Environment and Climate Change Canada
Canada Nature Fund: Community-Nominated Priority Places for Species at Risk

Kootenay Connect: Columbia Wetlands

Restoration of Habitats and Species at Risk in the Columbia Valley

Year 4 (2022-2023)

Environment and Climate Change Canada | Environnement et Changement climatique Canada

KCP Kootenay Conservation Program

Kootenay Connect

The Columbia Wetlands Stewardship Partners

Executive Summary

In year four (2022-2023) of the Kootenay Connect project the Columbia Wetlands Stewardship Partners (CWSP) continued work on Species at Risk in the Columbia Valley, from Canal Flats north to Golden. We built upon knowledge gained in previous years and developed conservation actions benefiting four at-risk species: Western painted turtle - intermountain - Rocky Mountain population (*Chrysemys picta* pop. 2), American badger (*Taxidea taxus jeffersonii*, eastern population), Lewis's woodpecker (*Melanerpes lewis*), and osprey (*Pandion haliaetus*).

It has been estimated that 100-160 adult American badgers live in the East Kootenays, which includes the Columbia Valley study area. We had a public outreach campaign to pursue information on locations of public sightings of badgers (or their dens) to get a sense of where badgers occur on the landscape. Seventy-nine public observations were recorded. Most badgers were observed on private land. However subsequent inventory work occurred only on provincial Crown land since our goal is to establish a conservation designation for badger habitat; a designation that only applies on Crown land. During badger inventories, we identified 983 badger burrow entrances in four unique areas. Seven-hundred and ninety of those burrows were in functioning condition, meaning they were still capable of providing habitat and ecological functions for badgers. Those burrow locations have been nominated to become Wildlife Habitat Features and two Wildlife Habitat Areas. During inventory we observed that several of the burrows are facing anthropogenic threats, such as cattle trampling and unauthorized off-road vehicle (ORV) activity.

The Western painted turtle is listed as a 'Species of Special Concern' under the federal Species at Risk Act. Through public outreach and inventories at turtle habitats, locations of important nesting areas in Columbia Valley were identified in 2020. At a particular nesting hotspot, the turtle population was being impacted by mortality events (road kill and predation). To help reduce mortality during this critical life stage, an alternate nest site was created in 2022 to entice turtles to a safer nesting location. Nesting substrate was brought in and fenced to help protect the newly created nest area from nest predation. After the alternate site was completed, we observed turtles continuing to use their historic nesting area. Through effectiveness monitoring we learned of additional challenges at this site during the nesting season. Identified challenges will be addressed in 2023, which will include fence modifications, and the creation of another alternate nesting site that would need to be passed over by turtles to reach their historic nest site. At a second area that we enhanced with fencing for predator exclusion, turtle hatchlings and successful nesting within the enclosure was observed.

Multiple outreach methods were designed to attract volunteers to monitor turtle basking logs installed by CWSP in 2021. Twenty-four volunteers were coordinated to monitor logs in 2022, but no turtles were observed on the logs during the irregular monitoring periods. CWSP staff did observe turtles using the logs at selected sites. We also worked with the Ministry of Transportation and Infrastructure to have 'Wildlife Area' signs installed at two road locations with known turtle mortality, where turtles are crossing the road to access nesting sites.

In 2022 we located 11 active Lewis's Woodpecker nests in the study area, all on private land. Three of those nests were located outside federally designated critical habitat. Since nest site locations for Lewis's Woodpecker can fluctuate from year to year, when the Recovery Strategy for Lewis's

Woodpecker is revised, it is recommended that critical habitat expand to areas where the new nest sites were discovered.

Osprey are a bio-indicator of ecosystem health. They are sensitive to anthropogenic and climatic influences and can be affected by land and water management practices. They are also threatened by human disturbance, predation and displacement by other species. Since they are a bio-indicator, CWSP continued with the fourth year of monitoring osprey. Seventy-one osprey nests were monitored three times during the breeding season; 27 of those nests produced chicks and were deemed successful. This nest success is similar to rates observed in previous years of monitoring. We also accessed the durability of osprey nest platforms and proposed the addition of two poles and platforms at specific sites.

Through Kootenay Connect, CWSP has learned where important habitat areas are located for specific species at risk. We are raising public and stakeholder awareness of those species, their important habitats and implementing conservation actions to benefit focal species at risk.

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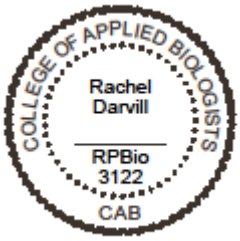

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1.0 Introduction

Kootenay Connect (KC) is a multi-year initiative that focuses on conservation actions benefiting species at risk in priority locations (Proctor & Mahr, 2019). The Columbia Wetlands is one of the priority regions and the Columbia Wetlands Stewardship Partners (CWSP) a key partner group working in this area. The CWSP was formed in 2006 and has been active with conservation and stewardship activities in the Columbia Valley. Comprised of more than 30 diverse groups of community interests, Indigenous groups and government agencies, the CWSP develops and implements effective stewardship practices for the Columbia Wetlands and the Upper Columbia River. The CWSP works to engage the general public and works with all levels of governments to implement a shared stewardship model for the management of the Columbia river and wetlands. The three years of previous CWSP work on species-at-risk for KC is presented in annual reports from the previous three years (Darvill, 2020; Darvill, 2021; Darvill, 2022), with some accompanying videos available on the KC website.

This report describes conservation actions accomplished in Year 4 (2022-2023) of the species-at-risk component of the CWSP-KC project. The report is organized by sub-projects: Western painted turtle - intermountain - Rocky Mountain population (*Chrysemys picta* pop. 2), American badger (*Taxidea taxus jeffersonii*, eastern population), Lewis's woodpecker (*Melanerpes lewis*), and osprey (*Pandion haliaetus*). The accompanying stewardship actions that took place for those species in the Columbia Valley are described, as well as recommendations for additional conservation actions.

2.0 Study Area

The Columbia Valley (UTM: 535767; 5649168) is a vast mosaic of habitat types including montane, subalpine, grasslands, riparian areas and wetlands, and freshwater rivers and lakes - situated in the Rocky Mountain Trench in southeastern British Columbia, Canada (Figure 1). At nearly 55,000 hectares it provides habitat for a vast number of species including at least 65 species at risk (SAR) and 21 ecological communities at risk (Darvill, 2020). After a nomination made by Wildsight, the Columbia Wetlands were identified as a Ramsar site under the Ramsar Convention in 2005. Ramsar status recognizes this ecosystem as a wetland of international significance.

Approximately two-thirds of the study area is within the Regional District of East Kootenay (RDEK) Areas F and G, the other one-third is located within the Columbia Shuswap Regional District (CSRD) Area A. A number of communities are located in the area including Fairmont, Invermere, Radium, Edgewater, Brisco, Spillimacheen, Parson, Nicholson and Golden. The Columbia Valley is within the unceded traditional territory of the Ktunaxa Nation (including ?Aqam and Akisqnuk bands), Secwepemc Nation (including the Shuswap Band) and Metis Nation Columbia River.

Figure 1. The study area depicted in the Columbia Valley within British Columbia, Canada.

3.0 Western Painted Turtle

3.1 Introduction

The Western painted turtle - intermountain - Rocky Mountain population (*Chrysemys picta* pop. 2) (hereafter referred to as WPT) is blue-listed in the province of British Columbia (B.C.). It is listed as a 'species of special concern' by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and under the federal Species at Risk Act (SARA). It is the only native freshwater turtle found in B.C. Reasons for the WPT population decline are attributed to the "continuing loss of habitat, fragmentation of habitats and road mortality" (B.C. Ministry of Environment, 2017). The Intermountain – Rocky Mountain population is estimated to have somewhere between 5,000 to 10,000 adults, but no accurate population estimate exists (COSEWIC, 2016).

The WPT population in the Columbia Valley can be considered as peripheral, or on the edge of its habitat range; it may contain unique genetic material that could be important for the long-term survival and evolution of the species (Fraser, 1999). Species at the edge of their habitat range are particularly susceptible to disturbances that may cause mortality. During climatic changes endangered species (if the WPT becomes endangered) often collapse towards their periphery (B.C. Ministry of Environment, 2017). This species has limiting factors including that it is slow to mature, has low reproductive rates, relatively long-life span, dependence on wetland/terrestrial habitat matrix, and a limited ability to disperse beyond 200 meters (B.C. Ministry of Environment, 2017).

To assist with recovery efforts, CWSP has been working to identify important nest sites for WPT and subsequent turtle conservation initiatives in the Columbia valley since 2020 (Darvill, 2020; Darvill, 2021; Darvill, 2022). In 2020, a WPT inventory was done with the help of a public observation reporting program to guide inventory efforts in this large ecosystem (Darvill, 2021). We identified several important WPT habitat areas (e.g., nesting beds, basking log locations), as well as threats to those areas or limited available habitat features (basking logs) (Darvill, 2021). In 2021 conservation actions included the installation of basking logs in specific areas (shown to support WPT but with a lack of basking habitat), and enhancements to a WPT nesting bed suffering from high rates of predation (Darvill, 2022). In 2022-23, we continued with WPT nesting bed enhancement efforts at two locations and basking log installation at three additional locations.

3.2 Turtle nesting bed enhancements

3.2.1 Zehnder Farm (Invermere)

The project at Zehnder Farm began in 2021 when a fence was erected around the main WPT nesting area with the goal of keeping predators from predating the nests (Darvill, 2022). The landowner made regular observations at this site and reported the following from the 2022 field season:

- Prior to the nesting season, a whipper-snipper and blow torch were used to get vegetation out of the enclosure. After turtle egg laying season, the weeds were pulled attempting to remove them at the root. This occurred because plant roots can grow through turtle eggs killing hatchlings or preventing emergence.
- 15-20 WPT nest attempts occurred within the nesting bed enclosure during the egg laying season (May/June 2022) (Figure 2a). It was observed that turtles abandoned a nest attempt when they uncovered a large rock in the way of their digging.

- In late June, WPT were nesting nearly every night.
- Two completed nests were observed inside the enclosure (Figure 2b). To discourage predation, wire covers were put over these two nests.
- Four nests were laid outside of the enclosure and all four of these nests were predated (likely dug up by skunk but possibly American badger or Columbian ground-squirrel as they are common in the area); eggshells were found.
- Three additional nests were laid outside of the enclosure and were covered with wire to deter nest predators.
- When turtles were seen outside the enclosure and not nesting, those turtles were moved to the inside of the enclosure where they immediately began to nest in substrate within the enclosure (Figure 2c).
- Observed hatching event on June 20, 2022. Three days after hatchling emergence, this nest was excavated by the landowner to determine nest success: six eggs were intact (but shrivelled up with yolks intact) and six eggs had produced hatchlings leaving only eggshells (Figure 2d).
- A few turtles were found on the outside of the fenced enclosure trying to get back to the water. These turtles were then put inside the enclosure on nesting substrate in hopes of getting them to lay eggs.

a)  b) 

c)  d) 

Figure 2. a) turtle nesting attempt within the enclosure; b) successful nest laid within the enclosure; c) turtle moved from outside of enclosure onto substrate pile within enclosure; d) nest excavation which determined 50% nest success.

3.2.2 Stewart's Farm (Spillimacheen)

A 'hotspot' nesting bed was identified at Stewart's Farm in 2020 during public outreach and reporting (Darvill, 2021). This nesting area is on private property and was reported to have a large amount of turtle nest predation (Figure 3). Adult females need to cross the road (Westside Road) when moving between the water and nesting site, making them especially vulnerable to road mortality (B.C. Ministry of Environment, 2017). At the time of writing, Westside Road received relatively little traffic, but a few turtles had been found dead on the road at this location over the past few years.

The creation of an alternate nest site with fencing was erected in 2022 to help with issues of road and predator mortality (Figure 4). On April 1st, 2022, three loads of substrate were brought to the private land with a dump truck at the alternative nesting site location. On April 15, 2023, a 284-foot fence (galvanized 19-gauge 36" X 50' long with 1/2" squares of stucco wire) was installed around the substrate for nest protection from predators. We used 28, 6-foot T-rail fence posts that were pounded 1.5 feet into the ground with a rubber mallet, placed 12 feet apart. Another type of fencing material (galvanized 19-gauge 24" X 50' long 1/2" squares) was placed horizontally over the ground. The two fence types were woven together (using tie wire) at the ground to prevent predators from digging under the fence (Figure 5). The ground fence had large rocks placed upon it to keep it from bending upward. The intent was to bring each end of the upright fence into the water so that a predator would need to swim to get into the fenced-in nesting enclosure, typically WPT predators do not like swimming) (Figure 6). Vegetation and other limitations prevented the northwest end of fencing from ending in the water.

Figure 3. Skunk digging up turtle nests on the historic nesting bed in Spillimacheen (Stewart's Farm).

Figure 4. Alternate nest site created in Spillimacheen for western painted turtle.

Figure 5. Horizontal fence woven into upright fencing to prevent predators from digging under vertical fence.

Figure 6. Fence end brought into water: predator avoidance technique.

3.3 Additional conservation actions

3.3.1 Road signage and basking log monitoring

Outreach methods were developed and distributed (posters, social media, newspapers) to attract volunteers to monitor the turtle basking logs that were installed the previous year (Darvill, 2022) (Appendix 1). We coordinated twenty-four volunteers to monitor logs at Armstrong Bay and Radium Mill Pond in 2022, but no turtles were observed using these basking logs during the irregular monitoring periods. CWSP staff observed turtles basking on logs along Westside Road installed in 2022. We also worked with the Ministry of Transportation and Infrastructure to have 'Wildlife Area' signs installed at two road locations with known turtle mortality where turtles are crossing the road to access nesting sites: Westside Road in Spillimacheen and Lake Enid in the Wilmer area (Figure 7). CWSP also worked with Columbia Lake Stewardship Society to create WPT educational signage for the Columbia Lake and Armstrong Bay areas.

Figure 7. 'Wildlife Area' signs installed at two locations with known turtle mortality.

3.4 Recommendations for WPT conservation actions

3.4.1 Vegetation Maintenance

- Vegetation control at enhanced nesting areas is important since plant roots can grow through eggs, killing hatchlings, or preventing emergence. Roots of vegetation have been shown to grow in the eggs or hatchlings of WPT in both Revelstoke (Maltby, 2000) and Elizabeth Lake in Cranbrook (Clarke & Gruenig, 2003). "Light clearing of the enhanced nesting areas of vegetation twice a year: once in fall and once in in early spring. Avoid use of chemicals and mowing. Maintenance should be done keeping the seasonal activities of turtles in mind in order to avoid harm to turtles (avoid activities from mid-May to mid-July)" (Smithers, 2016). Remove any trees or shrubs that encroach on the enhanced nesting beds.

3.4.2 Basking Logs

- In 2021, after habitat assessments the CWSP installed 18 basking logs at three locations where basking habitat was lacking (Armstrong Bay at Columbia Lake, Dorothy Lake, Radium Mill Pond) (Darvill, 2022). In 2022, through the direction of Dr. Suzanne Bayley, the CWSP and the Lake Windermere District Rod and Gun Club installed six basking logs along Westside Road, two basking logs in the Palmer wetlands and four basking logs on the Trescher wetland. Turtles were observed using the logs along Westside Road. "Maintenance of these structures should be done on an annual basis as they are known to deteriorate over time. Maintenance should include

checking to make sure structures are still present, perform minor repairs, replacing structures with new ones if needed" (Smithers, 2016).

3.4.3 Enhancement of nesting areas in 2023

At the Zehnder Farm in Invermere:

- Bring substrate to the enclosure that was created in 2021 to expand the habitat availability in the nesting area. Currently the substrate inside the enclosure is limited (Figure 8).
- Encourage the landowner(s) to make ongoing observations at the turtle enhancement and report all WPT and predator activity to the CWSP WPT program.
- Build nest cages and provide some to landowner so that nests can be covered (protected from predation) if they are found outside of the enclosure.
- Build 4-5 one-way doors (escape routes) and provide to the landowner; assist with the installation of these doors in the fence. These aim to prevent turtles from getting stuck on the wrong side (outside) of the fence, which would make them susceptible to mortality events (predation).

Figure 8. Current WPT nesting enclosure highlighting lack of available turtle nesting substrate.

At Stewart's Farm in Spillimacheen:

- Create an additional nesting bed along the edge of the road (Figure 9), within a Ministry of Transportation (MoT) Right of Way. Permission from MoT was provided in January 2023 for this project. This nesting bed should be approximately 1 meter x 5 meter, 30 centimeters deep.
- When selecting potential nest sites, female midland painted turtles (*Chrysemys picta marginata*) have been shown to exhibit nest site fidelity (Rowe, 2003). The degree of nest fidelity for WPT is unknown. At the Spillimacheen nest sites adult females are crossing the road and they may continue to make these risky movements each year unless they select alternate nesting sites. To minimize road crossing and the potential for road mortality, nesting substrate should be added to the edge of the road that must be traversed to access the 'historic' nesting grounds (see bullet above). We will assess if they have high site fidelity (with wildlife cameras) to find out if the turtles stop to nest at the newly created alternate nest site or continue to cross the new bed and road to reach the historically used area (Figure 9).
- Realign the fence (installed in 2022) so that both ends go into the water, thereby reducing or eliminating possible predators. This will involve cutting vegetation such as cattail.
- Remove the horizontal fencing and replace it with wildlife crossing specific fencing (Animex fencing) to be installed alongside the vertical fence that is currently in place. This should help guide turtles stuck on the wrong side of the fence into one way escape doors, or along the fence into the water. The Animex fence is black which will reduce the sightlines of where turtles were wanting to go, and also creates a smooth fence for them to move against.
- Two to three one-way escape doors retrofitted into the fence. This will help minimize turtles on the wrong side of the fence (outside nesting area) that are trying to get back to the water. These doors should be open from May-June then closed to prevent predators from moving through them.
- Place a load of substrate (40% sand, 40% silt, 20% clay) on top of the current alternative nesting site created last year, about 30 centimeters deep.
- Wildlife cameras on: a) one-way escape doors to determine if they get used by turtles, or if predators are getting into the enclosure through them, b) natural historic nesting site (to help learn about population numbers using the nesting bed and level of skunk predation, c) the new nesting bed created along MOT ROW to monitor WPT use and predation and, d) the artificial nesting bed created in 2022 to monitor WPT use and predation.
- Create temporary signage for both ends of the nesting area, to go on the road during May and June only. This will alert the public to turtles that will be crossing the road during the sensitive nest laying time period.
- Volunteers requested to help with building nest covers, one-way escape doors, and fence installation.

Figure 9. Historic nesting area is shown as area #1. The area marked with #2 is where the alternate nesting bed will be created during Spring 2023.

4.0 American Badger

4.1 Introduction

The American badger (*Taxidea taxus jeffersonii*, eastern population) is red-listed in the province of B.C. and is listed as an Endangered species by COSEWIC (2012) under the Species at Risk Act (SARA) (2018). The rationale for Endangered status is the loss of open areas (forest succession, urban development) resulting in ongoing habitat decline; "as few as 100 mature badgers live in the East Kootenay region where they are vulnerable to increasing threats from roadkill" (COSEWIC, 2012). Several threats exist for badgers and their habitat including trapping, persecution, urban development, highway mortality, forest in-growth, reservoir flooding, gravel and sand pits, cultivation agriculture, extermination of prey (Adams & Kinley, 2004). A proposed Recovery Strategy was released in 2021 by Environment and Climate Change Canada (Environment and Climate Change Canada, 2021). It sets the strategic direction to stop or reverse the decline of the species, including the identification of critical habitat (when possible). Much of our study area is listed as critical habitat in the proposed recovery strategy for American Badger (Environment and Climate Change Canada, 2021).

Badger densities are low where they are found, and they have large home ranges with hundreds of different burrows within their home range (Newhouse, 2001). They often change locations daily and they reuse burrows from year to year making it important to ensure that unoccupied burrows are not destroyed (Newhouse, 2001). It has been shown that soil and prey availability are the key defining features or requirements for badger habitat (COSEWIC, 2012). Their primary food source in the study area is the Columbian ground squirrel (*Urocitellus columbianus*) (Kinley & Newhouse, 2008). Badgers prefer coherent soils that do not collapse when tunnelled (COSEWIC, 2012). Additional habitat associations are also important for badgers: low elevations, shallow slopes, low forest Crown exposure, and high solar radiation (Kinley, Whittington, Dibb & Newhouse, 2014). Badger habitat requirements are vast within the study area, however, "connectivity habitat in [the] Upper Columbia is primarily a north-south concern as badgers are mostly limited to lower elevations in the Trench" (Adams, 2011).

The American badger is recognized as a species at risk under the Forests and Range Practices Act (FRPA). A number of provisions under the FRPA can be used to manage badgers such as the creation of Wildlife Habitat Areas (WHAs) and Wildlife Habitat Features (WHFs). These designations are established to protect important habitats on provincial Crown land. American badger WHFs protect single features such as a burrow. Once identified, persons carrying out a primary forest activity or range activity in a WHF must not damage or render ineffective a WHF. "The Wildlife Habitat Feature designation… may be sufficient to protect and maintain badger burrows, especially maternal dens, provided that a 20 meter radius (or one tree length, whichever is less) around the burrow is kept free of machinery impacts and soil disturbance" (Adams & Kinley, 2004).

Badger WHAs protect concentrations of burrows, abundant prey sources, maternal denning areas, preferred friable soil (Adams & Kinley, 2004). Once a WHA is established there are 'general wildlife measures' (GWMs) to protect or conserve the species at risk associated with a WHA. GWMs are species dependent and provide specific direction related to the local situation (Kinley, 2009). GWMs can include specific direction on access (e.g., no road building), harvesting and silviculture, pesticides, range, and recreation. When proposing a WHA for badgers, there are no firm requirements regarding the amount of badger activity, WHA size, vegetation type or density of burrows (Kinley, 2009), but generally the size of a WHA ranges from 2-100 hectares.

The goals for GWMs in a badger WHA are as follows:

1. *Maintain important habitat features including sufficient structure/litter to provide hiding cover, open- or non-forested land, grasslands in a range of seral stages, friable soils, and prey.*
2. *Control forest encroachment and in-growth.*
3. *Manage livestock grazing to maintain suitable habitat for prey species (Columbian Ground Squirrel, Yellow-bellied Marmot, microtine rodents).*
4. *Minimize disturbance during the breeding season.*
   (Adams & Kinley, 2004).

WHAs provide more protection than WHFs through land management practices at a broader scale. The two designations are not mutually exclusive – features can be listed as WHFs as an initial step in the process, then designated as WHAs where warranted (e.g., on parcels of Crown land where badger activity is concentrated) (K. Stark, personal communication, September 2022). The WHA designation process is more time consuming so it can be useful to have features first designated as WHFs.

At the time of our project there was only one American badger WHA in the study near Canal Flats (Figure 10). The project biologist (R. Darvill) had received a number of anecdotal reports of badger activity in other locations of the study area. The main objective for the badger portion of the CWSP- KC species at risk project was to identify where potential important habitats are located for badgers, collect the requisite data at these locations, and submit applications for WHF/WHA proposals.

4.2 Methods

Information regarding American badger observations was requested from the public (Appendix 2 and 3). This information was used to determine where badger activity was on the landscape to help narrow the spatial extent for inventory work. Since WHA and WHF designations apply only to provincial Crown land, only locations on Crown land were inventoried to collect the requisite data for WHF/WHA proposals and submissions. Two people (R. Darvill, V. Shaw) searched the badger habitat areas directed to us through public input. At each burrow, a variety of parameters were recorded including UTMs, whether the burrow was old or new, in functioning condition, visible evidence of use, threats to habitat area, and additional comments when warranted.

Inventories avoided the sensitive denning period and occurred in 2022 on: August 5, September 7, 14, 22 and October 17, 18, 20, 21. Data on the required parameters (as described above) was collected at each individual burrow on the first three dates of inventory (August 5, September 7 and 14); this was a time-consuming process. Subsequent feedback from the provincial government was as follows, " for areas with multiple burrows relatively close together, assuming you are using a GPS unit with accuracy of ~5-6 m, it's probably best to provide a UTM for the centre of the cluster, then include a note with how many burrows are present around that UTM. This approach will suffice for our purposes" (k, Stark, personal communication, September 16, 2022). This is the approach that was taken on the remaining five days of inventory.

4.3 Results and Outcomes

Seventy-nine public submissions of American badger observations were provided through public outreach initiative (Figure 11). Most observations were made on private land; only four were on provincial Crown land and one was within the Columbia National Wildlife Area (federally managed lands). A map was created to overlay the public badger sightings acquired in 2022, various land jurisdiction categories, and high habitat suitability [according to the American badger resource selection function (RSF) model (Kinley, Whittington, Dibb & Newhouse, 2014)] (Figure 11).

Four unique areas were inventoried for badger use within the study, where the above layers overlapped. Nine-hundred and eighty-three burrow entrances were located during the surveys at four areas; 147 of those burrows were 'new', meaning they were used by badgers in 2022 (Table 1). Three-hundred and eighty-nine burrows were 'old', meaning they were used prior to 2022; 447 burrows (of the 983) were recorded as 'unknown;' it was not possible to tell if those burrows were made in 2022 or during the previous year (Table 1).

A feature/burrow is considered to be in 'functioning condition' when it is still capable of providing habitat and ecological functions to badgers. If there is vegetation or some soil sloughing around the burrow entrance, the feature is considered to be in 'functioning condition' because a badger could easily reoccupy it; if the burrow had collapsed, it would not be considered to be in 'functioning condition' (K. Stark, personal communication, September 2022). If a burrow is still in functioning condition, regardless of whether it is currently active or inactive, it can be documented as a feature and thus become a WHF and/or WHA. Seventy-five (of the 983) burrows were not in 'functioning condition', 118 were 'unknown', and 790 were in 'functioning condition'. The 790 burrows in 'functioning condition' were submitted to the provincial government to be registered as WHFs, this includes single burrows and points with multiple burrow counts (see Methods) (Table 1; Figure 12). Burrow locations technically become WHFs as soon as they are identified (K. Stark, personal communication, March 2023). A multiple WHA application package for American badger was submitted to the province in March 2023, these are for the Rushmere and Steamboat areas.

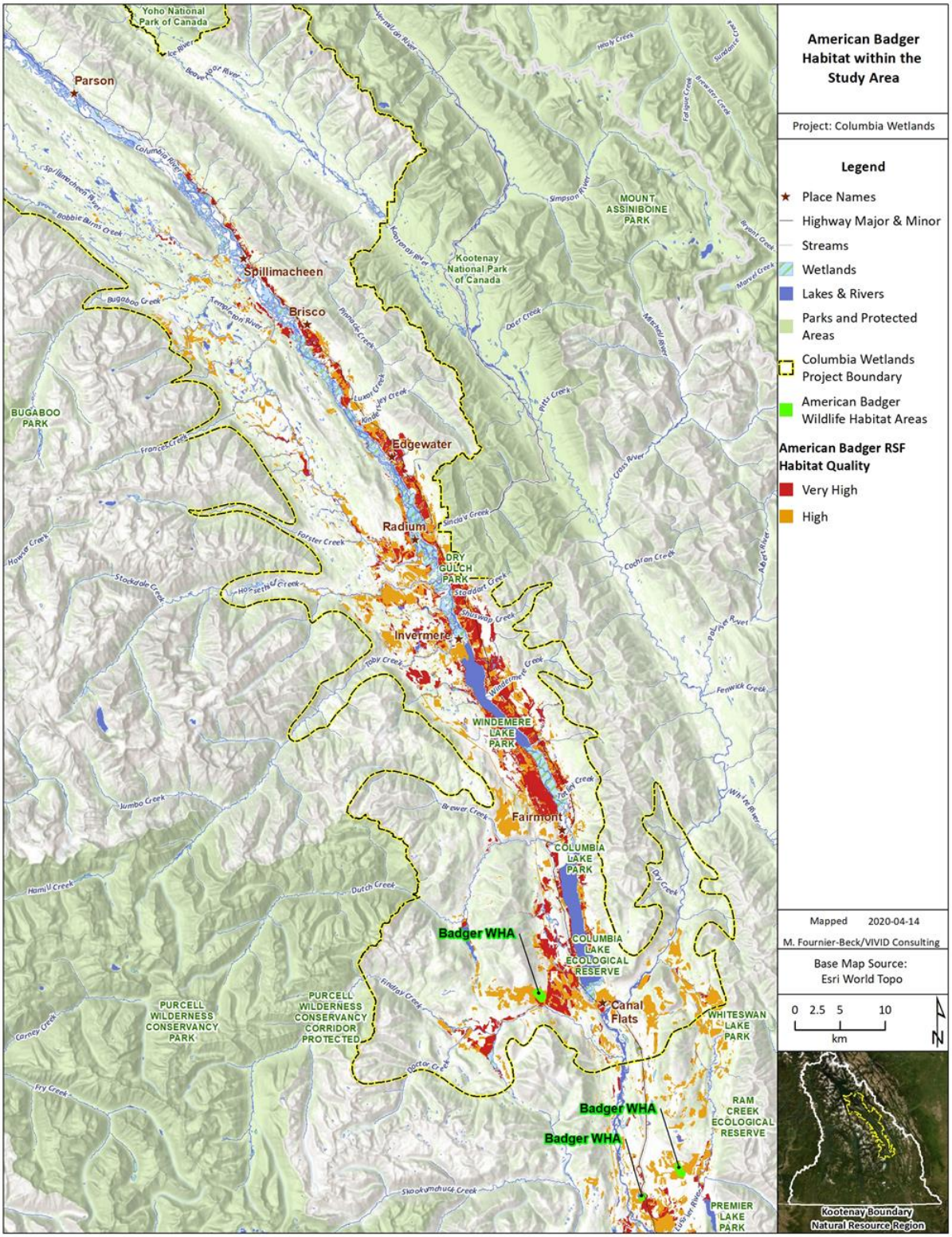

Figure 10. American badger habitat in the Columbia Valley study area, also indicating badger WHAs.

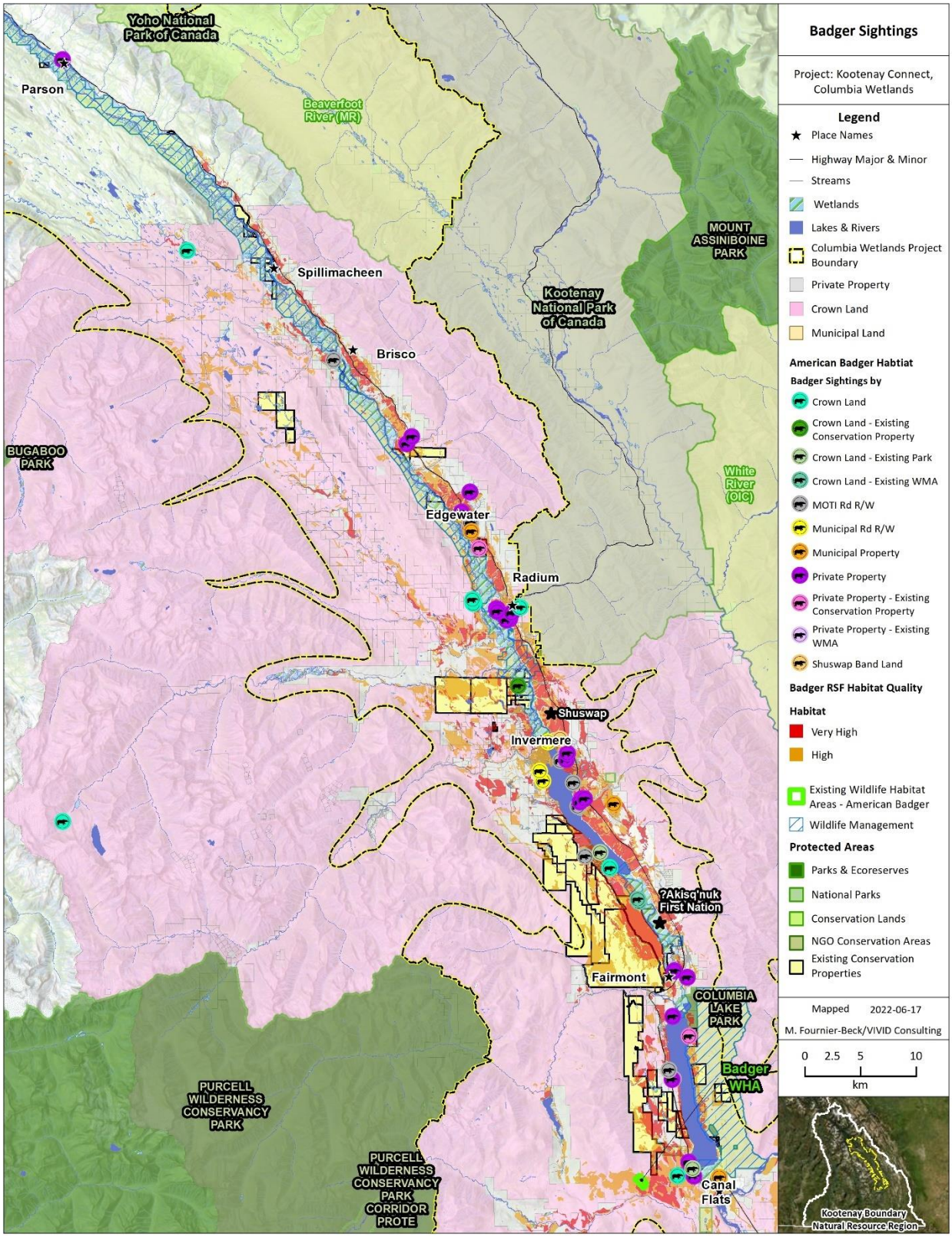

Figure 11. Locations of badger sightings according to public input, prior to ground truth inventories.

Table 1. Results from inventories on American Badger habitat on provincial Crown land.

Area	# of burrows in functioning condition	# of new burrows (used in 2022)	# of old burrows (used previous to 2022)	Unknown year of burrow use (2022 or previous)	Total burrow #	Inventory completed in area in 2022
Old Coach	367	0	0	367	367	no
Rushmere	96	8	149	42	199	yes
Steamboat	322	137	239	34	410	yes
Thunderhill	5	2	1	4	7	no
Totals	**790**	**147**	**389**	**447**	**983**	

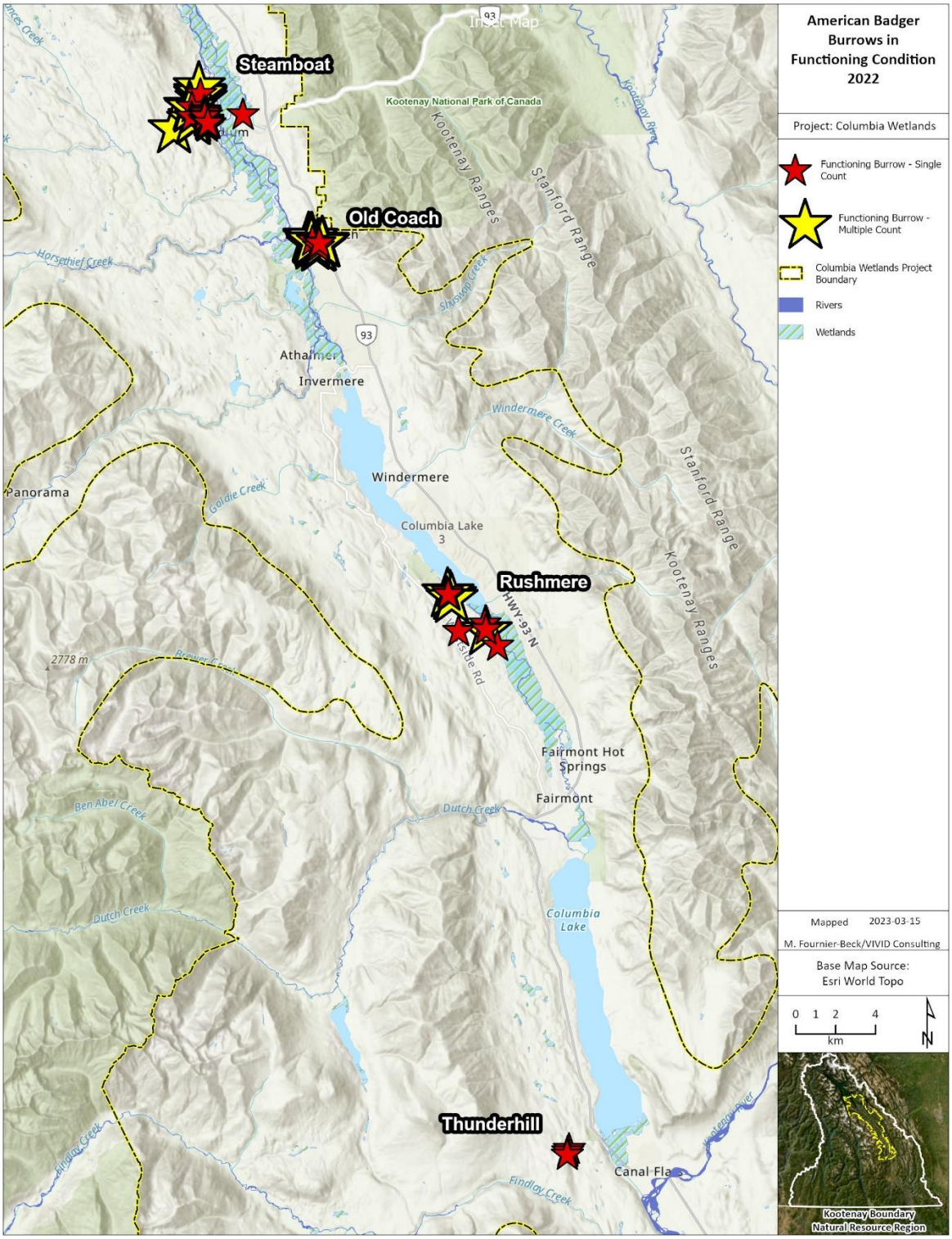

Figure 12. American badger burrows found in functioning condition during 2022 inventories.

Note: Inventory in the Thunderhill and Old Coach areas was not completed in 2022.

4.4 Discussion and Recommendations

1. Several burrows submitted to be WHFs and/or WHAs were observed to be negatively impacted. Impacts were mainly owing to unauthorized off-road recreational activities and livestock (Figures 13-16). Potential improvements to mitigate impacts are listed in Schedule 1's as General Wildlife Measures (GWMs) for American badger WHA's that were created in other areas within the Rocky Mountain Forest District (i.e., Tata Cr Airport North, Lost Dog Couth, McGinty Lake, North Kikomun Creek). Those GWMs include:
   - No new road accesses unless an exemption is provided.
   - No resource extraction during the denning period (May 1 – Aug 15).
   - Leave select live and dead trees to maintaining site ecology.
   - Do not use pesticides (exemption for selective application for noxious weeds and invasive plants).
   - Do not construct range corrals of fences during maternal period.
   - Do not place livestock attractants in WHA.

It has been suggested that off-road vehicle use (e.g., ATVs) could also be restricted in areas of high badger use (Adams & Kinley, 2004). The CWSP and KC should ensure that these GWMs are in place for any newly established American Badger WHAs in the Columbia Valley.

Since dogs can chase, harass or kill badgers, there should be no off-leash dogs in badger habitat during the maternal period. Badgers are substantially fearful of humans and perceive them as 'super predators' (Clinchy et al., 2016). Serious consideration should be given to how humans use critical habitat and WHAs established for badgers. "Hearing the sound of humans speaking significantly affected every measure of fear in badgers. Hearing humans delayed the initiation of foraging, increased vigilance and decreased the time spent foraging, and reduced the number of visits and number of badgers visiting the food patches (Clinchy et al., 2016). Hearing dogs will delay foraging in badgers, but the delay after hearing human voices is 189%-228% greater (Clinchy et al., 2016).

2. The CWSP- KC should submit badger WHFs and WHAs information to recreational planning groups in the region. Information could be used to collaboratively direct recreation away from the most sensitive badger habitat areas, which could aid in the species recovery process.

3. The CWSP- KC should discuss newly created WHF/WHA locations with Crown Range Act tenure holders to see if there are potential collaborations that can be made to protect critical badger habitat features from livestock grazing practices. "If there is a Range Act tenure on the Crown land where these burrows exist, the tenure holder is required to "not damage or render ineffective" the features. Measures a Range Act tenure holder may take to protect the burrows could include establishing fencing to exclude cattle from the area, or moving livestock attractants such as mineral/water away from the area" (K. Stark, personal communication, March 2023).

4. The CWSP- KC should complete badger inventories at Old Coach/Dry Gulch, Steamboat and Thunderhill for more badger holes/denning sites as these habitat areas likely have additional badger dens. The area of potential habitat at Thunderhill is very large. In order to pinpoint burrow locations, the use of a drone or conservation dogs should be considered prior to ground-truthing.

5. Apply for 1-3 additional Wildlife Habitat Areas (WHA) based on outcomes of 2023 inventory work and suggest potential improvements (mitigations) that could be used in 2023-24.

Figure 13. Unauthorized recreational impacts on Crown land at area with high badger activity, in core Critical habitat as proposed in the Recovery Strategy for badgers.

Figure 14. High level of unauthorized recreational impacts in the Columbia Wetlands Wildlife Management Area; within core Critical habitat in the proposed Recovery Strategy for American badger.

Figure 15. Cattle trampling in a high intensity use area for badgers; within badger core critical habitat.

Figure 16. Cattle impacts on badger burrow in badger core critical habitat.

5.0 Lewis's Woodpecker

5.1 Introduction

Lewis's woodpecker (LEWO) (*Melanerpes lewis*) is a relatively uncommon bird species. The LEWO is blue-listed in B.C. and is Threatened on Schedule 1 of the Species at Risk Act (SARA) (Environment and Climate Change Canada, 2017). Lewis's woodpecker is also a listed species under the B.C. Forest and Range Practices Act (FRPA) Identified Wildlife Management Strategy, meaning it requires special management attention by protecting its critical habitat with special management guidelines (applies only on crown land) such as Wildlife Habitat Areas (WHA), General Wildlife Measures (GWM) and Higher-Level Plans. In 2010, under FRPA the B.C. Ministry of Environment established three Wildlife Habitat Areas (WHAs) for LEWO in the southern end of the study area near Canal Flats (Environment Canada, 2014) (Figure 17). In 2017, under the federal government's 'Recovery Strategy for the Lewis's woodpecker,' critical habitat was designated in the study area at: Dutch Creek burn, Findlay Creek burn, and Wilmer area (Environment and Climate Change Canada, 2017) (Figure 17).

Lewis's woodpecker depends on standing, dead or partly dead conifers in advanced stages of decay (or softwood species) for nest sites. Nesting habitat for LEWO is limited and can fluctuate. Nest sites are limited by the availability of nest tree species (i.e., ponderosa pine, cottonwood) dependant upon; human development, habitat destruction, changing fire regimes, fire suppression leading to forest ingrowth, intensive grazing, replanting with closely spaced seedlings, and climatic changes. Since nesting tree sites change, federal critical habitat and provincial WHA boundaries need to be revisited to ensure they are protecting LEWO critical habitats. The CWSP has been conducting LEWO point counts at probable nest sites for LEWO, including areas located mainly outside of designated WHAs or critical habitat. If active nests are located, conservation designations should include expansion of critical habitat areas (under the federal LEWO Recovery Strategy) or WHA designation. The LEWO active nest count information is also being used for nominating the Columbia Valley Wetlands as a Key Biodiversity Area (KBA), which is something the lead author has been working on for nearly a decade. Various species accounts are useful for potentially triggering KBA recognition.

5.2 Methods

Seventeen point counts for LEWO occurred at 15 suspected or previously known nesting sites in the study area. Most counts occurred on June 29, 2022, but there were additional sites (according to public and expert reporting) that were surveyed at a later date (July 16, August 7). Point counts lasted for 15 minutes at each site. Several parameters were recorded at each site including date, time, coordinates, number of LEWO present, Beaufort wind scale, temperature, cloud cover, nest tree species, decay class of nest tree, main tree species in area (i.e., ponderosa pine, riparian cottonwood, Douglas fir, birch, spruce).

5.3 Results and Outcomes

Eleven active nests were identified, which could trigger the Key Biodiversity Area (KBA) threshold for LEWO. This information has been sent to the agency tasked with determining whether or not an area qualifies as a KBA, British Columbia Key Biodiversity Areas (KBA) - Wildlife Conservation Society Canada. All nest trees were on private land (Table 2, Figure 17). Since no nests were located on Crown land, FRPAs special management designations (WHA, WHF) do not apply for any of the nests located in 2022.

The predominant nest tree species was cottonwood. Lewis's woodpeckers, in addition to a number of other wildlife species, are dependent upon wildlife trees for critical life stages. Nesting habitat for LEWO can fluctuate since tree nest site availability is dependent upon things such as human development, habitat destruction, changing fire regimes, fire suppression leading to forest ingrowth, intensive grazing, replanting with closely spaced seedlings, and climatic changes. Since nest tree sites change over time, federal critical habitat and provincial Crown land conservation area boundaries should be revisited regularly to ensure they are protecting LEWO critical habitats. Three new LEWO nest sites were discovered outside of current LEWO critical habitat (Figure 17). This information was sent to ECCC staff. When the ECCC recovery strategy for Lewis's Woodpecker is revised, we have requested that critical habitat expand to include the new nesting locations. All nest data was also submitted to the provincial wildlife species inventory database (WSI) through the online submission process.

5.4 Discussion and Recommendations

- "Increasing ambient air temperatures and subsequent stand-replacement fires in ponderosa pine may become more common under future climate warming scenarios, so persistence of aspen forests may provide critical [LEWO] nesting habitat" (Towler et al., 2012) in the future. Aspen woodlands often have abundant nest cavities (Vierling, Saab, & Tobalske, 2020) and aspen forests near current LEWO nest locations in the Columbia Valley should be explored for potential LEWO conservation opportunities, e.g., forests managed to preserve mature trees and snags, WHA, critical habitat expansion, fungal inoculation.
- Some agencies or organizations [e.g., The Nature Conservancy of Canada (TNC), The Nature Trust of British Columbia (TNT)] have enhanced wildlife tree habitat supply in the southern portion of the Columbia Valley through fungal inoculation. Fungal inoculation treatment methods have been used to create wildlife tree habitat (Manley & Manning, 2017; Manning, 2008; Manning, 2010), with the intent to restore and maintain habitat for LEWO and other wildlife tree dependent species, such as flammulated owl and other woodpecker species. In 2007, 107 wildlife trees were inoculated at the Hoodoo-Hofert NCC property, 75 trees were inoculated in 2010 at Dutch Findlay, 19 trees were treated in 2010 at Thunder Ranch, and 25 trees were treated at Columbia Lake in 2013 (Manning & Manley, 2014). Consider revisiting the areas where fungal inoculation has taken place or see if there is data that has already been collected. If inoculation was successful at attracting LEWO to nest sites, consider and identify additional fungal inoculation opportunities.
- Home and driveway construction has been removing previously used nest trees and snags in the Fairmont community (Riverside Golf Estates Ltd.). Educational outreach with landowners should continue on LEWO. This should occur within (at least) the two communities with known nest sites (Fairmont and Trethewey Beach, Invermere), and should include the importance of maintaining large, sufficiently decayed, urban and suburban shade trees representing potential nest sites, their at-risk status, and the importance of limited habitat preservation for at-risk species.
- Nesting location information has been (and can continue to be) useful for private land purchases made for conservation.

Table 2. Data from 2022 Lewis's Woodpecker surveys.

Note: Specific nest site coordinates were removed due to sensitive nature of the habitat features.

Study Area Name	Date	Start Time	End Time	Surveyor	LEWO Count	UTM Zone	Beaufort Wind Scale	Cloud	Precipitation	Nest Tree Species	Comments
Stark Rd, Invermere	07/08/2022	13:16	13:32	RD	3	11	1	3	0	Birch	Could hear chicks.
Tretheway Beach, Windermere	16/07/2022	11:04	11:21	VS	4	11	3	2	1	Cottonwood	Could hear at least 2 nestlings being fed. Cluster of 7 cottonwoods together in a grassy park. Nest is in front left mature tree facing away from the road (west facing).
Fairmont	29/06/2022	14:38	14:53	VS	0	11	2	3	1	Cottonwood	Trail was flooded so was not able to get near trees.
Fairmont	07/08/2022	12:15	12:33	RD	0	11	1	3	0	Cottonwood	Many suitable cavities.
Fairmont Riverside golf course Estates	29/06/2022	6:16	6:31	VS	4	11	3	4	1	Cottonwood	Feeding young in hole of dead cottonwood
Fairmont Riverside golf course Estates	29/06/2022	10:33	10:48	VS	4	11	2	3	1	Cottonwood	Two nests found in this area but was not able to go right to the nests as this was on golf course property during the day so was not allowed to enter site. Young being fed.
Fairmont Riverside golf course Estates	29/06/2022	10:18	10:33	VS	3	11	2	3	1	Cottonwood	Could hear at least 2 nestlings being fed. Hole in top left branch area.
Fairmont Riverside golf course Estates	29/06/2022	9:18	9:33	VS	3	11	2	3	1	Pole	Nesting in 4th hole down from the top. Owner of house mentioned that Lewis' were 3 days later in coming back this year than the latest they'd come back in previous years. Young being fed.
Fairmont Riverside golf course Estates	29/06/2022	8:33	9:03	VS	3	11	2	3	1	Cottonwood	Short cottonwood with top part of the tree missing but still alive. Young being fed.
Fairmont Riverside golf course Estates	29/06/2022	9:03	9:18	VS	0	11	2	3	1	Cottonwood	Didn't see any Lewis Woodpeckers here.
Fairmont Riverside golf course Estates	29/06/2022	11:27	12:10	VS	5	11	3	3	1	Birch	2 LEWO pairs but only found one nest. Young being fed. The other nest could be in the next property over in a cottonwood but no confirmation. CORA fledgling close to LEWO nest and SSHA and the birds were all upset due to the raven.
Fairmont Riverside golf course Estates	07/08/2022	11:27	11:52	RD	3	11	1	3	0	Birch	Heard chicks. Many additional cavities in nearby trees (counted 13)
Fairmont Riverside golf course Estates	29/06/2022	12:20	12:40	VS	4	11	4	3	1	Cottonwood	Young being fed, could hear the chicks. There could be two pairs and two nests but only saw 1 hole being entered.
Fairmont Riverside golf course Estates	07/08/2022	11:06	11:26	RD	3	11	2	3	0	Cottonwood	Could hear chicks.
Ponderosa Heights area	29/06/2022	12:56	13:11	VS	0	11	4	3	1	n/a	Saw 3 Lewis' flying in the area but none came to the tree. There could be more nests in this area.
Ponderosa Heights area	29/06/2022	13:45	14:00	VS	1	11	4	3	1	Ponderosa Pine	Was at a distance and saw woodpecker go in a hole in the tree.
Ponderosa Heights area	29/06/2022	13:22	13:37	VS	1	11	4	3	1	n/a	Steep sloped ground. Brewer's Blackbird nesting in same tree.

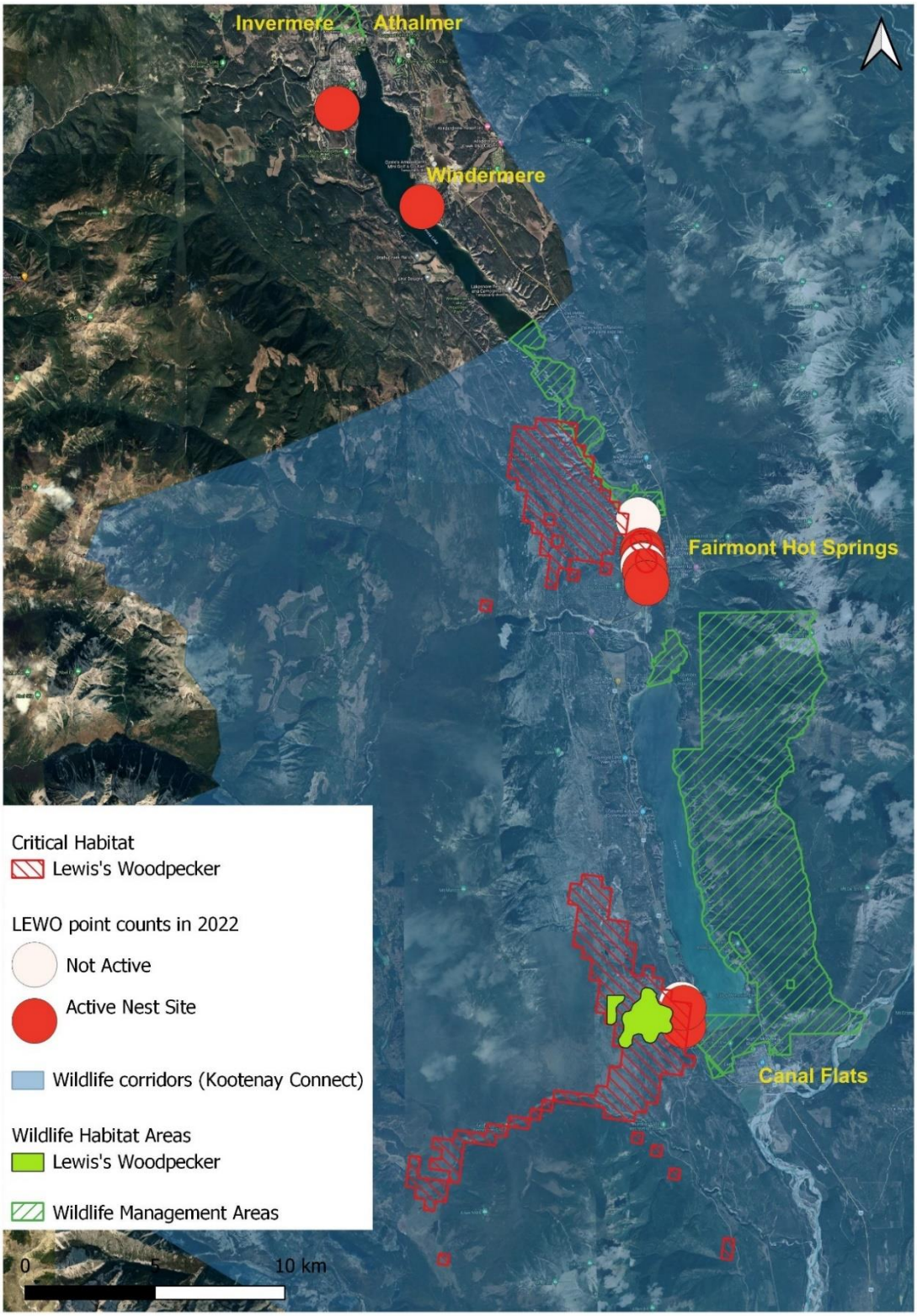

Figure 17. Map showing distribution of Lewis's Woodpecker nests located in 2022, along with designated critical habitat and Wildlife Habitat Areas (WHAs).

6.0 Osprey

6.1 Introduction

Osprey (*Pandion haliaetus*) is not an at-risk species, but it has faced severe population declines. Osprey populations have rebounded since Dichlorodiphenyltrichloroethane (DDT) (an insecticide used in agriculture) related population declines were seen during the mid-20 century (Winkler, Billerman & Lovette, 2020). Osprey are a bio-indicator of ecosystem health. They are sensitive to anthropogenic and climatic influences and can be affected by land and water management practices. They are also threatened by human disturbance, predation and displacement by other species. Osprey are a culturally valued species and due to their proven sensitivity towards pollutants they have been used as an indicator species of environmental change (e.g., changes in water quality) (e.g., Henny et al., 2004). Since they are a bio-indicator, we continued with the fourth year of monitoring osprey.

6.2 Methods

In 2022, the first of three nest observations took place on May 5 and May 7. Some nest visits occurred later if volunteers were involved in data collection and that is when they conducted surveys. The second round of nest observations were undertaken on July 24, 26, 27. The second round of nest observations was the best time period to see early-hatched young preparing to leave the nest. Observations lasted at least five minutes at each nest. This is the amount of time between rest periods that chicks generally move in the nest, with detection of movement being the most useful parameter to determine nest occupancy (Moore & Arndt, 2016). The last of three observations took place between August 6 and 26, with the majority of observations recorded on August 20 and 25. At each site the following parameters were recorded: observation date, UTMs, time of arrival, duration of visit at the nest, number of chicks in the nest (if known), other general observations at the nest (e.g., one adult at nest, one adult calling nearby, two chicks seen in nest).

6.3 Results and Outcomes

Seventy-one osprey nests were monitored three times during the breeding season, but poor and limited access prevented another two of the nests from being surveyed. Twenty-seven of the 71 nests surveyed produced chicks and were deemed successful, two nests had unknown success. Comparison of nest numbers and nest success over four years of monitoring was done to determine how many nests were active each year and to determine annual nest success (Table 3). The 2022 nest success rate is similar to what has been observed in previous years of monitoring. We also accessed the durability of osprey nest platforms and proposed the addition of two poles and platforms at specific sites to BC Hydro staff (Figures 18 and 19). BC Hydro installs osprey nest poles. Active nests on live transmission poles can cause power outages, fires, and/or injure or kill a bird. It is in BC Hydro's best interests to place nest poles adjacent to locations that have become a dangerous or inappropriate nesting site for osprey.

Table 3. Comparison of osprey nest success from 2019-2022.

Year	# of osprey nests recorded	# of nests active during beginning of season	# of nests either presumed or known to have produced fledglings
2019	59	43	27
2020	65	43	19
2021	72	39	27
2022	71	39	27

6.4 Discussion and Recommendations

- Continue monitoring osprey as a bio-indicator of ecosystem health given its sensitivity to human disturbance, degraded water quality, and discarded plastics/twine causing nest entanglement as well as predation and displacement by other species.
- Specifically monitor occupancy of nesting platforms and propose the addition of poles and platforms to be installed, if deemed appropriate.
- Continue to provide results from 2-3 separate monitoring inventories conducted throughout spring-summer to determine how many nests are occupied, active, and successful with fledglings.

Figure 18. Deteriorating nest platform on a nesting pole in Radium.

Figure 19. Osprey nests on an active transmission line in Spillimacheen.

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We acknowledge that this work has occurred on the traditional and unceded territory of the Ktunaxa Nation, Secwepemc First Nation, and Metis Nation Columbia River. Thank you to Verena Shaw who was hired for her naturalist skills and for doing much of the data entry work. Gratitude is extended to the vast number of individuals that contributed their time and submitted observations. Public sighting contributions have been of immense value to conservation actions for species at risk in the study area. Also thank you to John Zehnder, Gerhardt Lepp, and John Jenkins who helped significantly with private land enhancement work to improve nesting habitat for western painted turtles. Thanks to the Lake Windermere District Rod and Gun Club and Rick Hoar for the installation of turtle basking logs.

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The cover photo for this report is of a freshly dug American badger burrow within the study area, taken by Rachel Darvill.

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9.0 Appendices

Appendix 1. Social media and poster requesting volunteers to monitor turtle basking logs.

Appendix 2. Social media and poster for the American Badger public sightings request.

Appendix 3. Newspaper article requesting American badger sightings in the Columbia Valley.

American badger sightings wanted for the Columbia Valley

Submitted by Rachel Darvill

Did you know that there are American badgers living in the Columbia Valley? Southeastern British Columbia is the northern extent of where American badgers live. Unfortunately, the American badger is an endangered species and needs our help!

Badgers have stocky and flattened bodies with short, powerful legs. As few as one hundred mature badgers live in the East Kootenay region. Here they are vulnerable to being wiped out from increasing threats like roadkill, the loss of open habitat needed, and urban development. But, together we can work to keep them living here for generations to come. There is a new project supported by the Columbia Wetlands Stewardship Partners (CWSP) that is currently taking observational reports from the public - recording all badger roadkill sites, dens, burrows, and dead or alive sightings.

Leading project biologist Rachel Darvill states, "We are interested in knowing where American badgers are using dens in the Columbia Valley, especially where areas of high suitable badger habitat overlap with public crown land. These areas can be conserved through various regulations, but first we need to identify where those important areas are."

Badgers have large home ranges with hundreds of different burrows per individual. The burrows have an entrance that resembles a large elliptical hole, often with a mound of dirt at the entrance. Badgers often change locations daily and reuse burrows from year to year, making it important to ensure that unoccupied burrows are not destroyed. Badgers use dens for denning, foraging, resting and as a source of shelter.

American badger wanders alongside riverbank.
Submitted photo

"We are also interested if any badger denning and burrow sites are found in areas that we have already designated as wildlife corridors (through Kootenay Connect) that are important to other large ranging species like grizzly bear and elk," says Darvill.

"It has been shown that soil and prey availability are the key defining features or requirements for badger habitat," says Darvill. Their primary food source in our region are Columbian ground squirrels (which are often locally referred to as gophers). "Like badgers, Columbian ground squirrels also live in burrows, and at first glance it can be confusing to distinguish these holes from the ones badgers make," says Darvill.

Do you know where a badger lives, where a badger hole exists, or have you seen a badger in the Columbia Valley before? If so, please let us know by contacting the CWSP with your observations at badgersightings@gmail.com. This project is a partnership with Kootenay Connect and is financially supported by Environment and Climate Change Canada (ECCC) through the Canada Nature Fund with equal matching funding from local partners.