9	0	
WNM031	2019	3-135	2008	At	2	8	0	
WNM032	2019	3-137	2008	At	2	8	0	
WNM035	2019	3-130	2008	At	2	9	0	
WNM040	2019	3-129	2008	At	2	2	1	
WNM043	2019	3-142	2008	At	2	2	1	
WNM044	2019	3-134	2008	At	2	2	1	
WNM045	2019	3-139	2008	Fd	2	2	1	
WNM046	2019	3-133	2008	Py	2	9	0	
WNM047	2019	3-132	2008	At	2	9	0	
WNM049	2019	3-130	2009	At	4	9	0	
WNM050	2019	3-167	2009	At	2	9	0	
WNM054	2019	3-169	2010	At	6	6	1	
WNM057	2019	3-170	2011	At	2	2	1	
WNM058	2019	3-209	2012	Py	5	9	0	
WNM059	2019	3-210	2012	Fd	2	2	1	
WNM060	2019	3-208	2012	At	4	4	1	
WNM062	2019	3-211	2012	Py	4	9	0	
WNM063	2019	3-213	2012	At	2	2	1	
WNM064	2019	3-214	2012	At	4	6	1	
WNM065	2019	3-215	2012	At	2	2	1	
WNM066	2019	3-216	2012	At	2	2	1	
WNM075	2019	3-202	2012	At	2	2	1	
WNM078	2019	3-203	2012	At	3	9	0	
WNM079	2019	3-206	2012	At	2	2	1	
WNM080	2019	3-205	2012	Py	3	8	0	
WNM081	2019	3-204	2012	Py	3	3	1	
WNM082	2019	3-207	2012	Fd	3	3	1	
WNM083	2019	3-220	2012	At	2	3	1	
WNM084	2019	3-219	2012	At	3	7	0	
WNM085a	2019	3-217	2012	At	4	9	0	
WNM086	2019	3-210	2012	Py	3	3	1	
WNM087	2019	3-209	2012	Py	2	2	1	
WNM088	2019	3-208	2012	Fd	3	3	1	
WNM089	2019	3-132	2012	At	2	2	1	
WNM090	2019	3-212	2012	At	3	9?	0	
WNM092	2019	3-218	2012	At	2	7	0	
WNM096	2019	3-132	2015	At	?	9?	0	
WNM097	2019	3-092	2015	At	?	9	0	
WNM098	2019	3-131	2015	Py	?	4	1	
WNM099	2019	3-131	2015	Py	?	5	1	

Nest Tree GPS Mark	Year Checked	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
WNM100	2019	3-210	2015	Py	?	5	1	
WNM101	2019	3-214	2015	At	?	2	1	
Okanagan Nests (n = 80 nest trees checked of 100 total known)								
WN001	2020	8-106	1994	At	NR	NR	NR	2nd hand- location uncertain
WN002	2020	8-108	1994	Lw	2	2	1	(14 km signboard)
WN003	2020	8-106	1994	Lw	NR	NR	NR	2nd hand- location uncertain
WN010	2020	8-211	1996	Ew	6	9	0	Tree fallen by 2006
WN027	2020	P8-111	1998	Lw	2	2	1	
WN038	2020	8-101	2003	Sx	6	8	0	
WN040	2020	P8-117	2003	Py	2	4	0	
WN041	2020	8-102	2003	Lw	2	2	1	
WN042	2020	P8-119	2003	Lw	2	2	1	
WN043	2020	P8-120	2003	Lw	2	2	1	
WN044	2020	8-192	2003	Lw	2	2	1	
WN048	2020	8-108	2003	Lw	2	2	1	
WN049	2020	8-108	2003	Lw	2	2	1	
WN050	2020	8-108	2003	Lw	2	2	1	
WN051	2020	8-107	2003	Lw	2	2	1	
WN052	2020	P8-114	2003	Lw	2	2	1	
WN053	2020	8-106	2003	Lw	2	6	1	
WN203	2020	P8-114	2004	At	2	2	1	
WN209	2020	8-201	2004	Lw	2	2	1	
WN225	2020	8-103	2004	Lw	2	2	1	
WN226	2020	P8-307	2004	Lw	2	2	1	
WN227	2020	8-110	2004	Lw	2	2	1	
WN228	2020		2004	Lw	2	2	1	
WN229	2020	8-197	2004	Lw	2	4	1	
WN230	2020	P8-195	2004	Lw	2	2	1	
WN231	2020	8-194	2004	Lw	2	2	1	
WN232	2020	8-191	2004	Lw	2	2	1	
WN233	2020	8-190	2004	Lw	2	2	1	
WN234	2020	8-197	2004	Lw	2	2	1	
WN235	2020	P8-193	2004	Lw	2	2	1	
WN236	2020	P8-120	2004	Lw	2	3	1	
WN239	2020	8-106	2004	At	2	9	0	Tree fallen by 2016
WN305	2020	P8-198	2005	Lw	2	4	0	
WN306	2020	8-190	2005	Lw	6	6	1	
WN307	2020	8-199	2005	Lw	2	2	1	
WN308	2020	P8-200	2005	Lw	2	2	1	
WN309	2020	P8-196	2005	Lw	2	2	1	
WN314	2020	8-113	2005	At	2	6	0	
WN322	2020	8-110	2005	Lw	3	5	1	
WN325	2020	P8-212	2005	Py	4	9	0	
WN326	2020	8-197	2005	Lw	2	2	1	
WN327	2020	P8-114	2005	At	6	9	0	
WNK001	2020		2006	Lw	5	8	0	
WNK002	2020		2006	Lw	2	2	1	
WNK003	2020	8-103	2006	Lw	7	7	0	
WNK004	2020		2006	Lw	2	2	1	

Nest Tree GPS Mark	Year Checked	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
WNK005	2020	P8-112	2006	Lw	2	4	1	
WNK006	2020	P8-115	2006	Lw	2	9	0	could not find tree; probably cut during timber harvest
WNK007	2020	8-308	2006	At	2	2	1	
WNK008	2020	8-108	2006	Lw	2	2	1	
WNK009	2020	P8-306	2006	Lw	2	2	1	
WNK010	2020	P8-114	2007	Lw	2	2	1	
WNK011	2020	8-308	2007	At	2	2	1	
WNK012	2020	P8-123	2007	Ew	2	2	1	Large dead central stem, suckers still alive
WNK013	2020	P8-393	2007	Lw	2	4	0	
WNK014	2020	P8-119	2007	Lw	2	2	1	
WNK015	2020	8-108	2007	Lw	2	9	0	Tree cut down 2009
WNK016	2020	P8-120	2007	Lw	2	9	0	Tree removed, surrounding area cleared
WNK017	2020	P8-363	2008	Ew	2	2	1	
WNK018	2020	P8-112	2008	Lw	2	2	1	
WNK022	2020	8-355	2008	Lw	2	2	1	
WNK023	2020	P8-362	2008	Lw	2	2	1	
WNK024	2020	8-308	2008	At	2	2	1	
WNK025	2020	P8-200	2008	Lw	2	2	1	
WNK026	2020	8-356	2008	Lw	2	2	1	
WNK028	2020	8-101	2010	Lw	2	2	1	
WNK029	2020	P8-307	2010	Lw	2	2	1	
WNK031	2020	8-110	2010	Lw	2	2	1	
WNK033	2020	P8-124	2012	Lw	2	2	1	
WNK035	2020	P8-212	2013	Py	2	2	1	
WNK038	2020	8-108	2013	Lw	2	2	1	
WNK039	2020	8-108	2013	Lw	2	2	1	
WNK040	2020	8-108	2013	Lw	2	2	1	
WNK043	2020	P8-123	2014	Ew	2	2	1	dead central stem
WNK044	2020	P8-116	2015	Lw	2	2	1	
WNK045	2020	P8-122	2015	Lw	2	2	1	
WNK046	2020	P8-115	2015	Lw	2	2	1	
WNK047	2020	P8-115	2015	Lw	2	2	1	
WNK048	2020	P8-115	2019	Lw	2	2	1	
WNK050	2020		2019	Lw	2	2	1	

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 (e.g. 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

Appendix 5. Habitat Plot Field Data Collection Forms.

There are two reference data sheets (Pages 1/2 and Wildlife Trees).

The Field Data Forms are meant for a single plot per sheet.

The two field sheets are to be printed out on letter-sized paper double-sided and then folded in half to fit on a half-size clipboard that fits in a typical cruiser vest notebook pocket.

There is an Excel template meant specifically for entry of this data.

WISA Habitat Data 2020

Reference Pg. 1

Desktop: Make the harvested area (broken into treatment units if required) and reserves different strata. Place plots by stratum in GIS - either randomly without overlap or at intersection of 100-m grid. 100-m grid is only for fairly small areas. If >16 ha, either use random plots, or 150-m, or 200-m, etc. grid to reduce total number of plots. Check plot placement does not overlap strata boundaries, i.e., each plot at least 25 m from boundary.

Field: DO NOT move a plot from the planned point. If unsafe to do a plot, e.g. on a cliff or in a river, then drop plot. Roads or landings are okay if that is how the stratum has been laid out. Even if there are no trees, that is a valid result. Record any notes about plot site history (e.g. recently harvested, old high-grading, mature forest, road in plot).

Plot sheets are designed to be printed on 8.5x11" paper, fold on centerline to use on a half-size clipboard (which fits in a vest pocket), or in a 6-ring notebook binder.

Minimum plot radii in typical IDF forest:

9.77 m for 17.5-22.4 cm DBH trees;

11.28 m for 22.5 – 52.4 DBH trees/stumps,

17.84 m for ≥52.5 DBH trees/stumps and for all snags ≥22.5 DBH.

In Cuts: 9.77 m for stumps, 12.62 for trees if density 100-200, 17.84 for trees if < 100/ha, and larger plots for ST Cuts

Use smaller radii in dense young PI stands or SxBI stands.

Use the SAME plot size by DBH size class for all plots in a given stratum/stand for each survey area/block/WHA. Be CONSISTENT

Use either straight line route between points as **SNT** transects (e.g., 40-m x 100 m), or very large radius at the plot center.

Other Potential Plot Sizes

Circular Plot Radius (m)	50-m Trans. Total Width (m)	Plot Area (ha)	Plot Factor Tally x Factor = Density (/ha)
3.99	1	0.005	200
5.64	2	0.01	100
7.98	4	0.02	50
9.77	6	0.03	33.33
11.28	8	0.04	25
12.62	10	0.05	20
15.45		0.075	15
17.84	20	0.1	10
20.60		0.133	7.5
25.23	40	0.2	5
28.21	50	0.25	4
32.57		0.33	3
35.68	80	0.4	2.5
39.89	100	0.5	2
56.42	200	1.0	1

WISA Habitat Data 2020

Reference Pg. 2

Trees and Snags

Tally trees by 5-cm dbh classes as mid points. E.g., 25 = 22.5-27.4 cm dbh
WTC = Live (L or 1 or 2) or Dead (WTC 3 to 8) Record DBH for >60.

Stumps are WTC 9: Old rotten Cut Stumps (9O), recent cut stumps (9R) or Natural Stumps still in ground (9N). For stumps use Dia at Stump Ht (dsh)

Turned up stumps are CWD, not recorded on tree list.

Only Tally Dead ≥22.5 cm dbh in largest plot size.

Species = Py, Pl, Sx, Bl, Fd, At, Ac, Lw

Record C for Cavity seen: the letter is considered a tally mark.

Suitable Nest Tree plots usually overlap the Other Tree plots, therefore a SNT would be recorded in both plot types if it falls in both plots.

Radius used will depend on visibility. At a minimum use 17.84 m radius, but often much larger.

Suitable WISA nest trees will almost always have both old and new nest cavities of the size made and used by sapsuckers (3-5 cm diameter), as trees are used for many years.

Do NOT count trees with:

- only old nest cavities, (e.g. punky old Fd WTC 8)
- only small (<3-cm diameter) typical of chickadees and nuthatches,
- only with very old large cavities (>5-cm diameter) typical of NOFL, or

Nest cavities will sometimes be high up on the tree, and not visible from the ground on very tall large trees or snags-check carefully on large Lw

Suitable nest trees will most often be large to very large live Lw with obvious defects (broken top, dead top) or large dead Lw with that had obvious heart rot (when it was alive). **Do not** count fire-killed Lw that remain solid, i.e. did not have any decay before they were fire-killed.

Large aspen and birch are the next most used suitable nest trees. Only count if there are multiple cavities of the correct size, with some new and some old.

Other large conifers are rarely used, so be cautious before including these. Make sure the cavities are of the right size, and there are some new cavities and some old. Be sure to distinguish nest cavities (round entrances) from large woodpecker feeding holes. Tree decay class 8 snags of any species (very decayed and soft, usually <6-m tall), are not suitable nest trees.

CWD transects only measure the diameter of the piece/log at the intercept with the transect line. Visually estimate the Large End Diameter (LED) to decide which class (LWD, SWD) it is in, or measure it if in doubt.

Tree calipers work best for CWD intercept-diameters.

Circle LWD measurement if LED within 2 m of transect line (for density).

Split CWD into LWD (LED ≥22.5 cm) and SWD (LED 7.5-22.4 cm) to allow comparisons with past data. The LED is what distinguishes LWD from SWD. E.g., the intercept can be as little as 8 cm for a log with LED ≥22.5 cm.

Sometimes SWD can have an intercept >22 cm if the log is intercepted lower on the bole than the DBH/LED.

Where the CWD is a branch or root piece, this is considered SWD, do not use the LED of the tree bole.

One Plot per Sheet

OBS: _____ **Date:** _____ **Pg#** _____

WHA- **or CP**

Tree/Snag/Stump Tally Plot ID _____ Time: _____

[illegible]

CWD Intercept Transects (25 m) SWD = LED 7.5-22.4, LWD = LED >22.4

Tran/ Length	Record Intercept Diameter (d) only for Classes 1-4 (to closest cm) e.g. 20 8 15 11 . . . (smallest to record = 8) Circle LWD if LED <2m from transect line for density + add other LEDs if within 2 m but do not cross transect (e.g. "+1 in")
North-SWD	
North-LWD	
East-SWD	
East-LWD	

WISA Suitable Nest Trees Can use large radius plot, or transect.

Plot Area (LxW) or Radius	Sp	WTC	DBH 5-cm Class	Number/Type/Size of Cavities and Comments

WISA Habitat Plot Data

One Plot per Sheet

OBS: _____ Date: _____ Pg# _____

WHA- **or CP**

Tree/Snag/Stump Tally **Plot ID**_____ **Time:**_____

[illegible]

CWD Intercept Transects (25m) SWD = LED 7.5-22.4, LWD = LED >22.4

Tran/ Length	Record Intercept Diameter (d) only for Classes 1-4 (to closest cm) e.g. 20 8 15 11 . . . (smallest to record = 8) Circle LWD if LED <2m from transect line for density + add other LEDs if within 2 m but do not cross transect (e.g. "+1 in")
North-SWD	
North-LWD	
East-SWD	
East-LWD	

WISA Suitable Nest Trees Can use large radius plot, or transect.

Plot Area (LxW) or Radius	Sp	WTC	DBH 5-cm Class	Number/Type/Size of Cavities and Comments

One Plot per Sheet

Date:_____ Pg#_____

or CP

Plot ID _____ Time: _____

[illegible]

CWD Intercept Transects (25m) SWD = LED 7.5-22.4, LWD = LED >22.4

Tran/ Length	Record Intercept Diameter (d) only for Classes 1-4 (to closest cm) e.g. 20 8 15 11 . . . (smallest to record = 8) Circle LWD if LED <2m from transect line for density + add other LEDs if within 2 m but do not cross transect (e.g. "+1 in")
North-SWD	
North-LWD	
East-SWD	
East-LWD	

Can use large radius plot, or transect.

Plot Area (LxW) or Radius	Sp	WTC	DBH 5-cm Class	Number/Type/Size of Cavities and Comments

One Plot per Sheet

OBS: _____ **Date:** _____ **Pg#** _____

or CP

Tree/Snag/Stump Tally Plot ID _____ Time: _____

[illegible]

CWD Intercept Transects (25m) SWD = LED 7.5-22.4, LWD = LED >22.4

Tran/ Length	Record Intercept Diameter (d) only for Classes 1-4 (to closest cm) e.g. 20 8 15 11 . . . (smallest to record = 8) Circle LWD if LED <2m from transect line for density + add other LEDs if within 2 m but do not cross transect (e.g. "+1 in")
North-SWD	
North-LWD	
East-SWD	
East-LWD	

WISA Suitable Nest Trees Can use large radius plot, or transect.

Plot Area (LxW) or Radius	Sp	WTC	DBH 5-cm Class	Number/Type/Size of Cavities and Comments

LIVE		DEAD			DEAD FALLEN			
		Hard			Spongy	Soft		
1	2	3	4	5	6	7	8	9
					approx. 2/3 original height 	approx. 1/2 original height 	approx. 1/3 original height 	
Live/healthy; no decay; tree has valuable habitat characteristics such as large, clustered or gnarled branches, or horizontal, thickly moss-covered branches.*	Live/unhealthy; internal decay or growth deformities (including insect damage, broken tops); dying tree.*	Dead; needles or twigs may be present; roots sound.	Dead; no needles/twigs; 50% of branches lost; loose bark; top usually broken; roots stable.	Dead; most branches/bark absent; some internal decay; roots of larger trees stable.	Dead; no branches or bark; sapwood/ heartwood sloughing from upper bole; decay more advanced; lateral roots of larger trees softening; smaller ones unstable.	Dead; extensive internal decay; outer shell may be hard; lateral roots completely decomposed; hollow or nearly hollow shells.		Debris; downed trees or stumps.

WTC Codes: Note that 2, 3 4, or 5 may have broken tops, and may have heart rots.

Decay Types: DT = Dead Top; BT = Broken Top; CF = Cake Fork; HR = Heart Rots; FS = Basal Fire Scars into Heartwood; INJ = Physical Injuries to sapwood; DOTR = Double Trunk; DDTR = Dead trunk (if multiple); and write out others as applicable.

Use this key for Broad-leaved trees as well as Conifers. Do NOT use the 1 to 5 Broad-leaved WTC scale.

Stumps are 9-Cut ("9C") if not aged, but for this project we need to know if they are old or recently harvested: Old "9O" or Recent "9R".

Woody Debris (WTC9) (logs and upturned stumps) are recorded separately under LWD/SWD and not in the tree columns.

For this project, WTC Live (1 and 2) can be grouped, except for veteran or Very Large (>60 cm dbh) trees.

If a tree has cavities, that is a defect that puts it into WTC2.