

Williamson's Sapsucker Okanagan Occupancy Monitoring 2020

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ABSTRACT

This report continues the Williamson's Sapsucker (WISA) assessment of Wildlife Habitat Areas (WHAs) and WISA Best Management Practices (BMPs) begun in 2017 by assessing the Okanagan portion of the WISA Area of Occupancy (AO) in 2020. WISA breeding occupancy was assessed for 19 Wildlife Habitat Areas (WHAs), 22 proposed candidate WHAs, six harvested cutblocks, eight unharvested cutblocks, and three census areas (which included some of the WHAs) in May-June 2020.

WHA breeding occupancy was 22% Confirmed or Probable, and was 34% when Possible was included. This was similar for both approved and proposed WHAs, and was also similar to the WHA occupancy rates found in the Boundary. WISA were found in five of the six harvested cutblocks in May, but only one in June, and did not nest in any of them. Two WISA pairs nested right on the boundary of one block but did not use the harvested portion of the block.

The WISA nesting population of the Mt. Randolph census area was three active nests, the same as in 2008. The Okanagan Falls benchmark area continued its decline from seven nests in 2003 to only one in 2020. The Gregoire Creek census area was 11 nests when last checked in 2004 but only one nest in 2020. Possible reasons for that decline are unknown but appear to be local in scope, unrelated to timber harvest, and not range-wide.

Combining data from all regions in B.C., 89% of Western Larch found between 2003 and 2015 were still suitable for nesting in 2018-2020, but only 69% of those found between 1995 and 1998 were still suitable. Nest tree survival rates of Trembling Aspen and Water Birch were lower.

Recommendations were made to:

1. Determine whether the Site Plan tree retention targets were met for the six already-harvested cutblocks in the Okanagan,
2. Assess if the BMPs were being met, or were effective, and if not, examine how the BMPs might be better applied, or made more effective,
3. Develop a plan to assess WISA WHA effectiveness, identify foraging sites for nests within proposed WHAs, and field test any habitat portions of that plan later in 2020 in the Okanagan, and
4. Revise the Okanagan WISA Area of Occupancy boundaries in areas to reflect current data,
5. Monitor WHAs and BMP effectiveness in the southern portion of the WISA West AO (2021),
6. Continue annual desktop assessment of approved cutblocks within the AO for application of the WISA BMPs, and assess whether these meet the existing BMP targets,
7. Monitor long-term WISA nest tree survival to predict long-term habitat needs, and
8. Monitor long-term WISA population trends to determine if recovery goals are being met, both at a provincial-scale (annual monitoring) and at smaller scales in census areas.

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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 (GAR) stipulating 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 its objective of maintaining current 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), Kamloops, including some habitat plots. No effectiveness monitoring surveys had been undertaken in the Okanagan portion of the WISA AO prior to 2020

The purposes of this report for the was to:

1. Report Level 2 (June) WISA occupancy for the Okanagan portion of the WISA AO in:
 - a. all 19 approved WHAs and 22 proposed WHAs,
 - b. 6 cutblocks approved and harvested after 2014 that overlapped WISA Critical Habitat,
 - c. 8 cutblocks that have either not yet been approved or harvested that overlap with WISA Critical Habitat, and
 - d. 3 long-term census areas originally censused in 2003-2006, and that overlap with some of the WHAs referred to above,
2. Check on current nest tree condition while doing the occupancy monitoring of Bullet 1, and to summarize and estimate nest tree survivorship, and
3. Summarize and interpret the occupancy results from Bullet 1,
4. Conduct a preliminary assessment of the effectiveness of the BMPs in harvested cutblocks based on observed WISA breeding occupancy in the 6 harvested cutblocks of Bullet 1.

METHODS

Study Sites

Study sites were identified previously under a separate contract to FLNRORD in March 2020 (Figures 1-3). First, these included all the 19 approved WHAs and 22 proposed WHAs in the Okanagan. Secondly, these included 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. This included six cutblocks already harvested and eight that have yet to be harvested. Site Plans 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, and there were no proposed or approved BC Timber Sales blocks to which the criteria applied.

Occupancy Field Methods

The WHAs and cutblocks (Figures 1-3) were sampled for Level 2 occupancy from June 8-28, 2020. Methods have been described in Gyug (2016) but have been since slightly modified based on field trials and are summarized below. Level 1 Occupancy was not completed in 2020 because of late funding, but would have been completed if funding had come earlier. WISA are much more detectable in April as they establish breeding territories, so surveys are most efficient at that time. The six harvested cutblocks were sampled for WISA on May 27, 2020, in advance of the available funding for this project. These surveys were treated as Level 1 occupancy for the purposes of this report, and were sampled more intensively than cutblocks would normally be sampled in April.

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. Begin assessment at any previously known nests, should there be any and assess current nesting suitability of known nest tree.
3. If no WISA are detected at known nest sites, use at least 5 Call Playbacks (CPB) over 30 min. moving around entire site and listening for responses, or longer for sites >16 ha.
4. The assessment can be terminated as soon as any WISA are found since a later return will be required (Level 2) to attempt to confirm nesting.

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 visits to any old nests, and up to 30 minutes on sites ≤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.
3. Sites larger than 16 ha may take considerably longer to survey for breeding evidence.
4. Record locations and behaviour of all WISA detected and summarize the breeding activity observed using the Breeding Bird Atlas breeding evidence codes (see Appendix 4).

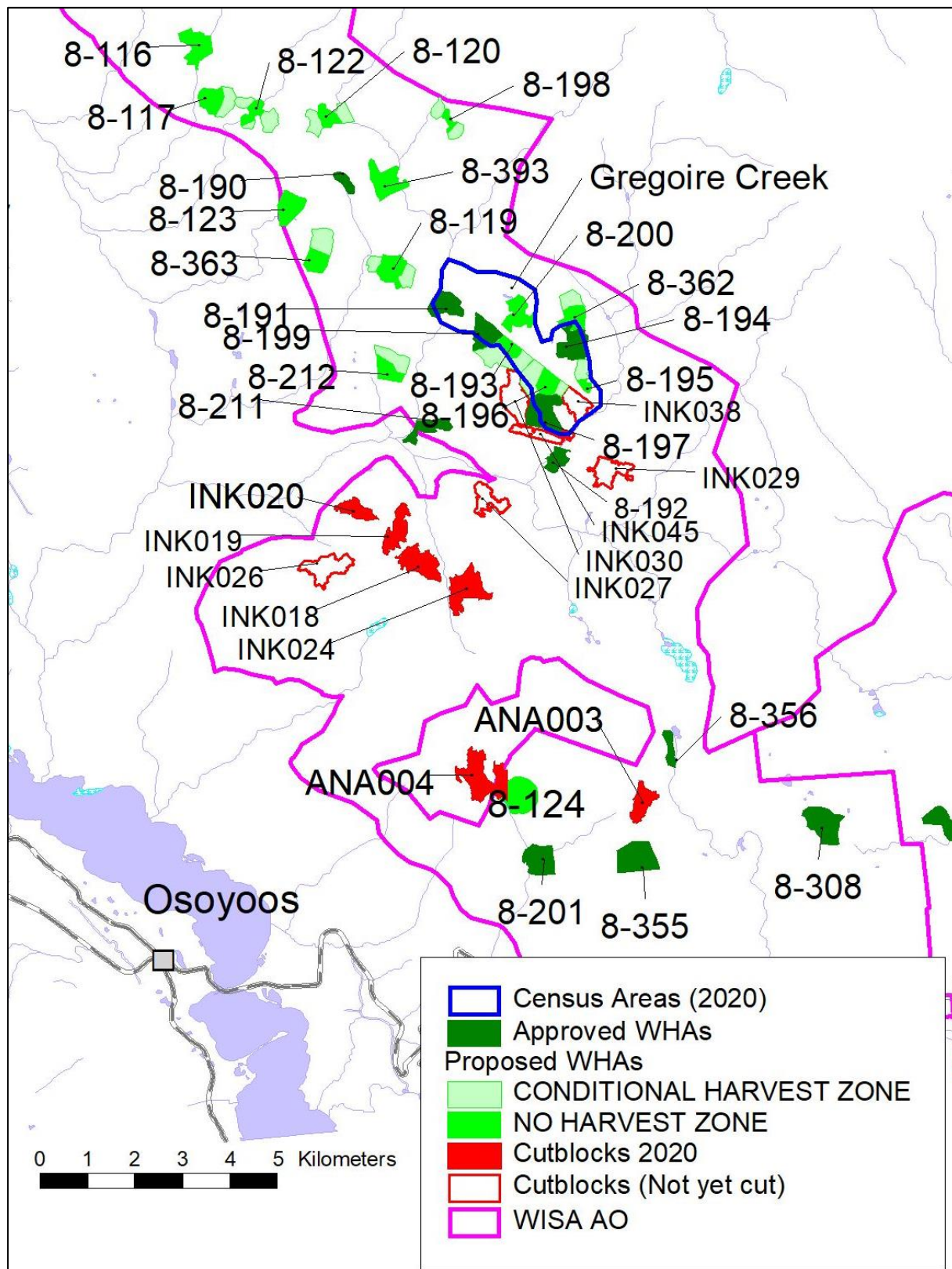


Figure 1. Locations of Cutblocks and WHAs for sampling in 2020 in the Okanagan AO east of Oliver and Osoyoos.

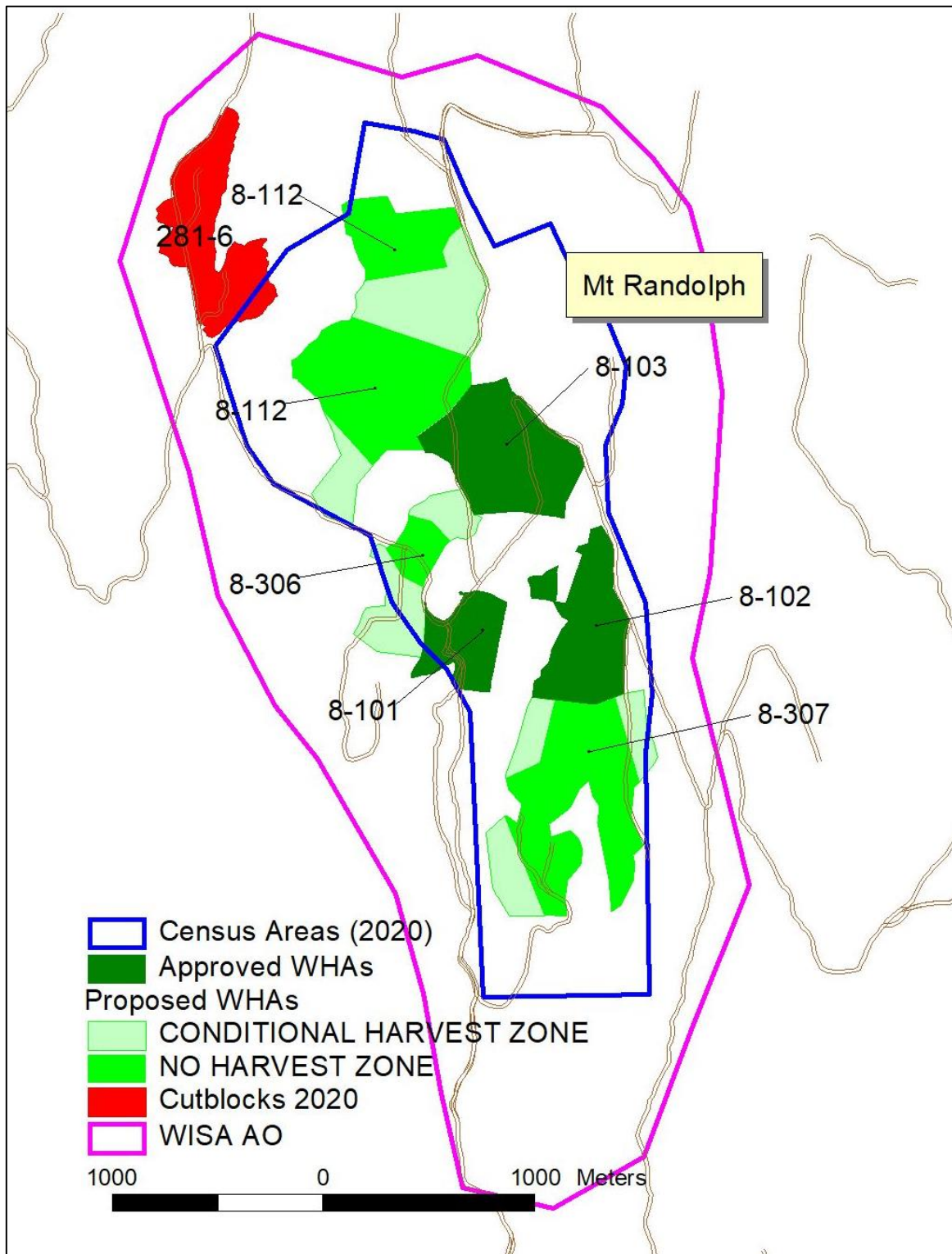


Figure 2. Locations of WHAs for sampling in 2020 in the Okanagan AO east of Naramata. Gorman's block CP281-6 at northwest corner was also surveyed.

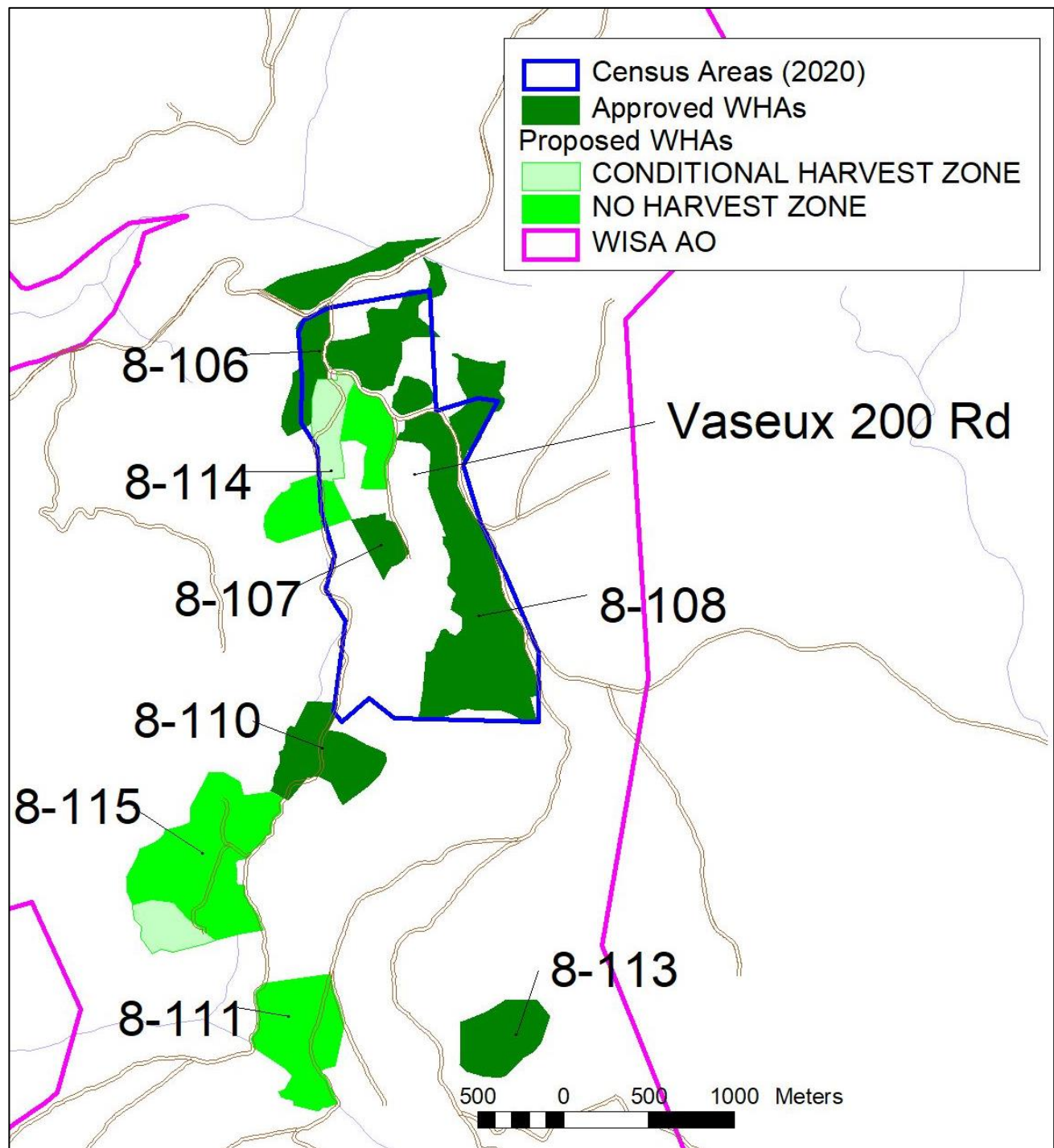


Figure 3. Locations of WHAs and Benchmark WISA area for sampling in 2020 in the Okanagan AO east of Okanagan Falls.

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 at roadsides, or a smaller pocket unit with 14-cm diameter speaker (FoxPro NX4 or equivalent) when doing intensive searches within a site.

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 with that point location recorded. For each WISA detection 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 (compass degrees) to each WISA detected. 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 generally did not do the full CPB protocol because WISA would be heard while walking away from a site, or even at the next CPB point, and the calls and/or drums used were varied to attempt to elicit responses. 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 walking to the WISA location and marking a GPS waypoint.

In this project, Level 1 checks were done late in May, but the same methodology was applied although extra time was taken to ensure that already-harvested cutblocks were thoroughly searched. Only Level 2 checks were done on cutblocks yet-to-be-harvested and on WHAs, so the methods were slightly different than when both Level 1 and 2 were done. We used CPB at every site, but these were not necessarily recorded as individual CPB points. The WHA or the cutblock was searched until WISA presence was confirmed, after which a nest search was undertaken, or until we were satisfied that WISA were not likely present. 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 other behavioural descriptions if needed to attempt to determine nesting status. Location and nest tree data were recorded for any new nest trees.

Re-census of three long-term census areas were also included in the Okanagan surveys in 2020 as monitoring method recommended by Gyug (2016). These areas all included a number of approved and proposed WHAs as well as some cutblocks that had yet to be cut. Description of sites and prior results of the benchmark Okanagan Falls site had been published by Gyug et al. (2007) with a further update in Appendix C of Gyug (2016). Each census area took three people a full day to sample, with later follow up where WISA were found but breeding activity could not be confirmed.

Data Management

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 were entered into the “CPB-DataEntry” sheet, and Census Areas surveyed first in April into its own sheet (“Census Areas April”). 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 (formerly named the “NestSearch_Visits-DigiDataEntry” sheet). There was a separate sheet for incidental detections of WISA or other species, and a separate sheet for looking up locations of all GPS points used for surveys (“Design Component Spatial Info” sheet which included CPB points, WISA points to be revisited, and any GPS points marked by the user during surveys) documenting locations of. These files were quality checked for formatting and for data entry errors. The excel file will be submitted to SPI in the fall at the end of the field season along with WISA data from any other regions or projects. The excel file was converted into the GIS shapefiles used for archiving all WISA call-playbacks and observations of the FLNRORD (formerly MOE, MELP or MWLAP) and CWS-sponsored projects (as well as some other WISA projects conducted concurrently). To date there are results from 21693 call playbacks and 6665 WISA observations (or negative observations where already-known locations may be revisited) in each of the two respective point shapefile sets.

RESULTS and DISCUSSION

WISA Occupancy Surveys

Level 2 (June) occupancy in the Okanagan WHAs in 2020 was 22% Probable and Confirmed breeding and 34% when including Possible breeding (Table 1). This was essentially the same for both approved and proposed WHAs. These levels of occupancy were also essentially the same to that found in WHAs in the Boundary from 2018-2020 (see Gyug 2019a, and unpublished data in preparation). 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).

Five of the six harvested blocks in the Okanagan area had previously had at least some surveys for WISA (Table 1, Appendix 2), as had all of the eight proposed cutblocks (Appendix 2). WISA had not been found in and near any of the already-cut cutblocks prior to 2020 (but the surveys had generally been cursory and along roadsides). WISA had been found in or near four of the eight blocks that have yet to be cut.

In May 2020, WISA were found in five of the six harvested blocks, but only in two of the same blocks in June. There was no breeding taking place in any of the blocks, although

two active nests were found right on the boundary on opposite sides of ANA004 (see BMP Assessment section).

Table 1. Williamson's Sapsucker occupancy summary, Okanagan area, 2020. See Appendices for detailed information on each site and Appendix 5 for the definitions of Possible, Probable and Confirmed nesting.

Type of Site	Occupancy Level 1 (April to early May)			Occupancy Level 2 (late-May to June)				
	Sites (N)	Occu- pied Sites (n)	Occu- pancy Rate (%)	Sites (N)	Prob. and Conf. Nesting		Poss., Prob. and Conf. Nesting	
					Sites (n)	Rate (%)	Sites (n)	Rate (%)
Okanagan WHAs								
Approved WHAs				19	4	21	6	32
Proposed WHAs				22	5	23	8	36
Total 2020				41	9	22	14	34
Boundary WHAs								
2018	9	8	89	9	3	33	4	33
2019	9	4	44	9	0	0	2	22
2020	28	18	64	28	9	32	11	39
Total*	38	24	63	38	9	24	12	32
Harvested Sites Okanagan								
Previously Surveyed for WISA*								
WISA presence known				0	0	0	0	0
Previously surveyed but no WISA detected				5	0	0	1	20
Not previously Surveyed				1	1*	100	1	100
Total				6	1	17	2	33

* counting WHAs checked in two years as half-weight for each year

Prior surveys in or near cutblocks may have consisted of as little as 1 CPB within 200 m of block, see Appendix 2 for individual block details.

In the eight cutblocks that had not yet been cut, a single WISA female was found at the edge of one of the blocks (INK026) in June 2020, with none found in any of the other seven. However, surveys were conducted in mid- to late-June when CPB surveys are not every effective, so negative results should not be considered conclusive.

Three long-term census areas were re-censused in the Okanagan in 2020 (Table 2) and one in the Boundary (Woodlot 411-1) which has been included for comparison. The Okanagan Falls census area seems never to have recovered from the timber harvesting of 2005-2006 and the nest density decline seems to be continuing (Table 2; Figures 4-5). While it was once the benchmark for WISA nest density in B.C., other areas have now eclipsed it. The nest density in the Mt. Randolph census area declined from 2006 to 2008, but then was the same in 2020 as in 2008, so does not appear to have declined any further. WISA nest density in Woodlot 411-1 has increased slightly since last censused in 2007.

Nest density in the Gregoire Creek census area has declined precipitously from 11 confirmed and probable nests in 2004 to just one in 2020. The reason for this decline is not known – there has been no timber harvesting within this census area since 2004 and all former nest trees were still in suitable nesting condition. However, a similar decline in relative abundance has been noted in the past two years (2019-2020) in annual WISA roadside monitoring along the Camp McKinney road that passes <1 km southwest of the Gregoire Creek census area (Figure 7). In the past two years, the number of WISA detected at 14 annual survey points in this area has dropped off precipitously from an average of 5.6 per survey (n = 15 surveys) from 2008-2018 to an average of only 1.3 in 2019-2020 (n = 3 surveys). It appears the downward trend in WISA detections and nesting is localized and relatively recent, i.e., unlikely to be due to habitat loss. The same sudden and dramatic reduction in numbers detected was not noted elsewhere on the annual road monitoring (L. Gyug and CWS, unpublished data; see Gyug 2014 for initial annual road survey results and survey point locations), nor in the other census areas, so is likely a localized phenomenon of an unknown cause or causes.

Table 2. Okanagan WISA Census Area results for WISA Level 2 (June) breeding activity, including the one census area in the Boundary.

Census Area	Year	Area (km ²)	N Active Nests	N Pairs (Probable nesting)	Confirmed Nest Density	Confirmed and Probable Nest Density	Comments
OK Falls	2003	2.26	6	1	2.65	3.10	23% of area clearcut with reserves in the 1980s
	2004	2.34	6	1	2.56	2.99	
	2006	2.34	5	0	2.14	2.14	26% (60 ha) timber harvested 2005-2006 (10-33 trees/ha residual)
	2007	2.34	3	0	1.28	1.28	
	2008	2.34	5	0	2.14	2.14	
	2009	2.34	2	0	0.85	0.85	
	2010	2.34	2	0	0.85	0.85	
	2013	2.34	4	0	1.71	1.71	
	2015	2.34	2	0	0.85	0.85	
	2020	2.34	1	0	0.43	0.43	1 other apparently unmated male
Mt. Randolph	2006	4.55	7	0	1.54	1.54	
	2007	4.55	5	0	1.10	1.10	Plus one other male on territory
	2008	4.55	3	1	0.66	0.88	
	2020	4.55	3	1	0.66	0.88	Plus one other male on territory
Gregoire Creek	2004	5.61	6	5	1.07	1.96	Plus one other male on territory; Fledged yg seen with 4 of the 5 pairs at the same time as the 6 active nests were still in nestling phase; Nest trees for 4 of the pairs and the one male were found later (2005-2008)
	2020	5.61	1	0	0.18	0.18	
Woodlot 411-1 (Boundary)	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"

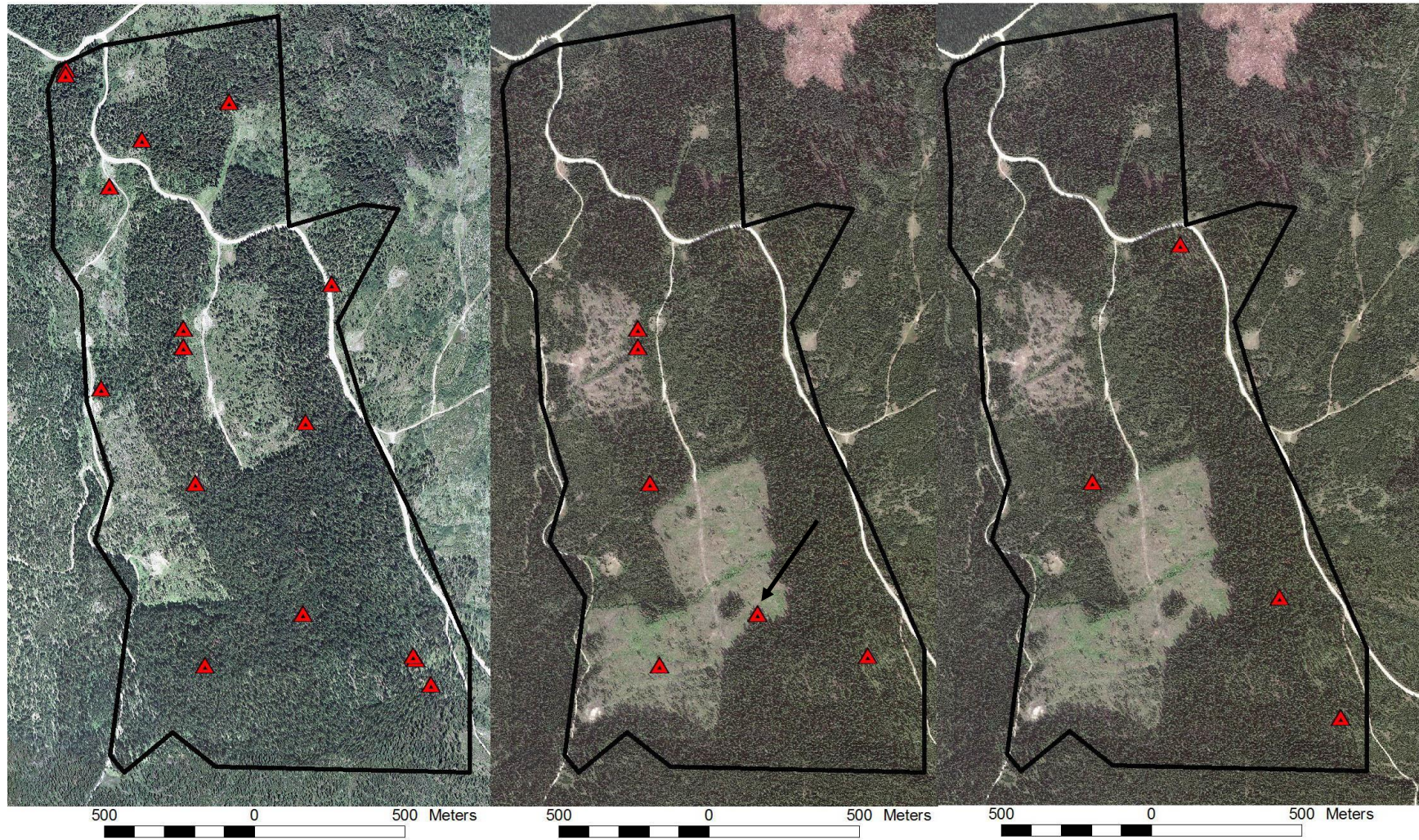


Figure 4. Williamson's Sapsucker nest locations (red triangles) in Okanagan Falls benchmark census area: left 2003-2008; middle 2008-2010; right 2013-2015. The only nest active in 2020 is shown with an arrow in the middle orthophoto. It is within a WHA but only a few meters from the edge of the 2005 clearcut. Figure modified from Appendix C of Gyug 2016.

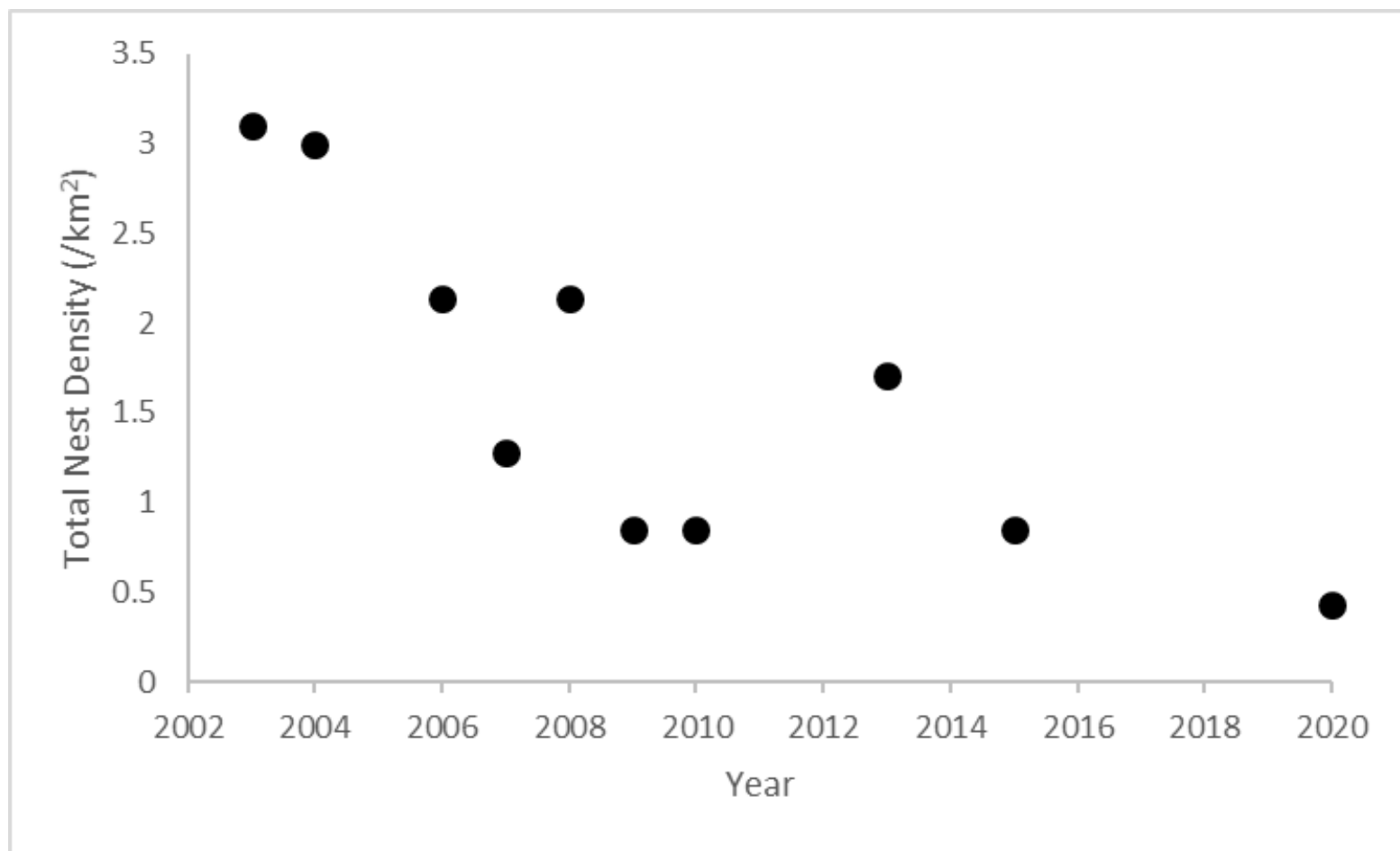


Figure 5. Total Nest Density (Confirmed and Probable) in the Okanagan Falls benchmark census area from 2003 to 2020.

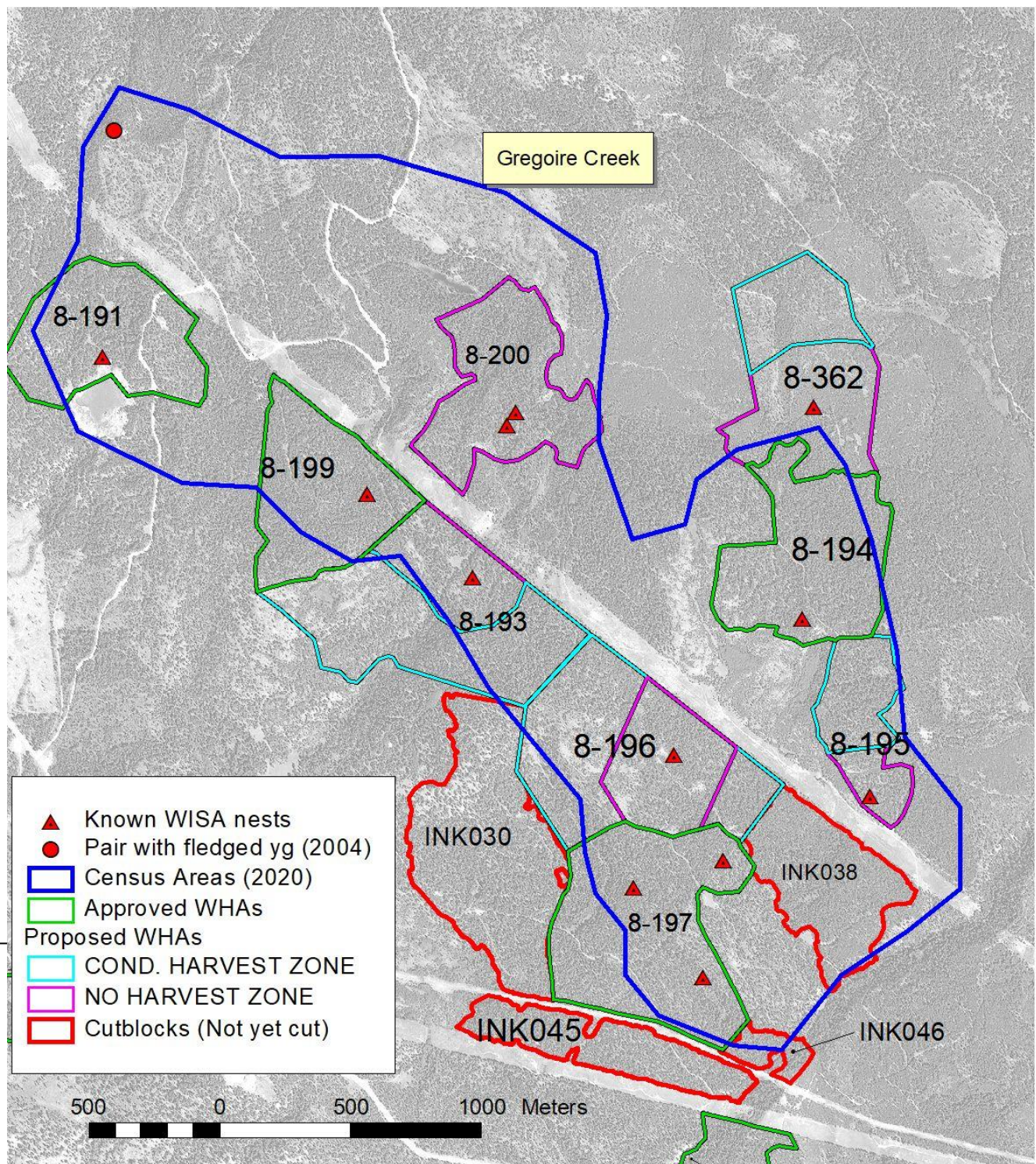


Figure 6. Known WISA nest locations in Gregoire Creek census area from all years. Only the nest in WHA 8-199 was active in June 2020, no other WISA were found in the census area.

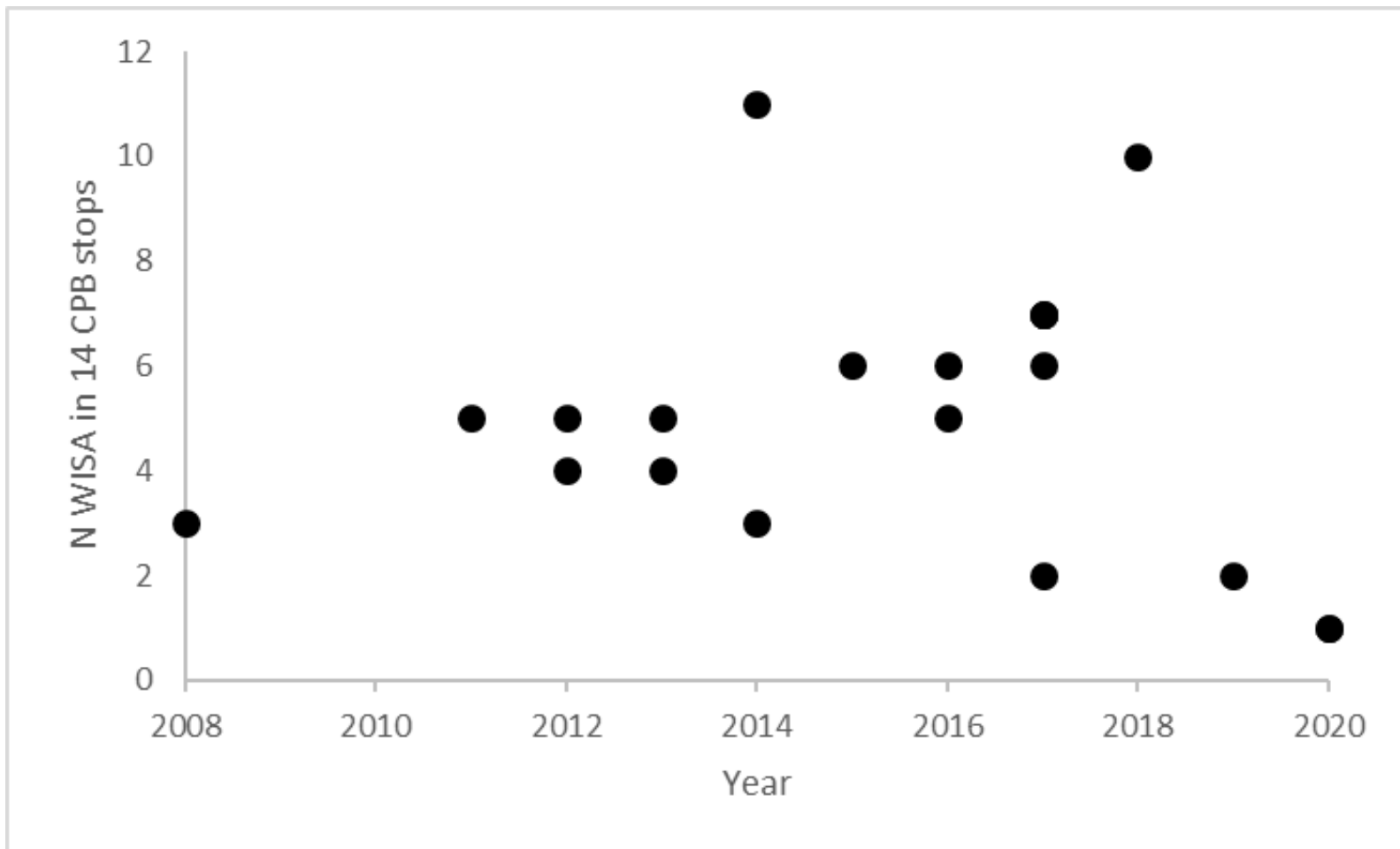


Figure 7. Number of WISA detected from 14 CPB stops along the Camp McKinney (Baldy) road at 800-m intervals during late March or April from 2008 to 2020. Note that there were two surveys in 2020, both only detecting 1 WISA.

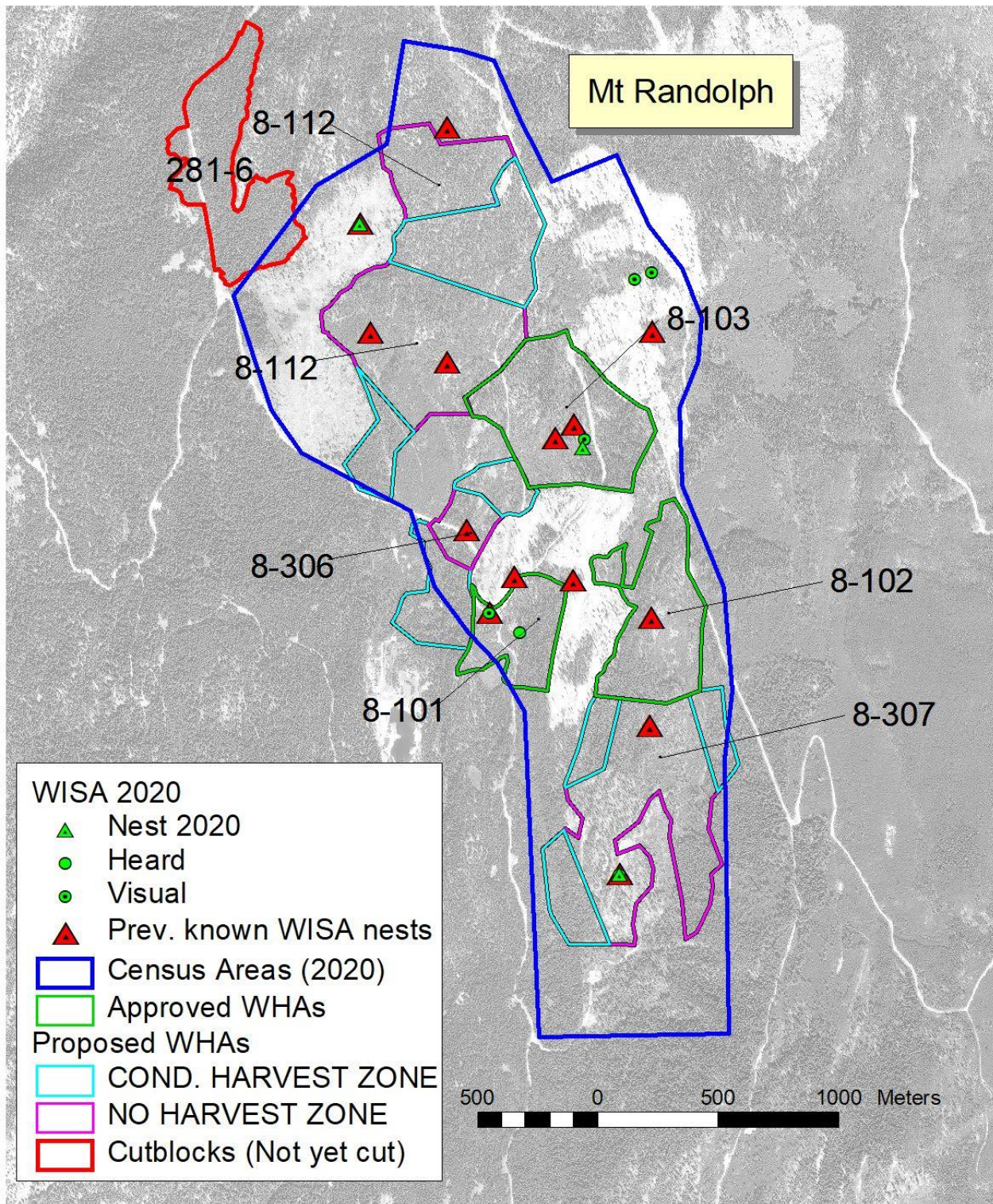


Figure 8. Known WISA nest locations in Mt. Randolph census area from all years. In 2020 two old nests were confirmed active, and one new nest found in WHA 8-103. WHA 8-101 had pair present. The “whitish” harvested areas in the orthophoto have all been cut since the original 2006 census.

Nest tree survival

We examined 76 WISA nest trees in the WHAs and census areas in Okanagan that had been discovered between 1994 and 2017 for current status in 2020 (Table 3). The nest tree was considered to have survived if it remained suitable for nesting, i.e., standing and with the portion of the tree where nesting occurred, or could occur, still intact. I first estimated tree survivorship regionally by species, and then reported the combined survivorship by species for all regions of B.C. Details for each tree are in Appendix 3.

For Western Larch, nest tree survival varied by time since discovery with only 69% of Western Larch discovered 20-25 years ago still suitable for nesting, but 89% discovered 5-17 years ago still suitable for nesting (Table 3). Extrapolating the survivorship regression against years since nest discovery (Figure 9), 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 of the extrapolation to 97 years are very large and not reliable (90% prediction interval of 57 years to infinity). Managing for suitable WISA Western Larch nest trees elsewhere will require retention and protection of existing nest trees, and recruitment on a very long time scale because Western Larch generally become suitable WISA nest trees only when they get older than 300 years, and even then, only when heart rots have progressed to the point that nest excavation is possible.

For Trembling Aspen, nest tree survival varied by both time since discovery and by status (live or dead) at time of discovery. Aspen nest trees discovered when already dead 10-15 years ago had lower current survival compared to live nest trees discovered in the same period (36% vs 56%). Extrapolating the survivorship regression against years since nest discovery (Figure 9), 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 Western Larch, we do not know the true shape of the survivorship curve, although the confidence limits are extrapolated over a much shorter time frame, and are more reliable. Based on these results relatively continuous recruitment of new aspen nest trees will be required for aspen stands to retain value for WISA nesting.

Survival of Water Birch nest trees (33%) was even lower than for Trembling Aspen (Table 3). Water Birch 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 and Douglas-fir for nesting when the trees are already dead (Gyug et al. 2009). Survival of Ponderosa Pine (67%) and Douglas-fir (47%) was similar to survival of aspen nest trees. Most of the Ponderosa Pine trees 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.

Table 3. 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
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
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
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.

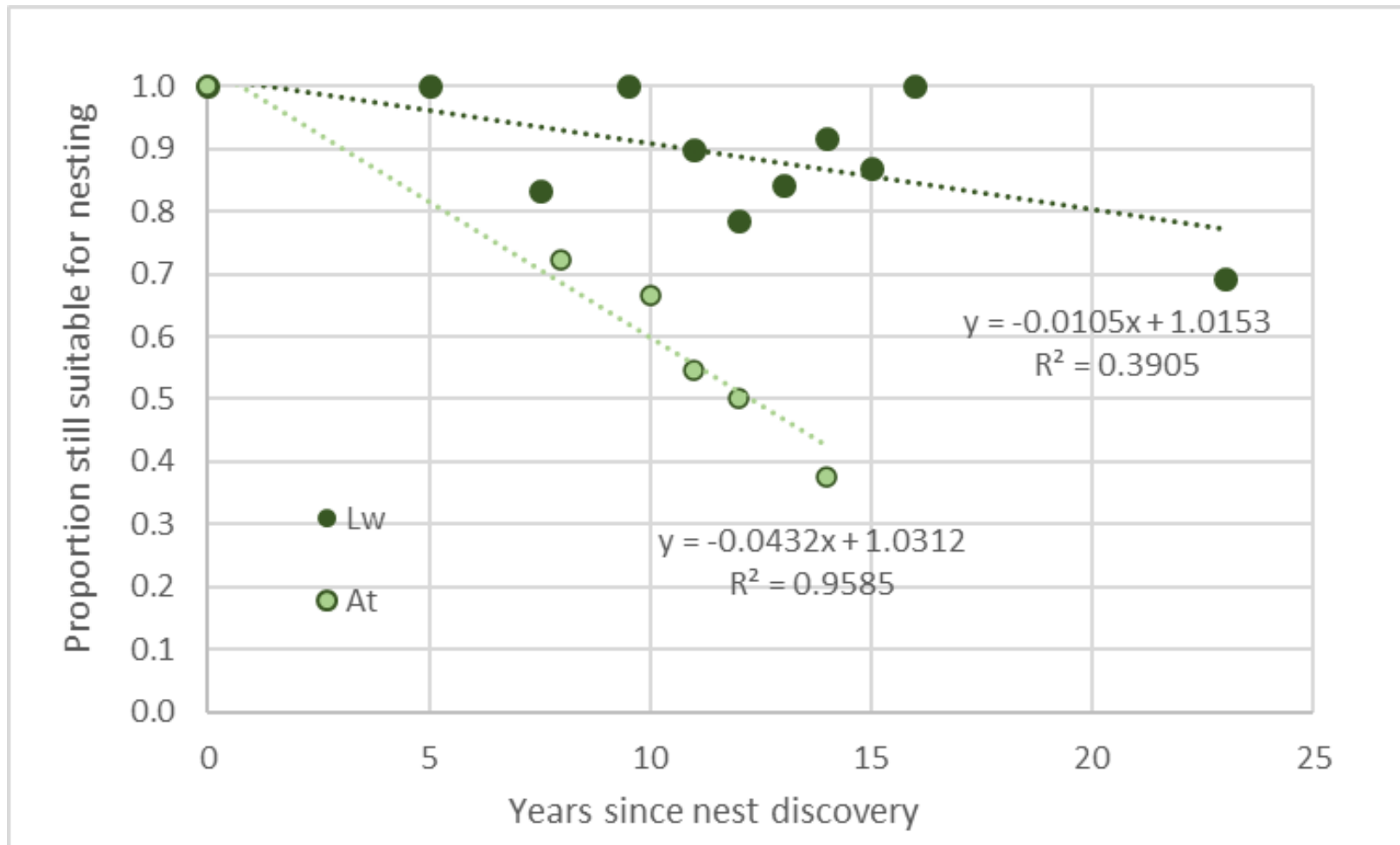


Figure 9. Proportion of WISA nest trees still suitable for nesting depending on years since nest discovery. Lw = Western Larch, At = Trembling Aspen. Linear regression used with points added for Proportion = 1 at time = 0. Total sample sizes were the same as in Table 3, with years since discovery grouped so that each point represents at least nine WISA nest trees.

Preliminary BMP Assessment

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

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 OGMAAs nor WHAs for any species are to be included in the live tree retention target averaging.

The WISA BMPs had been applied to all or portions of the six harvested cutblocks examined for this project. Overall residual tree densities in the harvested areas appeared to be too low to allow for WISA breeding occupation, i.e., the majority of each block appeared to be like Seedtree Cuts (1-10 residual trees/ha) with a few extra patches of trees retained. These may have met the block targets specified in the Site Plan (which may be confirmed with field plots later) but do not appear to meet the intent of the BMPs nor provide suitable WISA breeding habitat.

The only two WISA nests found near these six blocks were right on the boundary of ANA004. We did not see the WISA from either of these nests foraging within the block. There were several possible veteran Western Larch nest trees with existing sapsucker-sized cavities retained within this block, but none of those had been used. The majority of this block and the location of both nests were outside the WISA AO. This indicates that the AO boundaries were originally established in that particular area based on insufficient information, and need to be revised.

Quantitative evaluation of residual tree densities in each of the six Okanagan cutblocks may be done later in 2020 but within a separate project. However, based on a preliminary evaluation of these Okanagan blocks, the Merritt blocks in 2019 (Gyug 2019b) and blocks in Boundary from 2018-2020 (Gyug 2019a and unpublished data), I believe the principal problem with the development of the BMPs was a mistaken reliance upon averaging tree densities

where WISA were found nesting in harvested blocks. Re-analysis of existing data showed that blocks with fewer than 50 residual trees/ha in the harvested portion of the block do not form suitable foraging habitat because WISA end up commuting to nearby areas with higher tree densities, usually forests with >200 trees/ha. Average distance of these nests from forest was 55 m and maximum distance was 137 m (n = 29 nests). WISA only appear to nest in these blocks with <50 trees/ha because suitable nest trees are a scarce commodity, and cannot rely upon the blocks for foraging. Further analysis of existing information to develop a foraging habitat model including re-analysis of radio-telemetry data from St-Amand (2017) is currently underway in a separate project and will not be further explored here.

Preliminary WHA Assessment

The proposed WHAs in the Okanagan incorporate a new concept of a Core Area with no timber harvesting, and a Conditional Harvest Area where timber harvesting would be allowed in accordance with the WISA BMPs. However, in looking at the sites proposed for Core and Conditional areas, some Core Areas had been proposed around nest sites within recently harvested cutblocks, and Conditional Harvest areas set around the nearby forests. For some of those nest sites, WISA can probably only use that nest because they rely upon foraging in the nearby forest. Harvesting the nearby forest would almost certainly negate future use of that nesting site.

For each of the nests within the proposed Okanagan WHAs, the suitable foraging sites for each nest need to be identified using the model being developed in a separate concurrent project. Then those foraging sites upon which WISA would be relying upon need to be either included in the Core Area, or else timber harvesting residual tree retention targets set for the Conditional Harvest area that allow it to retain its foraging value.

RECOMMENDATIONS

The following recommendations are made based on the results and discussion reported here.

This year (2020)

1. Determine whether the Site Plan tree retention targets were met within the six already-harvested cutblocks in the Okanagan using a reliable sampling plan,
2. Assess if the BMPs were being met, or were effective, and if not, examine how the BMPs might be better applied, or made more effective,
3. Develop a plan to assess the effectiveness of existing and proposed WISA WHAs in the Okanagan (which may also apply to WISA WHAs elsewhere), and test any habitat portion of that plan on some or all of the 19 approved and/or 22 proposed WISA WHAs in the Okanagan. This would include identification of nesting and foraging areas within proposed WHAs using habitat models and/or field data.
4. Revise the Okanagan WISA Area of Occupancy boundaries in areas to reflect current data where few or no surveys were done prior to when the boundaries were drawn in 2006, particularly in the Anarchist Mt area, and including the Ellis Creek and Naramata areas using current survey data.

Short-term (1-5 years)

5. Continue WHA and BMP effectiveness monitoring by extending to the only remaining previously unsurveyed area in the southern part of the WISA West AO.
6. Continue an annual desktop assessment of approved cutblocks within the AO for application of the WISA BMPs, and assess whether these meet the existing BMP targets.

Long-term (>5 years)

7. Continue to monitor WISA nest tree survival to predict long-term habitat needs and assess whether current habitat management strategies are likely to continue providing suitable nesting opportunities.
8. Monitor long-term WISA population trends to determine if recovery goals are being met, both at a province-wide scale (annual roadside monitoring) and at smaller scales in census areas, both where there appear to be problems in population persistence (e.g. Okanagan Falls and Gregoire Creek), and areas that appear to have healthier populations.

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APPENDICES

Appendix 1. WHA WISA occupancy survey results, Okanagan WISA AO, 2020.

WHA Name	Part of Census Area	Core WHA Area (ha)	Conditional Harvest Zone (ha)	N WISA nest trees known in WHA prior to 2020	N WISA found In Level 2 Occupancy (June)-2020
Approved WHAs					
8-101	Mt Randolph	13.7		2	3 males, 1 female present, could not confirm breeding
8-102	Mt Randolph	24.4		1	0
8-103	Mt Randolph	31.7		2	1 active nest
8-106	OK Falls	47.5		4	0
8-107	OK Falls	6.9		1	0
8-108	OK Falls	72.7		9	1 active nest
8-110		22.5		3	0
8-113		17.4		1	0
8-190		11.6		2	0
8-191	Gregoire	30.6		1	0
8-192		18.8		1	0
8-194	Gregoire	34.8		1	0
8-197	Gregoire	46.7		3	1 male observed on 2 nd visit, probably not on territory
8-199	Gregoire	29.9		1	1 active nest
8-201		37.3		1	1 WISA present, no breeding found
8-211		24.4		1	0
8-308		46.4		3	0
8-355		47.3		1	1 active nest
8-356		14.0		1	0
Proposed WHAs					
8-111		30.2		1	0
8-112	Mt Randolph	51.0	27.1	2	0
8-114	OK Falls	24.4	10.7	4	0
8-115		48.8	9	4	1 active nest + 1 male on territory + 2 other males
8-116		35.8		1	0
8-117		23.6	15.0	1	0
8-119		29.3	20.2	2	1 male present
8-120		15.5	23.4	3	1 active nest
8-122		14.4	23.7	1	0
8-123		30.3		2	1 male present
8-124		43.9		1	2 - Pair visiting probable nest site
8-193	Gregoire	15.2	35.0	1	0
8-195	Gregoire	5.6	11.4	1	0
8-196	Gregoire	19.0	29.4	1	0
8-198		6.6	16.0	1	0
8-200	Gregoire	31.3		2	0
8-212		19.8	20.3	2	2 - Pair in area, could not confirm breeding
8-306	Mt Randolph	5.7	14.6	1	0
8-307	Mt Randolph	39.2	15.8	2	1 active nest
8-362	Mt Randolph	22.5	13.6	1	0
8-363		20.7	22.0	1	1 active nest 36 m outside SW boundary
8-393		37.9		1	0

Appendix 2. Cutblock specifics and WISA occupancy results, Okanagan area, 2020. Of the six blocks already cut, only ANA004 had never been surveyed by CPB points within 200 m. WISA had not been found in or near any of those blocks. All of the blocks not yet cut had at least some CPB points within 200 m of them, with WISA found in or near 281-6, INK030, INK038, and INK045.

Cut Block	Mod.+ (ha)	Low (ha)	Area (ha) within AO	Reten- tion Target	Leave Tree Spec summary	WISA Obsns May 2020	WISA Obsns June 2020
Weyerhaeuser A18674 (already cut)							
445-ANA003	0.2	5.2	25.0	25/ha	SU B (CH): Reserve FdLw >50cm dbh to max of 25/ha, area also includes some WTPs	1 Male drawn into SE corner of block by CPB	1 WISA present in forest SE of block
445-ANA004	2.8	11.8	14.5	25/ha	SU B (CH): Reserve FdLw >50cm dbh to max of 25/ha, FdLw 17.5-30 min 10/ha, FdLw >30 min 10/ha (includes any >50); 1 large WTP at edge	1 Male NW of block, 1 Female at E edge	2 active nests right on block boundary, no foraging seen within block; both nests outside AO
Weyerhaeuser TFL 59 (already cut)							
531-INK018	0.0	13.9	40.1	5/ha	Reserve FdLw >50 cm to max of 25/ha, reserve FdLw >17.5 minimum 5/ha	1 Male plus 1 other WISA within block	1 female present, not breeding
531-INK019	4.3	16.3	30.8	5-10/ha	Reserve FdLw >50 cm to max of 25/ha, reserve FdLwPy >17.5 5-10/ha	1 male drawn into block by CPB	0
531-INK020	3.2	1.1	21.8	5/ha	Reserve FdLwPy >50 cm to max of 25/ha, reserve FdLwPy >17.5 minimum 5/ha	1 male drawn into block by CPB	0
531-INK024	0.0	21.1	46.0	5/ha	Reserve FdLw >50 cm to max of 25/ha, reserve FdLw >17.5 minimum 5/ha	0	Not checked
Gorman A18671 (not yet cut) (included in Mt. Randolph census area)							
281-6	23.6	3.9	27.5	183/ha	Leave 95% trees >47.4 cm dbh, Leave 40% trees 17.5-47.4 cm dbh	NA	0
Weyerhaeuser TFL 59 (not yet cut)							
533-INK026	0.1	5.7	39.3		reserve 90-100% fdLw >47.5; reserve all species >12.5 10/ha to extent practicable	NA	1 female at edge, no nest seen in immediate vicinity
533-INK027	7.9	2.7	25.3		reserve 90-100% At >17.5, 90-100% FdLw >47.5, 10/ha >12.5 all species; Clumps of SU B throughout that are remove PI only by reaching in, i.e., dispersed reserve patches	NA	0
533-INK029	0.0	24.3	31.0		reserve 90-100% At >17.5, 90-100% FdLw >47.5, reserve 30% of FdLw 17.5-47.5\	NA	0
536-INK030	32.4	6.8	43.0		SP Pending	NA	0
536-INK038	12.8	7.9	24.6		SP Pending	NA	0, incl. in Gregoire census area
536-INK045	10.0	7.8	17.9		SP Pending	NA	0
536-INK046	1.1	2.8	3.9		SP Pending	NA	0, incl. in Gregoire census area

Appendix 3. WISA Nest Tree status for trees checked in 2018-2020 in all regions 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	
New Nests discovered 2020						-		
WNK052	-		2020	Lw	2	-		
WNK053	-		2020	Lw	2	-		
WNK054	-		2020	Lw	2	-		
WNK055	-		2020	Lw	2	-		

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