Quantifying and Enhancing the Ecological Services of Bats to the Forest Industry

Project # CAT19-4-569

The Potential for Artificial Roost Enhancements within the Nakusp and Area Community Forest and the Bonanza Corridor

Prepared for:
The Habitat Trust Conservation Society and
The Forest Enhancement Society of British Columbia

Prepared by:

Darcie Quamme, MSc., R.P.Bio., Integrated Ecological Research
Cori Lausen, PHd., Wildlife Conservation Society
Erin McCleod, UBC Forestry/True North Consulting

August 15, 2018

Table of Contents

Abstract: Multiple threats, including white-nose syndrome (WNS), and impacts from forest practices including wildfire/climate change mitigation and fuel management have increased the urgency for outreach to forest managers . Though poorly understood, preliminary study of the importance of bats to healthy forests suggests that conservation and enhancement of habitats for bats in forest plans is critical. Reducing non-WNS threats to bats, filling critical knowledge gaps, and evaluating and implementing appropriate mitigation and/or enhancement strategies is needed to best position BC and its forest industry as WNS spreads into the province in the near future. In this document we review a number of enhancement strategies and found that planning stages are critical and likely the most valuable mitigation option to the continued preservation of habitat for bats. However, strong enhancement or mitigation options reviewed here include Brandenbark and wildlife tree creation with attributes for bats but remain untested in BC.

1 Introduction

Currently, there is a need for increased understanding that bats have an economic value to humans, natural ecosystems (Eval 2016, BC Bat Program 2016, MOE 2016, Boyles et al. 2011). Obtaining information on the ecological services that bats provide to the forest industry and investigate methods on how to enhance populations is key information required to encourage forestry planners to protect bat foraging habitats and other wildlife habitat features (e.g. maternity roosts and hibernaculum) during forestry activities. In addition, the pest services that insectivorous bats provide to the forest industry are poorly understood (Barclay and Bigham 1995). The arrival of white-nose syndrome (WNS) in Washington State has increased the urgency and need to fill knowledge gaps that aid efforts to conserve bat populations including those related to the BC forest industry (Env. Canada 2017, MOE 2016 and 2017). These gaps include:

(1) Identifying the potential ecological services that bats provide to the BC forest industry and
(2) Developing of enhancement methods for the forest industry to aid with the bat population recovery.

The implications for B.C.'s forest industry are potentially large because insectivorous bats eat as much as their body weight in insects each night, helping to control insect populations (Laidlaw and Fenton 1971). For instance, bats have been shown to act as natural enemies to forest pests (BC MOE 2016) such as western spruce budworm (Wilson et al. 2006) and tent caterpillars (Dodd et al. 2012). In addition, moths and beetles, common orders of forest pests are dominant prey items found in bat fecal pellets (Nelson Forest Region, Grindal 1996). The economic costs to the forest industry are unknown but recent studies have calculated that losses of bat populations due to white-nose syndrome (>6 million bats killed by Whitenose Syndrome in eastern NA) cost the US agriculture industry $23 billion in pest control services from crop yield losses and increased pesticide-use (Boyles et al. 2011, Eyal 2016). The federal Government of Canada has issued warnings that the disease could increase the economic costs to the timber industry through decreased forest health and additional insecticide use (Env. Canada 2017). Because of these warnings, the BC Bat Action Team (BCBAT) has

recommended that collecting baseline data on the pest services provided by bats to the Forest Industry as a high priority (BC Bat Program 2016).

There is also a need to cost and evaluate newer roost enhancement methods that could be used by the forest industry to facilitate the reproductive success of bats. Habitat enhancement techniques that increase the availability of optimal roosting locations for bats may help in the recovery of bat species affected by multiple threats including forest activities (Env. Can 2017). For instance, many bat species prefer to roost older forest stands, relative to young forests (Barclay and Brigham 1996) because of greater snag availability for roosting (Crampton and Barclay 1996, Krusic et al. 1996, MOE 2017). Enhancement of roosting habitat could be carried out in targeted areas when roosting habitat is limited including recent methods that are untested in BC (see for example Modern Bats, Copperhead Design, Alberta Community Bat Program or University of Winnipeg).

Increased information and knowledge from this project will inform an upcoming provincial document providing guidance on Best Management Practises for Bats in BC to the forest industry. Target species include: Long-eared myotis, California myotis, Little Brown Bat, Yuma myotis, Long-legged Myotis, Townsend's Big-eared Bat and the Big Brown Bat, Keen's Myotis, Eastern Red Bat, Hoary Bat and Silver-haired Bat. The current report addresses the second gap in knowledge (Objective 2) within the overall Habitat Conservation Trust and Forest Enhancement Society of BC funded seed project.

Enhancing pest services provided by bats to the BC Timber Industry. We will test newer methods for roost enhancement that are applicable to bat species dependent on sloughing bark in forested habitats including species that do not use current bat house designs in use (pers. com Cori Lausen). Initial testing and evaluation of designs will occur in collaboration with current forest tenure holders in BC.

These roost enhancement methods may ultimately help to facilitate the reproductive success of bats and bolster the population and may promote WNS survival and or recovery. We have selected initial test sites for enhancement within the NABat cell centered around the Box Lake wetland and Summit Lake near Nakusp, BC. The Nakusp and Area Community Forest licence borders on these water features and we have support from their Board with in-kind time from UBC Forestry student, Erin McCleod to investigate options for enhancement.

2 Pre-harvest planning and post-harvest enhancements

We have selected initial areas for pre-harvest planning around wildlife features (thinning and wildlife tree patch creation), and post-harvest artificial roost enhancement centered around Box Lake, Summit Lake and Wesley development areas near Nakusp, BC.

Current planning by NACFOR involves removal of a series of forest patch cuts over time to provide heterogeneous age stands over the landscape and small dispersed cut blocks designed to protect multiple resource values (pers. com. Frances Swan, NACFOR Project Manager) in Box Lake and Summit

Lake areas with post-harvest treatments in the Box Lake, Summit Lake and Wesley Development areas.

NACFOR is currently interested in incorporating new information regarding wildlife habitat features, patch retention, nursery trees and forest thinning to best maintain habitat for bats during operations.

An extensive review on the recommendations on the Best Management Practises (BMP) for Bats for Forestry is currently near release by the BC Ministry of Environment (pers com S. Holroyd, 2018). . As a result, when this information is available it will be incorporated in pre-harvest planning for bats for areas shaded in green in Figure 1.

The new Wildlife Habitat Features Guidance Document, for the Kootenay Boundary (MOE 2017) defines and describes wildlife features important to bats including nursery trees and hibernacula as well as provides educational opportunities for forest managers and contractors. See Section 5.1 for a description of bat nursery tree and bat hibernaculum with possible considerations and actions in accompanying field cards and photos developed for forest managers.

Further outreach was carried out by Dr. Cori Lausen in a field visit to Box Lake on August 10, 2018. This included a review of wildlife habitat features, nursery patches and possible trees with defects that could be left as roosting sites during forest operations and patch removal (Minutes in Appendix 5.1).

However, because further detailed recommendations are pending with regards to Best Management Practices for Forestry, the initial focus of the current paper will involve reviewing the potential for artificial bat roost enhancement methods which simulate artificial bark (Noteman 1998, Chapman et al. 2002, Chapman et al. 2012, Whittaker et al. 2006, Mering and Chambers 2012 and 2014). These artificial roost enhancements could be used to re-establish summer roost habitats following patch removal for the areas shown below in yellow.

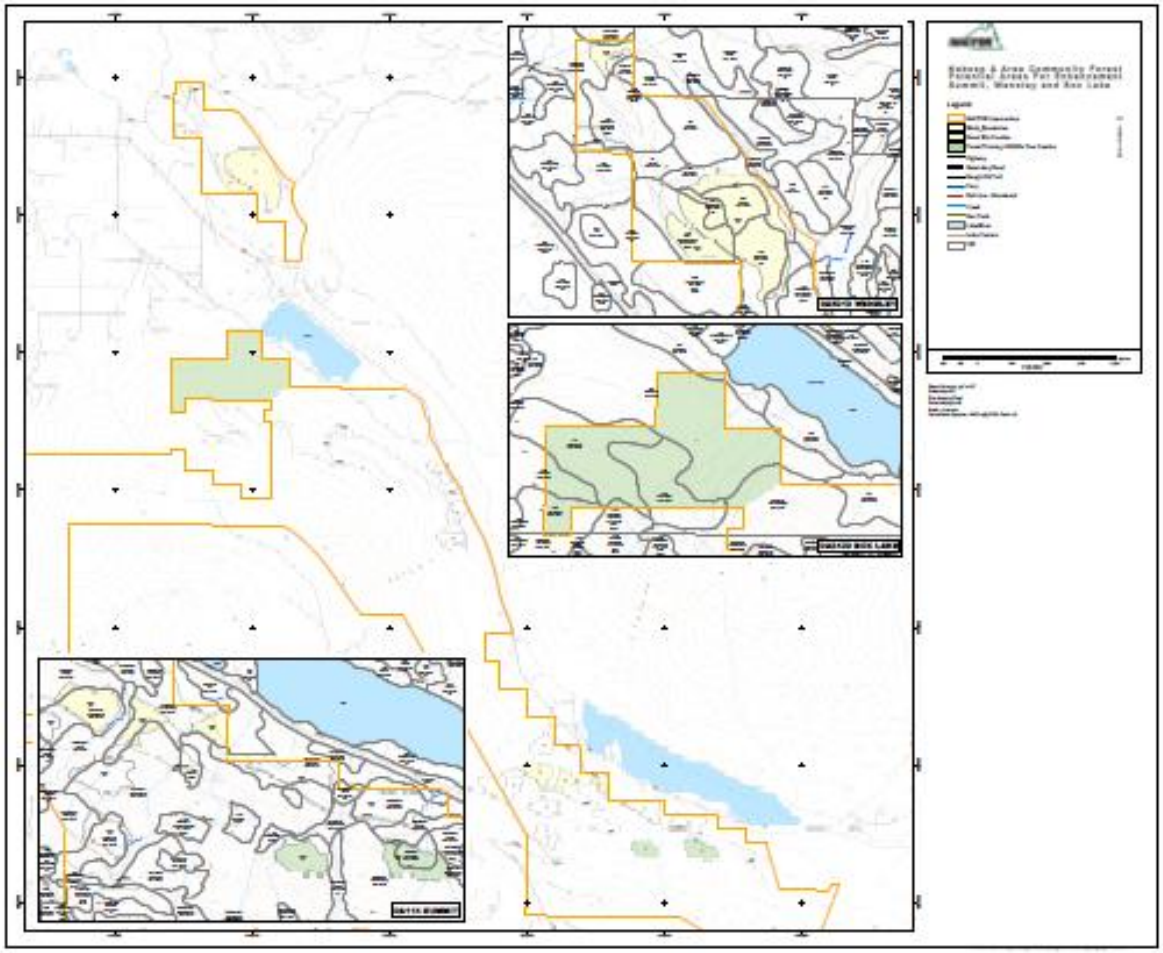

Figure 1. Overview of areas of thinning and roost habitat enhancement within the NACFOR property within Box Lake, Summit Lake and Wesley development areas. Shaded green areas are proposed areas for harvest with potential for thinning and bat focused wildlife tree enhancements. Areas shaded in yellow involve possible post-harvest roost enhancement sites.

2.1 Post-harvest roost enhancement actions

2.1.1 Summer roost enhancement

A field meeting was held at Box Lake wetland on August 3, 2018 facilitated by NACFOR summer student, Erin McCleod to workshop ideas. In attendance were Darcie Quamme, Integrated Ecological Research, Frances Swan and Erin McCleod from NACFOR, and Jason Rae and Cori Lausen from Wildlife Conservation Society. Dr. Cori Lausen provided a review of recommendations on summer roost enhancement ideas for the Nakusp and Area Community Forest that simulate loose bark used by bats for summer roosts.

An outcome of this meeting was that we decided to pilot and test roost enhancement methods within the NACFOR property. Previous research has shown that bats do use artificial wooden or resin roosts

when placed in trees as part of forest restoration treatments particularly when placed 2.2-15.2 m from the ground in south, south-west or south-east facing boxes (Chambers et al. 2002, Minard 2007).

Mering and Chambers (2014) suggest that roost enhancements are most successful when they mimic natural roosts for target species. Target species for this area based on capture in the North America bat cell centered around the nearby Bonanza wetland include: Long-eared myotis, California myotis, Little Brown Bat, Yuma myotis, Long-legged Myotis, and the Big Brown Bat, and Silver-haired Bat.

We suggested that perhaps we could test clusters of small cost-efficient enhancements such as cedar/asphalt shakes or white pine bark shakes. While these types of enhancements are not long-term solutions they may simulate the temporary nature of natural bark for temporary roosting rather than a long-term maternity roost (Whitaker et al. 2006). These designs, however, may be subjected to weather and a lack of waterproofing over the long-term. As a result, design type and annual maintenance are important to review and cost relative to BrandenBark placed on poles (Figure 2) or alternative longer-term wood or resin designs that can be placed on live trees (Figure 3, Mering and Chambers 2012 and 2014). Design testing is required for this type of enhancement method.

We discussed that three locations within a cutblock could be selected and shakes or boards attached at the top to create a crevice in large trees with a design that ensured water proofing. Artificial roosts could be placed high in the tree (> 5m above ground) in three cardinal directions excluding north-facing directions (Minard and Eagan 2007) with guano collectors attached below the roost to help determine the artificial roost use. Perhaps, three cutblocks could be assessed.

Post-placement monitoring is crucial to determine success of the enhancement activities. Mering and Chambers (2014) suggest that artificial roost dimensions, volume, type of use, percent occupancy, mount location, height, aspect, and microclimate (at least temperature) should be document for each roost.

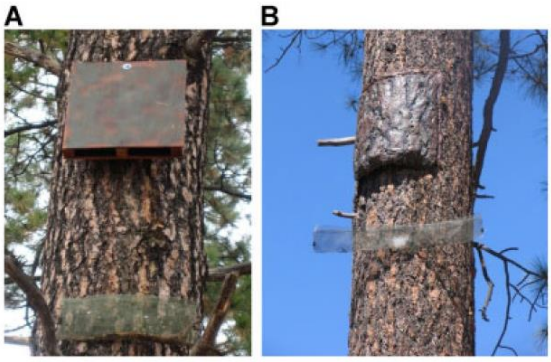

Figure 1. Artificial (A) wood and (B) resin roosts for bats with wire mesh catchers for guano.

Figure 3. Wood and resin artificial maternity roosts from Mering and Chambers (2012) and installation instructions Mering and Chambers (2014) with wire mesh catchers for guano.

Other recommendations include:

- Artificial roosts need to simulate natural habitat such crevices and cracks with shelter from the rain. Bats like crevices and cracks in trees, not necessarily snags and loose bark. Wildlife trees preferred by birds and other species may not be appropriate for bats. Snags and loose bark are too temporary and are usually not rainproof.
- Cedar shakes or asphalt shingles are best placed high in trees (>5 meters from ground) on edges of cuts to create artificial roosts with different space sizes/volumes under the shake.
- White pine bark could be obtained as part of NACFOR's operations and may work to create artificial roosts placed in trees.
- When putting up artificial roosts, a cluster of roosts is required so that the solar exposure of each roost is varied slightly to create microclimates for the bats. Roosts need to be within a couple metres of each other.
- Enhancement activities need to consider improving a "roosting area" or forest patch rather than one isolated bat house because bats are very colonial and live with their family unit. If they can't all fit in one roost, they have multiple roosts close together that they all use and take turns roosting together in the different roosts.
- Artificial roosts need to be located roosts near standing water not flowing waters. Some species prefer bigger bodies of water (like Box Lake) because they are too big to drink from water sources within in the forest and are able to avoid predation because they are fast and bigger. Other species prefer water sources within the forest because they are small enough to make it to small water sources and avoid predation.
- Artificial roosts should be placed near areas with a complex understory layer and wood decay which provide habitat for their insect prey base.
- Example experimental design could include: three sites/clusters within a cut block, with three pieces of bat bark in each cluster facing different direction to alter the solar exposure (south, south-west, south-east).

2.1.2 Wildlife Tree Creation: Incorporating Attributes for bats

We assessed the potential for incorporating bat attributes to wildlife tree creation projects in two day of field work with Todd Manning facilitated by Irene Manley (FLNRORD). We examined the feasibility of creating undercuts, bat slits, decay columns and cavity starts for bats, and provided input on attributes for bats. We also provided input to Todd's crew and this resulted in the creation of two trial wildlife trees with attributes for bats. This technique has strong potential because there is little maintenance required over a long-term period however, the effectiveness for habitat creation requires further assessment (see photos at Quamme 2018).

- Wildlife tree creation: Inoculating trees with laboratory cultured fungal inoculations can be used to speed up the death of some trees to create habitat. Girdling trees may present safety issues unless carefully carried out (see Manning and Manley 2014 and Quamme 2018 for examples of combined use of both these techniques).
- Using a chainsaw to make cracks in trees (bat slits, cavity starts) However, these enhancement strategies are mentioned but not well documented in the literature (Gower et al. 2015, Douglas et al. Unknown date).
- Initial successes have been observed in Kitimat forest management trials which provide for bat foraging and maternity roost requirements including thinned second growth stands, snag creation, and small openings (equivalent to those observed within old growth stands in the same site types within this landscape). Maternity bat roost boxes have been deployed as a short-term solution until the girdled trees naturally rot and decay. (pers. com Frank Doyle 2018).

2.1.3 Maternity/nursery roost enhancement

We have worked with Copperhead Design to price the cost of BrandenBark (Figure 2) a weather resistant longer- term maternity roost developed by Copperhead Design (Adams et al. 2015).

BrandenBark has been shown to have confirmed use as a maternity colony of little browns using our structures at Ft. Knox in addition to the success with the Indiana bat (pers. com Zachary Baer, Copperhead Design). The reproductive female little browns were roosting in the same structure as a maternity colony of Indiana bats.

Also, because BrandenBark wraps around a pole, it allows the colony to experience a variety of temperatures over the course of a day and move within the structure if needed . As a result, clusters of three structures allows the colony to move between structures to best find appropriate locations for roosting. It also may require less maintenance over the long-term.

BrandenBark is a strong option is cases where it has been determined that a maternity roost or nursery colony would have a high degree of success. This enhancement method has not been tested in British Columbia but may be a good enhancement method if the ground work and pre-assessment is completed and follow-up monitoring is planned.

Figure 2. BrandenBark™ roost structure from Adams et al. 2015.

Figure 4. Wildlife tree creation with attributes for bats with Todd Manning facilitated by Irene Manley.

2.1.4 Collaboration with Community Groups on bat enhancement opportunities

We are collaborating in a multi-year proposal with the Slocan Lake Stewardship Society with potential for enhancement on crown land in areas affect by clearcutting. We valued this at a $50,000 contribution in the coming year (unconfirmed), however, this is a large mult-year project. In addition, we are also working with the Slocan River Streamkeepers who have confirmed $30,000 in matching funds for 2019 for enhancement work on private lands. At present our work with NACFOR in planning and enhancement is unvalued, however we intend to submit proposals in the next funding cycle for a number of enhancement options. In addition, enhancement work is also currently matched with

$3000 from Darcie Quamme's work on private landowner enhancements and media/outreach in the Slocan Valley under FWCP.

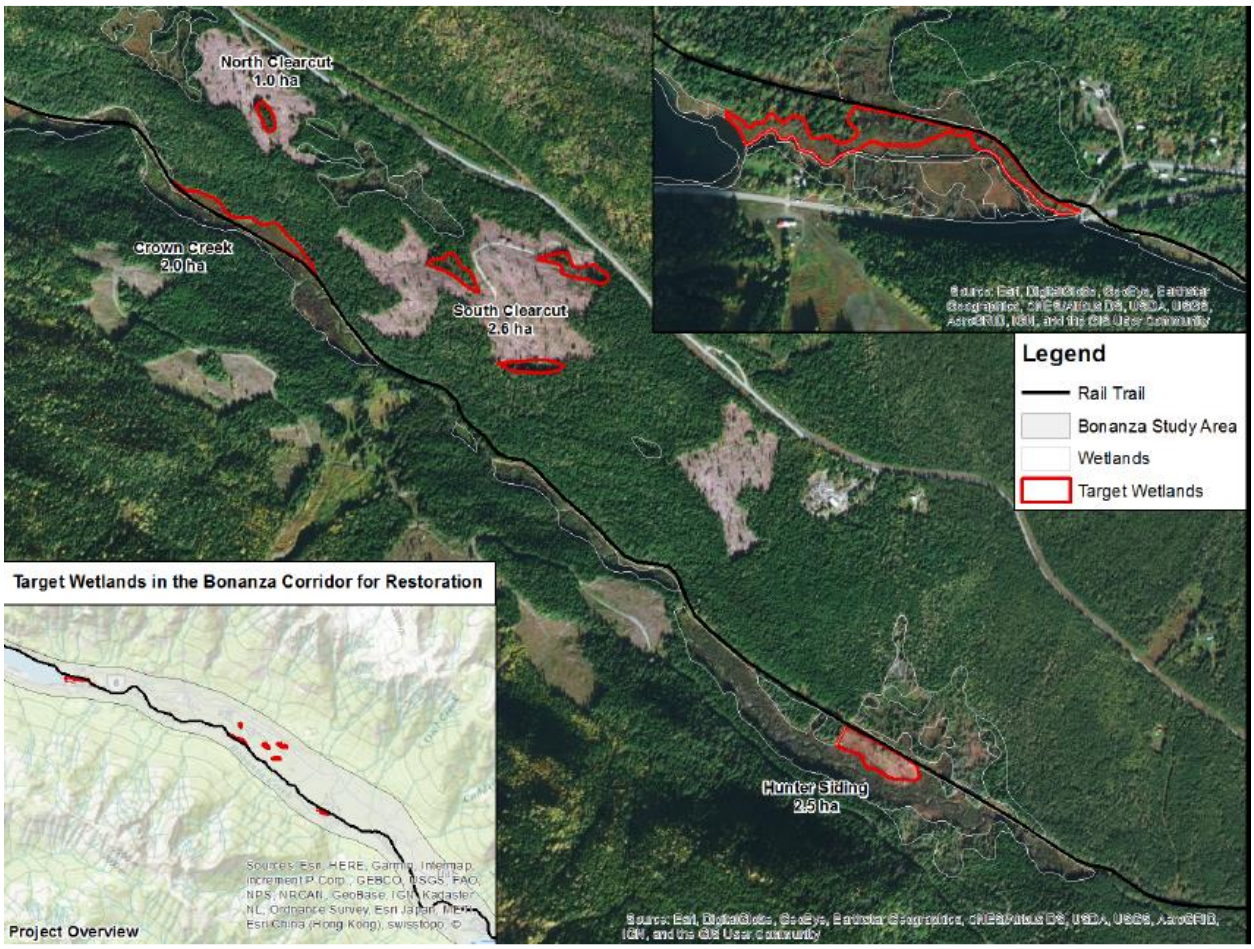

Figure 5: Mapping of planned restoration sites within the Bonanza Biodiversity Corridor. Ideal location for bat enhancement using Brandenbark or Wildlife Tree Creation with attributes for bats.

3 Acknowledgements

Integrated Ecological Research and the Wildlife Habitat Conservation Society recognize that the Habitat Conservation Trust Foundation and anglers, hunters, trappers and guides who contribute to the Trust, for making a significant financial contribution to support the project "Quantifying and Enhancing the Ecological Services of Bats". Without such support, this project would not have been possible.

Darcie Quamme of Integrated Ecological Research authored the initial draft report of the present report. Many of the original ideas and educational aspects that were presented to NACFOR at the field meeting in August 2018 were developed by Dr. Cori Lausen of Wildlife Conservation Society. Cori also a reviewed and contributed to the final draft. Frances Swan and Erin McCleod of True North

Consulting, the administrator/contractor of the Nakusp and Area Community Forest, provided mapping and input on operations and feasibility within their operating area. Erin McCleod, a UBC summer student with True North Consulting organized mapping, facilitated the August 10. 2018 meeting and carried out background research. Matching funding, in-kind support was kindly provided by the Naksup and Area Community Forest and Wildlife Conservation Society.

4 References

Adams, J., P. Roby, P. Sewell, J. Schwierjohann, M. Gumbert and M. Brandenburg. Success of Brandenbark, An artificial roost structure designed for use by Indiana bats (Myotis Sodalis). National Meeting of the American Society of Mining and Reclamation, Lexington, KY Reclamation Opportunities for a Sustainable Future June 7–11, 2014. R.I. Barnhisel (Ed.) Published by ASMR, 3134 Montavesta Rd., Lexington, KY <pdf>

Barclay, R. M.R. and R.M. Brigham. 1995. Bats and forests symposium: October 19-21,1995 Victoria, British Columbia, Canada. <pdf>

BC Ministry of Environment, Ecosystems Branch. BC MOE. 2017. DRAFT Wildlife Habitat Features Guidance Document (Kootenay Boundary Region), June 2017. <pdf>

Boyles JG, Cryan PM, McCracken GF, Kunz TH. 2011. Economic importance of bats in agriculture. Science 332: 41–42.

Chambers, C.L., V. Alm, M.S. Siders, and M.J. Rabe. 2002. Use of artificial roosts by forest-dwelling bats in northern Arizona. Wildl. Soc. Bull. 30:1-7. <pdf>

Douglas, T., and P. Burton, R. Holt and R. Seaton. Year Unknown. Integrating Ecosystem Management into Forest Management: Practical Examples for Forest Managers. Society for Ecological Restoration, BC Chapter. P. 95.

Dodd, L. E., Chapman, E. G., Harwood, J. D., Lacki, M. J., and Rieske, L. K. (2012). Identification of prey of Myotis septentrionalis using DNA-based techniques. Journal of Mammalogy, 93(4), 1119-1128

Eyal, F. 2016. Declining bat populations, increased pesticide use and infant mortality. Job Market Paper. 1-58.

Gower, T.L., P.J. Burton, and M. Fenger. 2015. Integrating forest restoration into mainstream land management in British Columbia, Canada. Pp. 271-297 *in* J.A. Stanturf (ed). Restoration of boreal and temperate forests, second edition. CRC Press, Boca Raton, Florida.

Minard, A. and D. Eagan. 2007. Bat habitat and forest restoration treatments. Working papers in Southwestern Ponderosa Pine Forest Restoration. Northern Arizona University. Flagstaff.

Noteman, 2011. L. Hidden housing – artificial bark for bats. Bats Magazine. Volume 16, Issue 3. Randall, L. A., Barclay, R.M., Reid, M. L., and Jung, T. S.

Manning, T and I. Manley. 2014. Results of Fungal Inoculation Treatments as a Habitat Enhancement Tool in the East Kootenay Region of British Columbia: 2007–2013. British Columbia Ministry of Forests, Lands and Natural Resource Operations. Extension Notes. <pdf>

Mering, E.D., and C.L. Chambers. 2012. Artificial roosts for tree-roosting bats in northern Arizona. Wildl. Soc. Bull. 36:765-772.

Mering, E.D., and C.L. Chambers. 2014. Thinking outside the box: a review of artificial roosts for bats. Wildl. Soc. Bull. 38:741-751.

Quamme, D. L. 2018. Wildlife Tree Creation: Incorporating attributes for bats with Todd Manning, SRS Avimetrics. Prep. for HCTF and FESBC [Powerpoint]. https://wordpress.com/page/integratedecologicalresearch.com/305

Whitaker, J. O. Jr., D. W. Sparks, and V. Brack. Jr., 2006. Use of artificial roost structures by bats at the Indianapolis International Airport. Environmental Management 38:28–36

Wilson, J. and R.M.R. Barclay. 2006. Consumption of caterpillars by bats during an outbreak of western spruce budworm. American Midland Naturalist 155:244-249.

5 Appendices

5.1 Minutes from Box Lake field tour at Nakusp and Area Community Forest on Forest Enhancement Ideas and Planning

Attendees:

- **Cori Lausen (Wildlife Conservation Society),**
- **Darcie Quamme (Integrated Ecological Research),**
- **Jason Rae (Wildlife Conservation Society),**
- **Frances Swan (True North Consulting/Naksup and Area Community Forest, NACFOR)**
- **Erin McCleod (True North Consulting/NACFOR)**

Minutes Taken by Erin McCleod, Summer Student with True North Forestry Consulting

August 3rd 2018

Habitat Enhancement Ideas

- Frank Doyle does bat enhancement in Kitimat, trying lots of different techniques
- Bats like crevices and cracks in trees, not necessarily snags and loose bark

- Snags and loose bark are too temporary and are usually not rainproof
- Girdling trees is a good way of speeding up the death of some trees to create habitat
- Using a chainsaw to make cracks in trees
- Cedar shakes could be good for fake roosts
- Bats don't explore their area much; when looking for new roosts they look very close to their current roosts
- Migratory foliage roosters (e.g. hoary bats) like tall trees
- White pine bark could be good for fake roosts
- When putting up fake roosts, alter the solar exposure of each roost to create microclimates for the bats and keep the roosts within a couple metres of each other (if they're going on different trees, have them on trees beside each other)
- Bats are very colonial and live with their family unit. If they can't all fit in one roost, they have multiple roosts close together that they all use and take turns roosting together in the different roosts. If they can all fit together in one roost then they will (like in an attic)
- Pups are being raised in June/July
- Need roosts near quiet H2O, not creeks. Some species prefer bigger bodies of water (like Box Lake) because they are too big to drink from water sources within in the forest and are able to avoid predation because they are fast and bigger. Other species prefer water sources within the forest because they are small enough to make it to the puddles and avoid predation.
- Understory layer and wood decay is important because it means there will be more bugs
- Nurseries are in an area, not just one tree
- Low airflow is important in the roost to keep in heat
- Example roost setup: 3 sites, 8-12 pieces of bark in clusters, differ the solar exposure and volume under the bark
- Bubbles under the bark of aspen are good for hibernacula

Bats in fir beetle funnel traps

- The bat in our funnel trap was a long-eared bat (Myotis evotis)
- Create a ladder to put in the funnel trap using wood and mesh or screening so that bats can climb out if they fall in the funnel traps
- Gleaning bats have big ears and listen for insects crawling around; this is probably why the bats are finding the funnel traps and is likely a predation event

Action Items

- Send Darcie and Cori the chemical and bat info for the funnel traps
- Send Darcie and Cori Dean's contact info

5.2 Wildlife Habitat Features: Bat Nursery Roost and Hibernaculum Descriptions

Wildlife Habitat Features Guidance Document, Kootenay Boundary Region

"Wildlife Habitat Features (WHFs) are established under the authority of Section 11(1) of the Government Actions Regulation (GAR) of the Forest and Range Practices Act (FRPA). A WHF is a feature used by one or more wildlife species to meet some or all of their life history requirements, and where special management is required to ensure that the feature is protected from damage during forest and range activities. Regulations under FRPA require that authorized persons carrying out primary forest or range activities must "not damage or render ineffective" a WHF. "

Information to Consider

- Establish a 100 m radius buffer around a bat nursery roost to avoid direct disturbance.
- Where multiple roosts are identified as a maternity colony (e.g., a cluster of tree roosts), measure the 100 m radius as a line drawn around the outer perimeter of all nursery roosts.
- Establish additional protection outside the buffer to avoid disturbances that may affect the functionality of the nursery roost.
- Acceptable activities within the buffer or additional protection area vary with the potential impact level of the disturbance.
  - **Low impact disturbances** (Livestock attractants. Activities on foot. Small group, visual screening present e.g. layout, cruising reconnaissance): acceptable in the additional protection area all year, and within the buffer outside of sensitive timing windows, though extra caution should be used immediately adjacent to the roost.
  - **Medium impact disturbances** (Light mechanized activities. Larger group/duration, no visual screening e.g. fence building, spacing, planting): acceptable in the additional protection area outside of sensitive timing windows, not acceptable within the buffer during sensitive timing windows, but may be acceptable outside of sensitive timing window if the activity does not degrade the habitat.
  - **High impact disturbances** (Mechanized activities e.g. road construction, falling and yarding, landing sites): possibly acceptable within the additional protection area outside of sensitive timing windows with review from a bat biologist, not acceptable within the buffer at any time.

Photos left to right: Todd Manning, Province of British Columbia, Suzanne Beauchesne

A BAT NURSERY ROOST

Definition

A feature that "houses" an aggregation of female bats and their young.

Location

- Often on southerly aspects
- Typically in mature forests with trees >50 cm dbh and decay classes 2-5

Features

- Can be hollow trees, 'stub trees', hollow branches, or behind loose, sloughing bark, as well as rock crevices on warm aspects
- Bat droppings (guano) are often present at the entrance, and a strong smell of ammonia may be present (bat droppings are similar to mouse droppings, but are generally not as smoothly formed and have a shiny speckled appearance from the remains of insect wings)
- Highly variable in size; typically large enough to hold a large group of bats so that they can keep each other warm

Notes

- Several species of bats may use the same maternity roost
- **Sensitive Timing: May 1 to August 31**

Similar features to a Bat Nursery Roost

Bat hibernaculum - how to distinguish:

- Hibernacula are typically much larger than a maternity roost
- Hibernacula are typically in caves and old mines, not trees
- Hibernacula are active during the winter, whereas maternity roosts are active during the spring and summer

http://www.env.gov.bc.ca/wld/frpa/WHF.Guidance.Document_KootenayBoundary_30June2017.pdf

https://www2.gov.bc.ca/assets/gov/environment/natural-resource-policy-legislation/legislation-regulation/frpa-pac/wildlife-habitat-features/whf_field_cards_kootenay_boundary_batnurseryroost.pdf

Information to Consider

- **Sensitive Timing: October 1 – April 30**
- Establish a 100 m radius buffer around a bat hibernaculum to avoid direct disturbance.
- Establish additional protection outside the buffer to avoid disturbances that may affect the functionality of the hibernaculum.
- Acceptable activities within the buffer or additional protection area vary with the potential impact level of the disturbance.
  - **Low impact disturbances** (Livestock attractants. Activities on foot. Small group, visual screening present e.g. layout, cruising reconnaissance): acceptable in the additional protection area all year, and within the buffer outside of sensitive timing windows, though extra caution should be used immediately adjacent to the hibernaculum.
  - **Medium impact disturbances** (Light mechanized activities. Larger group/duration, no visual screening e.g. fence building, spacing, planting): acceptable in the additional protection area outside of sensitive timing windows, not acceptable within the buffer during sensitive timing windows, but may be acceptable outside of sensitive timing window if the activity does not degrade the habitat.
  - **High impact disturbances** (Mechanized activities e.g. road construction, falling and yarding, landing sites): possibly acceptable within the additional protection area outside of sensitive timing windows with review from a bat biologist, not acceptable within the buffer at any time.

Photos left to right: Province of British Columbia, Anna Roberts, Paul Griffiths

A BAT HIBERNACULUM

Definition

A site where one or more bats hibernate in the winter (hibernacula [plural]).

Location

- Typically in undisturbed areas with exposed rock or old mines close to foraging habitat

Features

- Most often caves, cliff crevices, or abandoned mines that provide cool, constant temperatures and protection from the elements and predators
- Bat droppings (guano) are often present at the entrance, and a strong smell of ammonia may be present (bat droppings are similar to mouse droppings, but are generally not as smoothly formed and have a shiny speckled appearance from the remains of insect wings)
- Entrances can be large and conspicuous or small and obscure
- Chambers are typically deep and quite large

Notes

- Several species of bats may use the same hibernaculum
- Hibernacula are used year after year
- Here are no BEC associations of hibernacula as they are more based on topography

Similar features to a Bat Hibernaculum

Bat nursery roost- how to distinguish:

- Nursery roosts are typically much smaller than a hibernaculum
- Nursey roosts are often in trees, not caves or old mines
- Nursery roosts are active during the spring and summer, whereas hibernacula are active during the winter

http://www.env.gov.bc.ca/wld/frpa/WHF.Guidance.Document_KootenayBoundary_30June2017.pdf

https://www2.gov.bc.ca/assets/gov/environment/natural-resource-policy-legislation/legislation-regulation/frpa-pac/wildlife-habitat-features/whf_field_guide_kootenay_boundary_bathibernac.pdf