Wildlife Tree Effectiveness Monitoring 2022 – Summary Report

Wildlife tree effectiveness monitoring and associated contractor and First Nations training was conducted in the W. and E. Kootenay regions of BC from Nov. 17, 2021 to – November 16, 2022 by T. Manning (Strategic Resource Solutions, SRS), along with additional monitoring efforts by personnel from Okanagan Nation Alliance (ONA), Splatsin First Nation, Nupqu Resource Limited Partnership, and BC Ministry of Forests staff. Tree treatments dates ranged from 2014-2020; a summary of the results observed (N=182 treated trees and 4 control (untreated) trees) during this period is provided in Table 1 below. Overall, 39/182 (or 21%) of treated trees assessed had evidence of wildlife use, either feeding or nesting cavity excavations.

A field-based effectiveness monitoring training session was held on Sept. 16, 2022 at the Corn Creek treatment area in the W. Kootenay region, with two attendees from ONA and Splatsin First Nation. Participants were given the opportunity to assess treated trees using the wildlife tree assessment protocol and Survey123 digital data collection form recently developed by BC Ministry of Forests (Nelson); these data can be quickly uploaded to the Ministry wildlife tree monitoring database via a secure weblink.

Table 1. Summary of wildlife trees (N=186) monitored and assessed in 2021 and 2022.

Location	**Date of Visits** (2021, 2022)	**Observer**	**Treatment Year**	**Number of Trees Assessed**	**Observations** (Py = ponderosa pine, Fd=Douglas-fir, At=aspen, Act=black cottonwood)
Duncan-Lardeau Flats	15 Sep/22	T. Manning (SRS)	2015	2	* Large western larch (dead top treatment but had been inoculated 9x with *Fomitopsis pinicola*); tree is now fully dead; some feeding excavations and bark loss (15%). * One large diameter trembling aspen (window treatment) had been inoculated 6x with *Spongipellis delectans* (this species of heartrot fungus is usually used on cottonwoods) – this tree recently broke above the full stem girdle and showed considerable decay in this region. A wood sample was collected from the fallen stem for future lab culturing/identification.
Corn Creek	16 Sep/22 29 Sep/22 12 Oct/22	T. Manning A. Dobie (ONA)	2019	26 + 4 untreated controls	* All treated trees were trembling aspen * All trees had received Tall Stub (TS) treatments and were inoculated 6x with either *Ganoderma applanatum* or *Fomes fomentarius*. * No change in condition or use on any of the live control trees. * **7/26 (27%)** of treated trees showed evidence of decay and woodpecker use, including recent Pileated Woodpecker (PIWO) feeding and nesting cavities (see Figures 1, 1a), as well as Hairy Woodpecker feeding excavations and nest cavity starts.

Strauss Rd.	28 Sep/22	T. Manning	2016	9	* 6 Py with TS or Dead Top (DT) treatments (inoculated with F. pinicola) were assessed. * **5/6 Py** showed evidence of decay and woodpecker use (feeding, nesting cavities), including 3 recent PIWO nesting cavities (see Figure 2). * Py TS #116 had 7 nest cavities, ranging from just below the applied stem girdle, to approximately 3.5 m above ground (Fig. 3) * 2 recent sapsucker (possibly Williamson's Sapsucker) nest cavities observed on Py TS #114 (Figure 4) – both cavities were 2-3 m below or above the full stem girdle and on the north side of the tree (i.e., in the vicinity of the inoculant dowel insertions) * Additional significant PIWO and Hairy Woodpecker feeding excavations observed on the above trees (Figure 5). * Some tall stub trees located in sunny/warm aspects exhibited bark loss/loosening and development of relatively wide and lengthy stem cracks; these features can provide important bat roosting habitat (Figure 6). * Visited Douglas-fir dead top trees showed some loss of bark (5-15%) and minor woodpecker feeding activity. * No change in condition or evidence of wildlife use observed on "Window" treatment trees.
Skooker North	5-10 May/22	S. Clow (BC MoF)	2017	16	* Mostly Ponderosa pine DT and TS treatments; some Douglas-fir treated * 5/16 trees (31%) had feeding cavities – these were all in Py. * Minimal additional changes in tree condition or wildlife use at this time.
Dutch-Findlay, Powerline	5-10 May/22	S. Clow	2010, 2017	48	* Varied results, with the 2010 treatments exhibiting more evidence of decay and excavations. * The larger (>50 cm dbh) Ponderosa pine with TS or DT treatments from 2010 showed the best results, with both feeding and nesting excavations present. * 4/24 (17%) of the 2010 trees had significant feeding excavations; these were all in Py.
Wigwam Flats	28 Mar/22 30 Mar/22	M. Fjeld (Nupqu)	2014, 2015	18	* 5/18 (28%) of trees observed showed presence of decay (fungal fruiting bodies) and/or nesting cavities. * All of the above trees were TS treatments (4 Py, 1 Fd). * The most significant decay appeared to be on those treatments which had been inoculated with the heartrot fungus *Ganoderma applanatum*.

Deer Park	16 Nov/22	A. Dobie	2014	18	* 4/18 trees (22%) showed evidence of stem decay (saprot or heartrot). 3 trees (17%) had wildlife use, either feeding or nesting excavations (Figure 7). * 3 trees had failed, either due to stem snap or uprooting (likely due to root disease and/or wind events).
Marsden	1 Nov/22	A. Dobie & L. Lin (ONA), S. Basil (Splatsin)	2020	13	* Just two years have passed since treatment; only minor saprot decay and small feeding cavities were observed on 2/13 trees (15%). Of note, however, is that both trees were ponderosa pine (one DT treatment, one TS treatment), and both had been inoculated with *G. applanatum*.
Marsden	17 Nov/21	A. Dobie & C. Dolman (ONA), K. Vaino (MoF)	2016	19	* 10 DT treatments on Py and Fd. All had been inoculated 3x with *F. pinicola*. 2/10 (20%) trees had feeding or nesting cavities, including an Fd with 5 small nest cavities. * 9 Fd or Py trees had received window trees (inoculated 6x with *F. officinalis*); 3 of these trees (33%) showed evidence of minor decay and woodpecker feeding excavations: all of these were Py. 2/19 trees (one Fd and one Py) had snapped stems sometime after treatment (no apparent reason).
Duncan-Lardeau	18 Nov/21	A. Dobie & C. Dolman (ONA), K. Vaino (MoF)	2016	13	* All trees were relatively large diameter Act (68-141 cm dbh). 6 trees had received DT treatments and 7 had window treatments. 3/6 (50%) of the DT treatments had medium/large size circular nest cavities; these had inoculated 3x with *G. applanatum*.

Figure 1. Very fresh Pileated Woodpecker feeding excavation located approximately 1.5 m below top of aspen tall stub #C21 (Corn Cr.). Note position of one of the inoculant dowel insertion holes at the red arrow.

Figure 1a. Recent Pileated Woodpecker nest cavity (at red arrow) located approximately 1.5 m below top of aspen tall stub #C19 (Corn Cr.). This cavity was located on the NW side of the tree, also in the region where fungal dowels were inserted.

Figure 2. Two large and recent oval-shaped Pileated Woodpecker nest cavities in Ponderosa pine tall stub (#114, Strauss Rd.). This tree had also lost approximately 30% of its bark, with other bark sections loosening up; such bark features provide potential roost sites for bats.

Figure 3. This Ponderosa pine tall stub (#116, Strauss Rd. site) had 7 nest cavities (multiple woodpecker species), ranging along the tree bole from 3.5-7 m above ground. This section of the stem is just below some of the inoculation points with *Fomitopsis pinicola* at approximately 8 m above ground.

Figure 4. Potential Williamson's Sapsucker nesting cavity (at red arrow) located at approximately 8 m above ground and about 2 m below the full stem girdle (at green arrow) on Ponderosa pine tall stub #114 (Strauss Rd). Hairy Woodpecker foraging was observed on the bole below and above the stem girdle, and Pileated Woodpecker nesting cavities were observed further up the bole (refer to Figure 2).

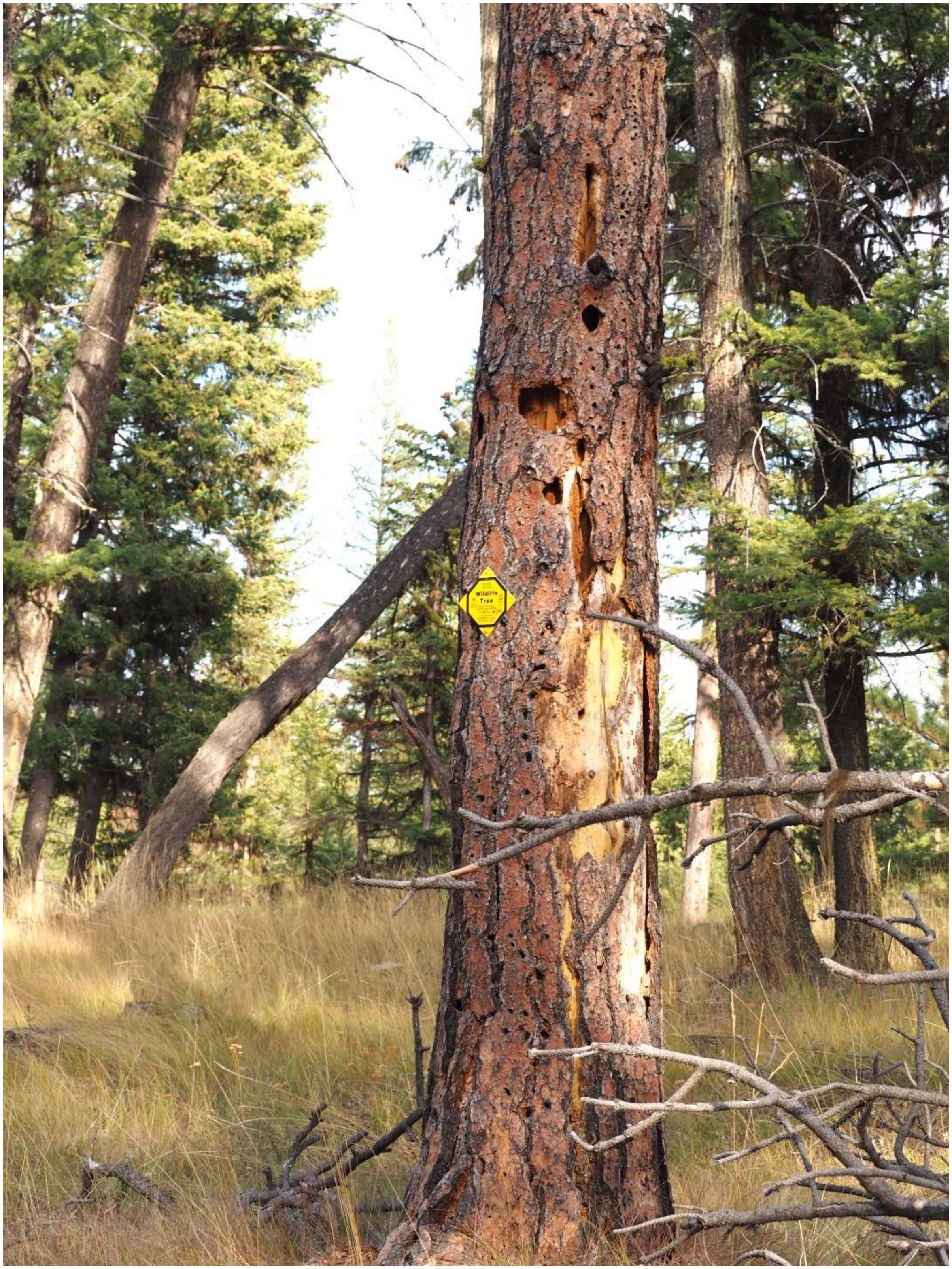

Figure 5. Abundant and deep woodpecker feeding extending along the entire bole of Ponderosa pine tall stub #114 (Strauss Rd.).

Figure 6. Potential bat roosting habitat resulting from loosening bark and relatively wide (i.e., 2 cm) lengthy vertical cracks induced in the stem of Ponderosa pine tall stub treatments. These cracks resulted from dessication of the stemwood after tree treatment and subsequent tree death, and appeared primarily on the sunniest/warmer south and west sides of the tree bole.

Figure 7. Ponderosa pine (WT #18) at Deer Park, treated as a Tall Stub in 2014. Note the recent circular woodpecker nest cavity at the red arrow.

Additional Observations

The following results are linked to the surveys/assessments summarized in Table 1, but provide additional details concerning tree condition and evidence of wildlife use (Source: *Survey 123 Wildlife Tree Monitoring Database*, BC Min. Forests, Nelson Region, Dec. 5, 2022). Tree treatment dates range from 2010-2019. Sample sizes below are variable and are cited relative to each tree statistic category.

1) 17/74 trees (23%) of trees (all treatment types combined) showed evidence of wood decay post-treatment. Decay ranged from relatively superficial saprotting, to extensive heartrot (i.e., presence of decayed wood (brown cubicle rot); deep woodpecker feeding excavations; circular or oval-shaped nest cavity entrances.

2) Approximately 38% (17/45) of trees with Dead Top treatments showed evidence of decay post-treatment, as evidenced by visible saprot and various shallow or deep woodpecker excavations. In addition, the vast majority of DT treatments (47/50 trees or 94%) still had intact stems post-treatment (i.e., the dead top portion of the stem was still intact and unbroken).
3) About 18% of trees (14/76) had visible fungal fruiting bodies at the time of observation.
4) About 34% of trees (25/73) showed woodpecker excavations. Of this total, 60 % (15/25) were feeding excavations, with the remainder (10/25) being nesting cavities.
5) The majority of the nest cavities observed occurred on NE and NW aspects; this is significant since the inoculation methodology (Manning 2021; Manning and Manley 2014) recommends inoculating treated trees on the cooler north and east-facing aspects.
6) The observed nest cavities predominantly occurred between 3-19 m above ground, which reflects the post-treatment heights of the tall stub (i.e., 8-12 m) and dead top (i.e., > 15 m) treatments.
7) 62/70 trees (82%, all treatment types) had fully intact stems, while 6 trees had a broken mainstem. One tree had been uprooted (windthrow) while another had been cut down (likely mistaken as a dangerous tree/snag).
8) About 1/3 of trees assessed (n=74) had some bark loss or exfoliation (loosening).
9) About 10% (6/62) of trees observed showed relatively lengthy, wide and deep stem cracks post-treatment (see Figure 6). These all occurred in ponderosa pine tall stub (TS) treatments which had been inoculated with either *F. pinicola* or G*. applanatum*, and were likely due to the combination of tree death and stemwood dessication following treatment. This feature along with loosening bark on such trees, provides important and suitable bat roosting habitat.

Conclusions

1) The decay rate and subsequent wildlife use of inoculated trembling aspen tall stubs appears to be rapid, with woodpecker feeding or nesting excavations observed within 3 years. Thus, treatment of trembling aspen in this manner should be continued where larger aspen stems (>30 cm dbh) occur and for wildlife species of particular conservation interest (e.g., Williamson's Sapsucker, Pileated Woodpecker).
2) Ponderosa pine tall stub treatments are clearly the most successful wildlife tree creation and enhancement technique observed thus far, with treated trees showing significant feeding and nesting use by various woodpecker species, including Pileated Woodpecker which is now a species afforded "*Special Protection*" under the federal Migratory Bird Regulation (Sept. 2022; URL: https://laws-lois.justice.gc.ca/eng/regulations/C.R.C.,_c._1035/index.html). Such woodpecker activity and use will also benefit various secondary cavity-dwelling wildlife species (e.g., Western Screech-owl, bats, furbearers).
3) The heartrot fungus *Ganoderma applanatum* appears to be initiating relatively significant internal decay columns in both treated conifers and deciduous trees, particularly in Ponderosa pine, black cottonwood and trembling aspen. Continue application of this species of fungi for tall stub and dead top treatment inoculations; *Fomitopsis pinicola* is also working well as an inoculant fungus for these two treatments and should continue to be used in comparative fashion to *G. applanatum*.
4) *Fomes fomentarius* appears to be successfully colonizing trembling aspen, causing relatively rapid onset of internal decay and subsequent woodpecker excavations (i.e., within 3 years after

treatment). For comparative monitoring purposes, this species of fungus should continue to be used to inoculate *Populus* tree species.

5) Dead top (DT) treatments also appear to be working well in Ponderosa pine, and to a lesser extent in Douglas-fir. Because the tree remains alive post-treatment and the upper stem sections tend to remain intact well after treatment, DT treatments provide longer-term nesting habitat supply than tall stub treatments.
6) Window treatments are intended to provide the longest term habitat recruitment and supply (i.e., >25 years). Negligible evidence of decay or wildlife use has been observed on window-treatment trees to date. This result is expected and its application is likely most beneficial on large diameter deciduous trees such as black cottonwood, and western larch; both of these tree species typically exhibit wildlife use (e.g., nest cavity construction) within the decayed middle portions of the live stem.
7) Shift tree treatment bias to tall stub and dead top treatments as these treatments provide a combination of short and medium term habitat supply, and are exhibiting the majority of the evidence of change in tree condition and wildlife use based on the monitoring efforts to date.
8) Tall stub treatments on larger, thick barked conifers including Ponderosa pine and Douglas-fir have a secondary benefit of providing roosting habitat features for bats (i.e., exfoliating bark, long stem cracks, see Figure 6).
9) Overall, 39/182 (or 21%) of treated trees assessed had evidence of wildlife use, either feeding or nesting cavity excavations.
10) Include bat habitat micro-features in future treatments (see Figure 8) where suitable trees and locations permit (i.e., trees > 30 cm dbh or ideally larger, with sunny aspects and/or located near natural openings and aquatic habitats where flying insects may be abundant). Bat features can be easily added to any of the wildlife tree treatment types (i.e., tall stubs, dead tops or windows).
11) Where “softer” coniferous tree species such as balsam fir, amabilis fir or western hemlock occur, consider conducting tall stub and dead top treatments (with appropriate fungal inoculants) in these species as they will decay more rapidly and bring on new habitat supply more quickly than other coniferous tree species.

Recommendations for Continued Monitoring and Treatments

1) Focus monitoring assessments on tall stub and dead top treatments rather than window treatments.
2) Monitor ponderosa pine which were treated in 2016 as tall stubs at Strauss Rd., in May-June 2023 to determine if Williamson’s Sapsucker (WISA) are nesting in these trees (i.e., given this area has known WISA occurrences and high habitat suitability for this species).
3) Where feasible, continue to provide wildlife tree effectiveness monitoring training to interested and qualified persons in government, First Nations, NGO’s and industry.
4) Monitoring has not been completed at the following sites and given their older treatment dates, assessments should be conducted at Earl Ranch (2016), Strauss Rd. (2016), Fort Shepherd (2014) and Columbia Lake Park (2013).
5)

6) Further monitoring can be delayed until any **remaining unassessed sites have had 5 or more years lapse** since initial time of treatment.
7) Going forward, all treated wildlife trees should have a numbered aluminum tree tag attached to the lower stem. This will greatly assist tree identification and relocation for subsequent monitoring purposes, and may prevent unintended felling (i.e., danger tree removals associated with other ecosystem restoration treatments).
8) For 2023 and 2024, new wildlife tree creation treatments should be administered. The location of treatment sites should be determined strategically based on:
    a) geographic gaps (i.e., locations where capable forested habitat exists but no or very few wildlife tree treatments have been yet applied);
    b) areas where increasing the supply of wildlife trees will benefit focal species of concern including Williamson's Sapsucker, Lewis's Woodpecker, Pileated Woodpecker, Western Screech-Owl, bats or furbearers;
    c) locations where wildlife tree creation treatments were applied a number of years ago that used inoculation and girdling techniques which are now recognized as less effective (i.e., stem girdling methods, dowel insertion method, number of fungal dowels used, choice of fungal species, refer to Manning 2021 for further discussion of current recommended methodology). Hoodoo-Hofert (2007) and Foosey Pasture (2009) are example treatment sites in this context.

Literature Cited

Manning, T. 2021. Wildlife tree creation and fungal inoculation treatments in British Columbia: Effectiveness monitoring summary and recommendations. Report prep. for Environment and Climate Change Canada, Canadian Wildlife Service, Pacific Region, Delta, BC. April 2021.

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Figure 8. Long, deep stem crack (green arrows) and two “plunge cut cavities” (red arrows) intended to provide bat roosting features; applied relatively low on a trembling aspen as bat habitat enhancement for Northern Myotis (Peace Region, BC, Oct. 2022). Plunge cuts are relatively deep (~15 cm) and angle upward into the tree stem, allowing bats to cling to an internal wooden surface. Also note the two ½ circumference stem girdles (blue arrows); these are intended to dry out the sapwood layer in this region of the tree stem, thereby enhancing colonization by the inserted fungal inoculants while also not killing the tree (therefore a live tree with basal decay and bat micro-habitat features is achieved).

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