ENHANCING WILDLIFE TREE HABITAT Effectiveness Monitoring 2024

Project supported and funded by:

- *Fish & Wildlife Compensation Program (Peace Region)*
- *Tsay Keh Dene Lands, Resources and Treaty Operations*

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Strategic Resource Solutions (SRS)

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Topics for Presentation

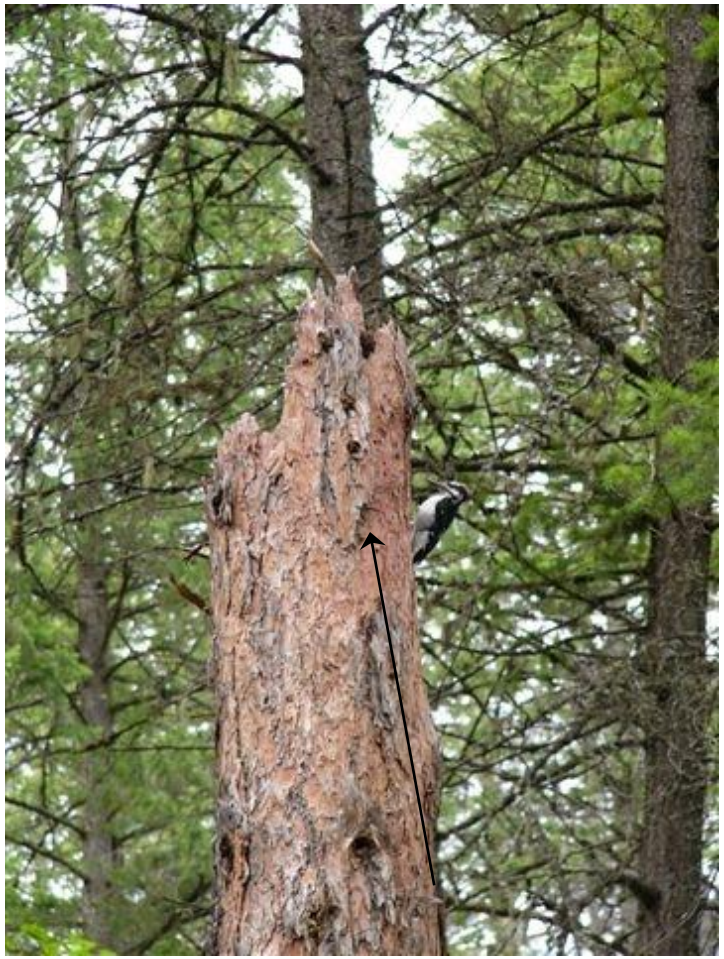
1. What is a wildlife tree
2. Important wildlife quality indicators and characteristics
3. Ecological importance of wildlife trees and types of wildlife tree users
4. Tree treatment techniques – 4 steps
5. Effectiveness evaluation – FWCP Peace Tsay Keh Dene project - 2024 Results
6. Conclusions
7. Continuous Improvements

A Wildlife Tree……

… is any standing dead or live tree with SPECIAL CHARACTERISTICS that provide habitat for wildlife

Wildlife Tree Quality Indicators

- Tree height and diameter
- Tree decay stage and condition
- Location (e.g., riparian zone)
- Cause of death (disease, insects, mechanical, wildfire)
- Relative abundance in local area – often in short supply



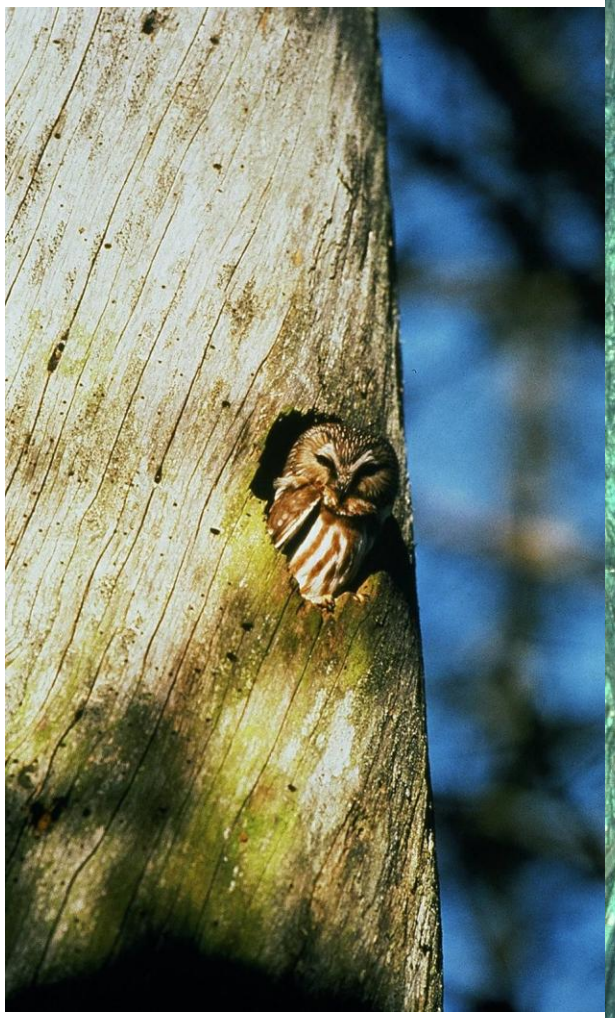
Wildlife Tree Characteristics

Evidence of DECAY is important

- nest cavities (circular or oval shaped)
- feeding excavations
- visible fungal conks or decayed wood
- Tree decay classes 2–6 most valuable

Importance of Wildlife Trees

- Required for the life history strategies of many species:
  - 18% or over 70 species of BC's native birds, mammals, salamanders
- Wildlife uses include:
  - nesting, roosting, shelter and overwintering, and feeding



Types of Wildlife Tree Users

- Over **70** wildlife species in BC depend on wildlife trees for nesting, roosting, denning and feeding, including:
  - **Primary cavity excavators** – woodpeckers, sapsuckers, chickadees, nuthatches
  - **Secondary cavity users** – small owls, some ducks, bluebirds
  - **Open nesters** – Bald Eagle, Osprey, Great Blue Heron, Great-horned Owl
  - **Mammals** – bats, fisher, marten, squirrels
  - **Amphibians** – Clouded Salamander
- Some of the above include Endangered and Threatened species

Cavity Nesters and Open Nesters

Bat Roosts

- Large, hollow tree cavities can be used as bat maternity roosts
- Smaller cavities, crevices and spaces behind loose bark can be used as day roosts by smaller numbers of bats

Black Bear Dens

Creating/Enhancing Wildlife Tree Habitat Supply

- Native heart rot fungi are often in "short supply" in some ecosystems
- This shortage affects the supply of trees that can become future wildlife trees

Creating wildlife trees using fungal inoculation – 4 Steps

1. Fungal specimen sample collection from the field
2. Specimen culturing and purification in the lab on malt agar plates
3. Transfer of prepared fungal mycelia to sterile wooden dowels (1.3 cm x 7.6 cm) in sterile bags
4. Fungal mycelial colonizes wooden dowels in the bags – this last step takes about 60 days and are now ready for tree inoculation treatments

The First 3 Steps

Step 4: Climbing, Drilling and Chainsaw Modifications: 3 Examples

Dead Top Treatment with Fungal Inoculation (Kootenay Region)

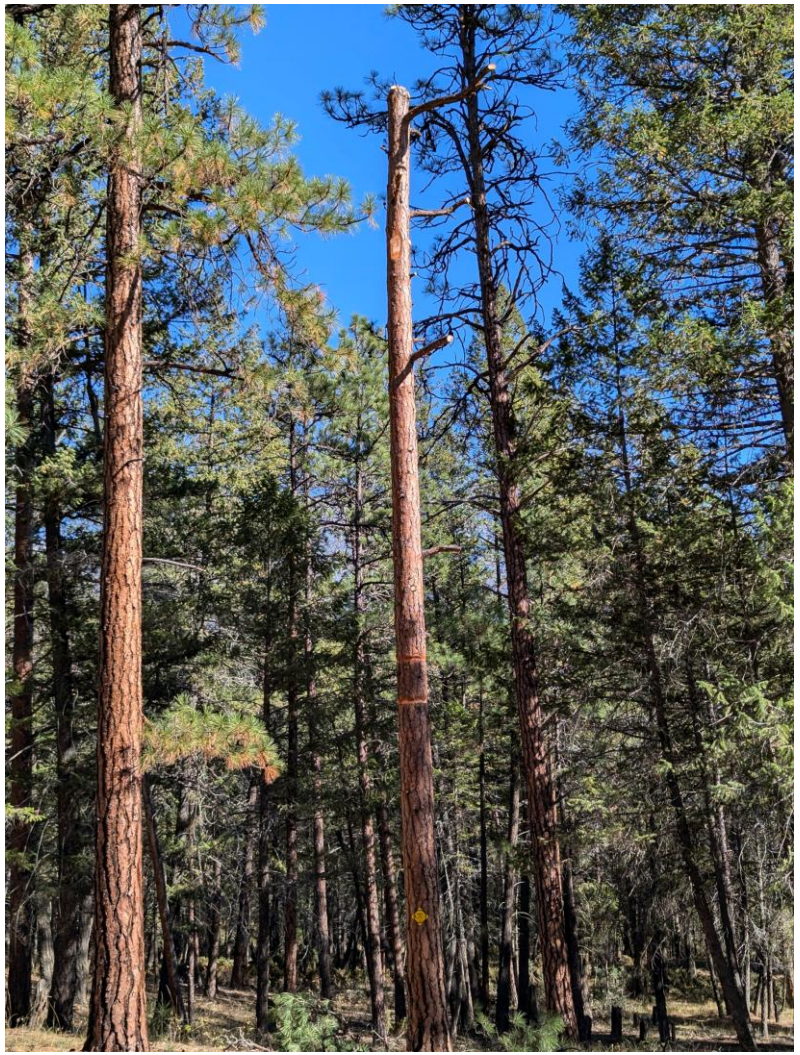
Douglas-fir Dead Top - BEFORE

Douglas-fir Dead Top - AFTER

Tall Stub Treatment with Fungal Inoculation (Kootenay Region)

Py Tall Stub - BEFORE

Py Tall Stub - AFTER



Tall Stub with Fungal Inoculation (Kootenay Region)

Aspen Tall Stub, about 10 m tall after topping

Close-up showing double stem girdle which prevents moisture flow, ensuring tree death and stem dessication

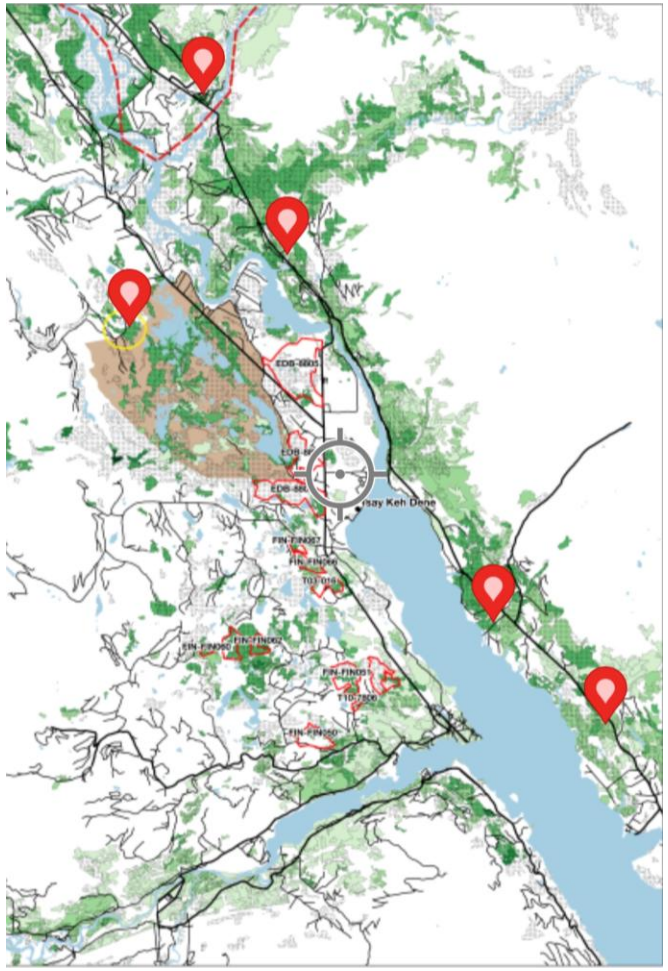
Window Treatment with Fungal Inoculation

- Intended to retain a **full height, live tree**
- Two x ½ circumference stem girdles spaced vertically about 3-4 m apart applied to the stem, along with limb removal and bark scuffing in this section of the stem (red arrow)
- The stem is inoculated 6x with appropriate heart rot fungi between these girdles in order to **create a future decay column in the lower-middle stem**, while the tree remains alive
- Recent technique improvements include adding vertical stem cuts to sever medullary rays and further reduce stem moisture, and applying 3 x ½ circumference girdles
- Other modifications to the stem can include added bat habitat features and fisher den cavity starts

Additional stem modifications can be added to enhance habitat for specific wildlife, including bat roosting and fisher denning

2018 FWCP Peace Region Project: Enhancing Habitat for Wildlife Tree Dependent Species

- 50 trees (black cottonwood, white spruce, trembling aspen) were mechanically modified and inoculated with heart rot fungi in 2018 near Tsay Keh Dene, BC
- 10 additional trees (aspen) had stem modifications (stub treatments) but were NOT inoculated = Control trees
- Project objectives were to:
  - ✓ Increase critical nesting, denning and roosting habitat supply for wildlife tree dependent species in the Peace-Williston Reservoir footprint area
  - ✓ Target wildlife species included woodpeckers, small owls, squirrels, marten, fisher and bats
  - ✓ Provide employment, awareness and training opportunities for local TKD First Nation members



2018 FWCP Peace Region Project: Enhancing Habitat for Fisher

- In the boreal zone of the Peace Region, fisher typically den and rear their young in large diameter, LIVE black cottonwood and balsam poplar trees > 52 cm dbh
- Larger diameter trembling aspen > 40 cm dbh can also be used
- Viable den trees must have sizeable internal decay columns large enough to accommodate female fishers and growing kits
- Den entrances often occur via old frost crack wounds, woodpecker cavities and other stem wounds (e.g., lightning strikes, ungulate browsing)
- Den entrance dimensions are very specific, thereby providing security against potential den predators such as male fisher and black bear
- In 2018, **18/60 trees** were specifically treated as **future fisher den trees**, with stem modifications intended to help develop decay columns and cavity entrance starts
- All treated fisher den trees were cottonwoods, ranging in diameter from 39.0-93.0 cm dbh (mean 56.0 cm dbh)

* Two natural fisher den trees; cottonwood and trembling aspen

* Rectangular cavity entrances at old stem wounds which facilitate fungal colonization and cavity development

* Den entrance heights range from 1.5-17 m above ground

* Typical maternal den entrances are approx. 5-10 cm wide x 7-15 cm high

2018 Fisher Den Treatment

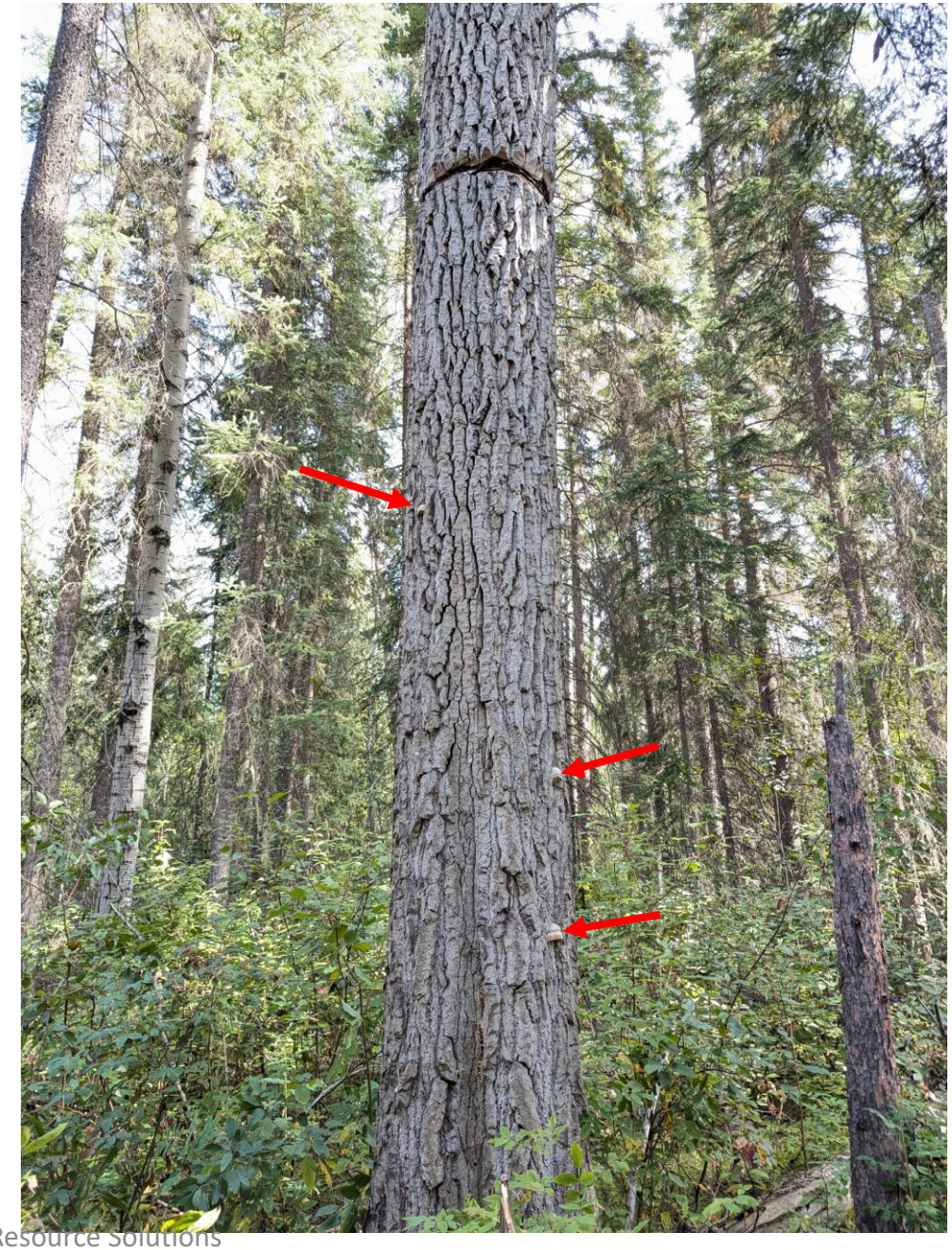
- Tree #14, Akie River, 59 cm dbh live cottonwood
- Fishers usually den in live trees thus all fisher den treatments were applied to live trees
- Window treatment applied at 8 m above ground
- Note ½ circumference lower girdle at blue arrow
- Note installed cavity entrance starts at red arrows
- Tree was inoculated 6x with *Pholiota populnea* between the upper and lower stem girdles

Tree #14 in 2024

- Brownish-yellow decaying wood visible inside the cavity starts
- Unidentified fungal conk visible inside the vertical cavity strike (blue arrow)
- Without climbing and probing, uncertain how extensive the decay column is at this time (6 years post-inoculation)
- Treatment is promising for further enlargement of the internal cavity in this part of the stem
- The installed cavity starts will allow access to the developing decay column

Tree #2 (Pesika R.) in 2024

- Fisher den window treatment
- Live cottonwood, 58 cm dbh
- Inoculated 6x with *Pholiota populnea*
- Fungal fruiting bodies (conks at red arrows)) now visible a few meters below the lower stem girdle and points of inoculation above



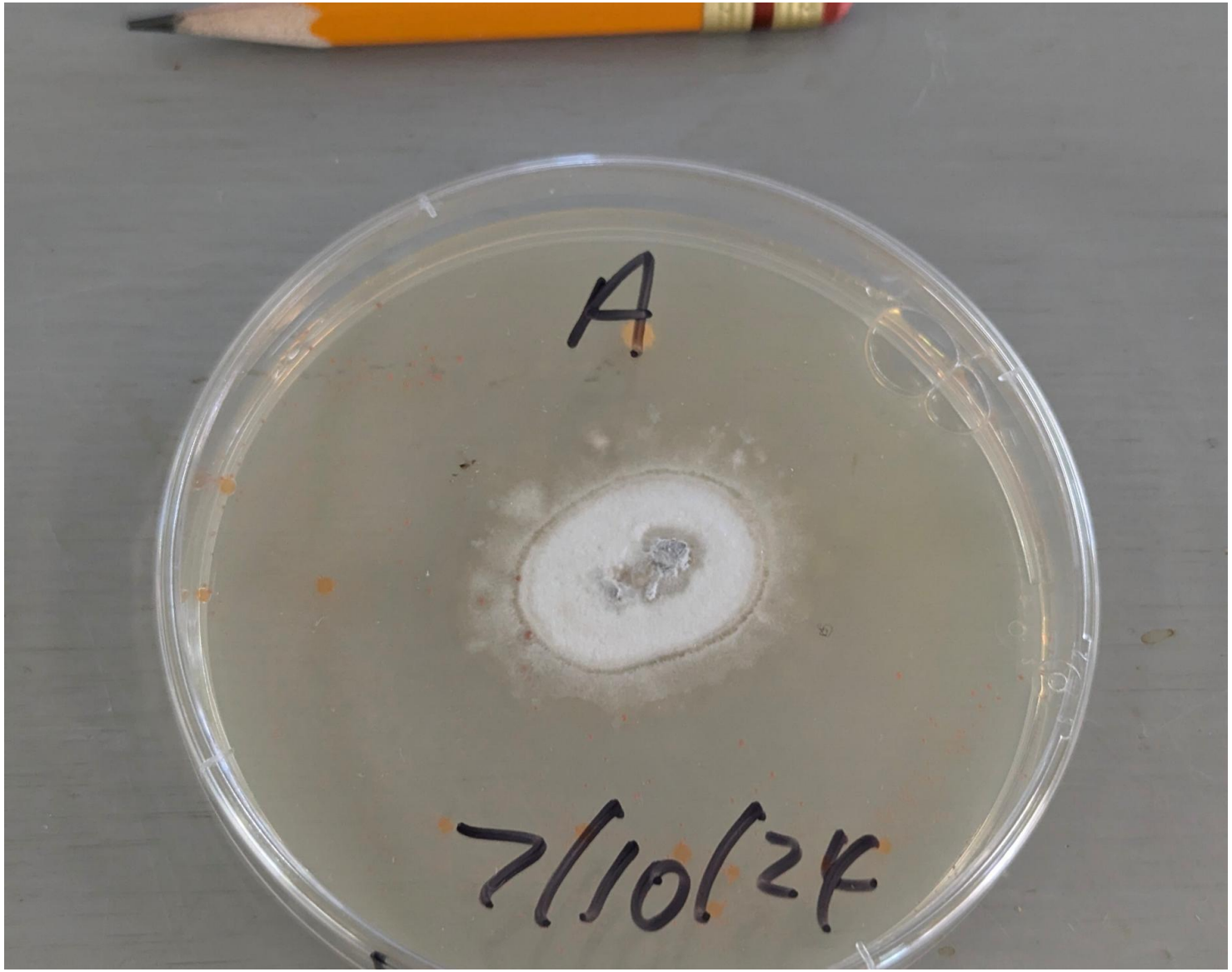
Tree #2 in 2024

- **Wood decay/softening in lower stem below erupting conk**

- **Decay column has travelled down the stem from the 2018 points of inoculation 2-3 m above**

Tree #2 – 2024 Sample

- Fungal conk collected from this tree in Sept. 2024 was re-cultured in the lab
- Microscopic characteristics → elliptical, smooth cinnamon-brown basidiospores are diagnostic of the original fungal inoculant species (*Pholiota populnea*) that was inserted into this tree in 2018



Tree #4 (Pesika R.) in 2024

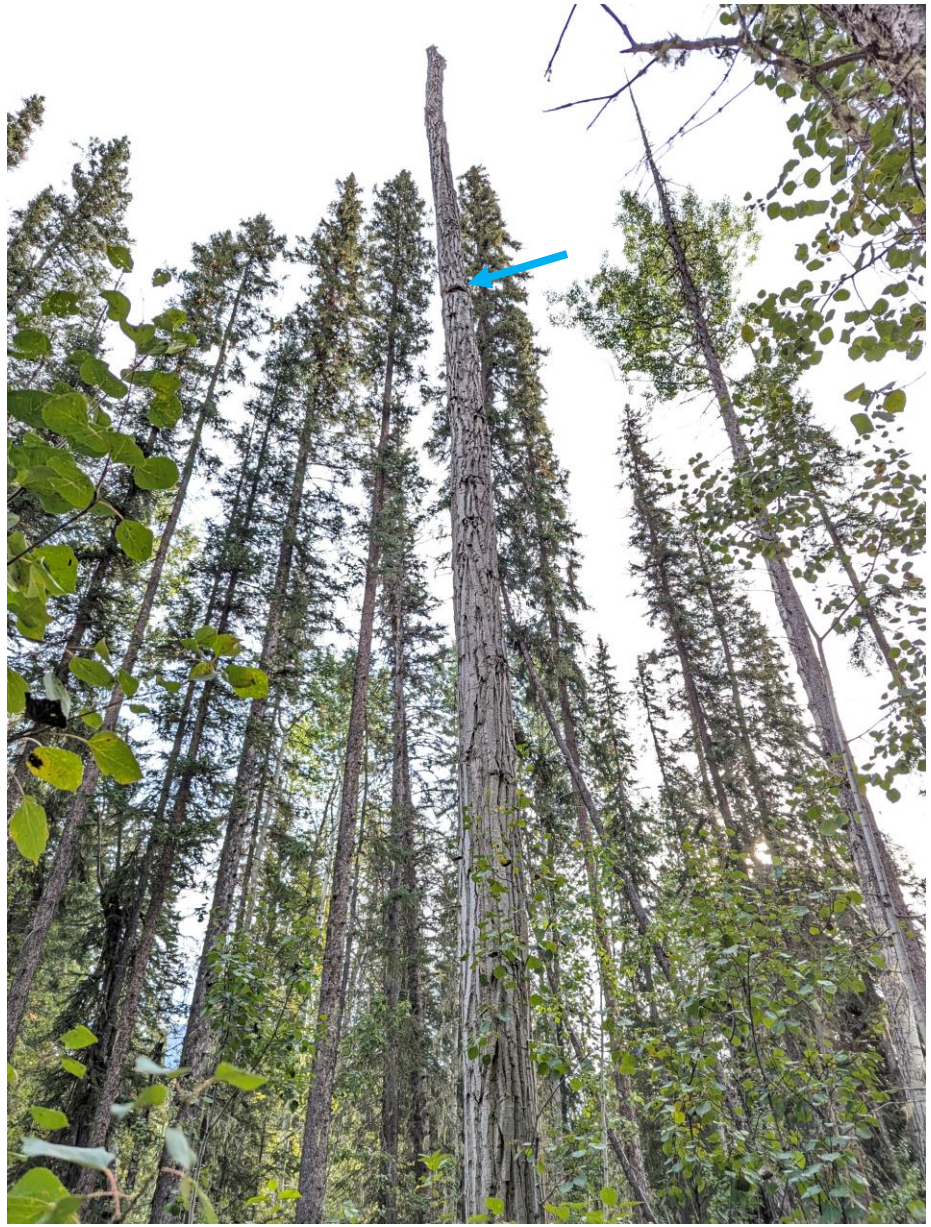
- Cottonwood window treatment (live tree), intended to benefit cavity excavators
- Inoculated 6x with *Pholiota populnea* at 9 m above ground
- *P. populnea* conk (red arrow) erupted approx. 1.5 m below the lower stem girdle (blue arrow)

Tree #5 (Pesika R.) in 2024

- White spruce tall stub treatment
- Inoculated 6x with *Porodadalea pini*
- Woodpecker circular nest cavity start approx. 50 cm below top (red arrow)

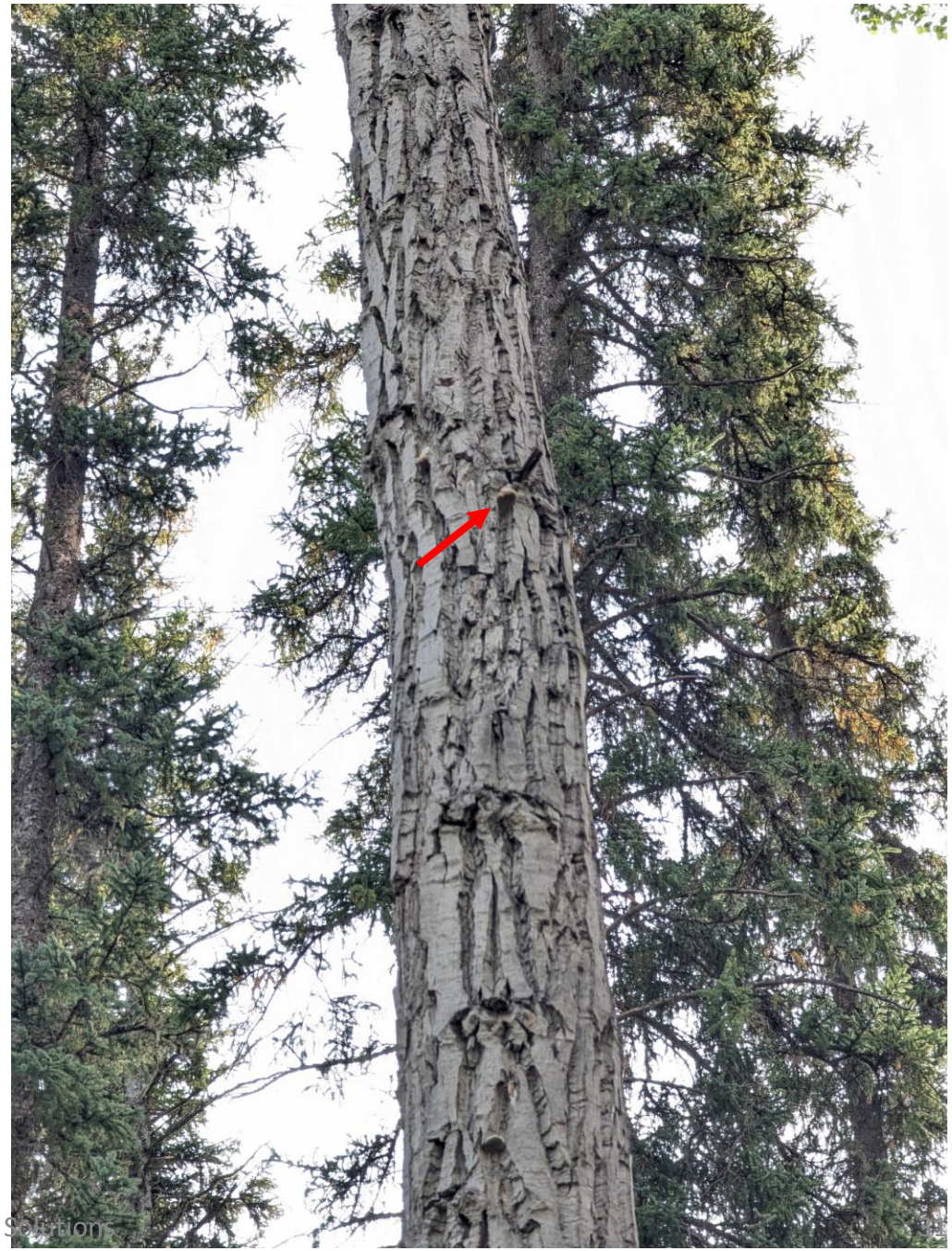
Tree #8 (Pesika R.) in 2024

- Cottonwood tall stub treatment (approx. 13 m tall, 42 cm dbh)
- Benefits a variety of cavity dwellers
- Inoculated 6x with *Spongipellis delectans*
- 3 fungal conks erupted approx. 2 m below the stem girdle (at blue arrow)
- Visible ID indicates *S. delectans*



Tree #8 in 2024 – *Spongipellis delectans* conk on Cottonwood

- *S. delectans* fruiting body at red arrow in mid-stem, below the full circumference stem girdle
- All 3 conks located on the cooler, north side of the tree stem, which is the same side that the inoculant dowels were inserted



Tree #16 (Akie R.) in 2024

- **White spruce tall stub, 40 cm dbh**
- **Inoculated 6x with *Ganoderma applanatum***

- **2 “golf-ball sized” circular woodpecker nest cavities (at red arrow) located approx. 3 m below top**

Tree #28 (Blk. EST-5905) in 2024

- Cottonwood window treatment with fisher den modifications
- Inoculated 6x with *Spongipellis delectans*
- Large cavity start (blue arrow) with visible brown decay approx. 1 m below lower stem girdle
- 2 circular woodpecker nest cavities (at red arrows) approx. 40 cm above/below the lower girdle

Tree #32 (Blk. EST-5905) in 2024 – Potential Fisher Den Access Scar

- Cottonwood window treatment with fisher den modifications
- Installed vertical stem crack has not closed over and is open, with an unidentified fungal conk visible inside

Tree #36 (Blk. EST-5905) in 2024

- Cottonwood tall stub treatment with fisher den modifications, 41 cm dbh
- Inoculated 6x with *Spongipellis delectans*
- Two *S. delectans* heart rot conks erupted approx. 2 m below modified top, with **one clearly visible on the applied stem scar** (red arrow)
- 8 additional sap-rotting fungal conks (undetermined species) were also visible on this stem

Tree #36 in 2024 – Lower end of the top section that was removed as part of the tall stub treatment

- Note absence of decay in this piece of the removed stem
- There was no decay in this piece at the time of stubbing in 2018 nor in 2024
- This is in contrast to the inoculated portion of the remaining stem below, which now has fungal conks in 2024

Tree #26 (Blk EST-5905) in 2024

- Cottonwood window treatment, inoculated 6x with *Spongipellis delectans*, plus fisher den features added
- Tree had upper stem snapped at 14 m above ground, but is still alive
- Multiple Pileated Woodpecker feeding cavities (near green arrows) in upper 2m of remaining stem
- One woodpecker nest cavity (at red arrow) approximately 4 m below the top
- This tree had received fisher den treatments with inoculation and girdling approx. 3 m below the visible nest cavity

Tree #39 (Davis Rd.) in 2024

- All 19 treated aspen received tall stubb treatments
- 9 aspen inoculated 6x with *Ganoderma applanatum*
- 10 aspen were “stubbed” but were NOT inoculated = Control Treatments
- Aspen treatments are primarily intended to benefit woodpeckers and other generally cavity users (e.g., small forest owls)
- Tree #39 – aspen tall stub treatment, 41 cm dbh, 14 m tall after treatment, inoculated with *G. applanatum*
- Tree #39 is fully dead (as per treatment objectives), with some loosening bark and minor saprot decay
- Some woodpecker feeding excavations visible in upper stem
- No evidence of significant internal heartrot decay (e.g., nest cavities, fungal conks) at this time

Summary of 2024 Assessment Results

1. 60 trees treated in 2018 were re-visited in Sept. 2024
2. One tree (#56, aspen tall stub, control treatment) could not be located → likely uprooted due to root disease
3. 25/59 trees (42%) had evidence of woodpecker feeding excavations and the onset of wood softening on the treated sections of these trees
4. 7/18 (39%) of fisher den treatments had visible heartrot or saprot fungi present on the treated sections of the tree stem
5. 7/49 inoculated trees (14%) had significant heart rot decay with 1-6 fungal conks visible on the treated stems. Five of these were cottonwoods, plus one spruce and one aspen
6. Visible heartrot conks included 2/4 species of the inoculant fungi used in the 2018 treatments → *P. populnea* and *S. delectans*
7. 4/49 inoculated trees (8%) had recent woodpecker nest cavities →these included two spruce tall stubs, and two cottonwoods windows (with fisher den features)
8. One tree (#57, aspen tall stub) had a recent oval-shaped Pileated Woodpecker nest cavity at approx. 6 m above ground (red arrow) and 30 cm below the full stem girdle. This was a non-inoculated control tree – *Phellinus tremulae* conks erupted after tree death, which means this tree was already infected with this endemic heartrot fungus (specific to trembling aspen)
9. Two other fungal heart rot species (*Fomitopsis pinicola* and *Phellinus tremulae*) which were NOT inoculants, appeared on 5 trees and would have erupted sometime after these trees were dead
10. 8/59 trees (14%) had saprot fungal conks (low-moderate abundance) visible on the treated stems – saprots typically colonize dead wood

Summary of 2024 Assessment Results

11. Spruce: 6/15 (40%) of treated spruce showed visible decay → these were all inoculated tall stub or dead top treatments. Decay was primarily evident by woodpecker feeding excavations, wood softening and saprot conks
12. One spruce tall stub had a nest cavity start
13. Cottonwood: 10/26 (38%) of treated cottonwoods showed evidence of wood softening/decay, erupted fungal conks, and woodpecker feeding or nest cavity excavations
14. Aspen: 9 aspen trees had tall stub treatments inoculated with *Ganoderma applanatum*. 6/9 (67%) of these trees had NO evidence of decay or presence of fungal conks
15. Three tall stub treated aspen had erupted *Phellinus tremulae* heart rot conks (red arrows) after treatment. Two of these trees were CONTROLS which were NOT inoculated, and one was inoculated with *G. applanatum*. Thus, these trees would have had resident *P. tremulae* prior to the 2018 treatments

Control Trees in 2024

- **10 aspen trees** were mechanically modified as tall stubs, but were NOT inoculated as “Control Treatments”
- All control trees were fully dead as a result of the stubbing/girdling treatment
- All trees had negligible visible stem decay
- No erupted fungal fruiting bodies (conks) were visible on 7 trees
- 3 trees had erupted *Phellinus tremulae* conks which erupted after tree death. This fungus would have been resident in the tree (but not easily detectable) in 2018
- No woodpecker feeding excavations or nest cavities
- Minimal bark discoloration and some bark loosening observed on all control trees
- Note optional bat roost crevices (at red arrows) applied to this stem – however, interior wood is still light-colored, indicative of negligible decay at this time

Conclusions

1. Cottonwood treatments, either for fisher denning, or for additional cavity dwellers such as bats and woodpeckers, are very promising
2. The relatively rapid development of decay-causing heart rot fungi in inoculated large diameter, live cottonwoods (within 6 years) is very encouraging. This timeframe is much shorter than natural decay dynamics in large cottonwoods that can easily take 50-100+ years
3. Wildlife tree creation treatments in trembling aspen are challenging → care must be taken to ensure no current infection with endemic *Phellinus tremulae*. Other fungal species such as *Fomes fomentarius* may be hold more promise for aspen inoculation treatments (e.g., Kootenay region 2019 aspen tall stub inoculation with *F. fomentarius* → note Pileated Woodpecker nest cavity at red arrow, only 3 years after treatment)

Continuous Improvements – Fisher Den Treatments

1. Improved girdling and stem moisture flow mitigation techniques on large, live trees to enhance fungal colonization
2. Improved cavity entrance starts that incorporate female fisher cranial and body size dimensions and improve inoculation effectiveness
3. Use of larger “blocks” of fungal inoculant material instead of dowels

Continuous Improvements – Bat Roost Treatments

- Bat feature treatments provide opportunities for bat maternity roosting and day roosting
- Treatments can be applied to both live and dead (after tall stubbing) trees
- In addition trees can be inoculated with appropriate heart rot fungi in order to increase internal cavity size/volume to accommodate potential maternity roosts
- Two types of installed bat features which provided roosting, shelter and resting sites for bats:

i) Plunge cuts (URL: https://www.dropbox.com/scl/fi/t4eojisng3m5jauu0huvw/IMG_7420.MOV?rlkey=it78as6b59ilzdasrzhg2uzie&st=duvxf1a4&dl=0)

ii) Simulated lightning strikes/frost cracks

Continuous Improvements

- Building the native heart rot fungi culture bank: **13 endemic species** in storage for use in future and ongoing habitat enhancement and restoration projects
- Continue monitoring and effectiveness evaluations of past wildlife tree creation treatments completed in BC from 2009-present
- For example, the tree at right is a ponderosa pine tall stub treatment – modified and inoculated in 2021 in the E. Kootenay region. Note the circular woodpecker nest cavity (red arrow, about 2 m above the stem girdles), that is now present in 2024

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Time for Questions??