Final Report

Conserving Wildlife Habitat in the Salmon River Watershed

(FWCP Project # COA-F19-W-2700)

Prepared for:

Fish and Wildlife Compensation Program

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The Nature Trust of British Columbia

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Date: April 4, 2019

Executive Summary

Since 1978, in recognition of the exceptional fish and wildlife values found in the Salmon River watershed, The Nature Trust of British Columbia (NTBC) and its partners in the Pacific Estuary Conservation Program have been actively securing habitat in the Salmon River estuary. In 2015, with support from the Fish and Wildlife Compensation Program (FWCP) and others, NTBC purchased 165 acres (66.8 ha) near the lower Salmon River as an addition to the Salmon River Estuary Conservation Area. This complements 257 acres secured since 1978. The new property contains a diverse mix of riparian, wetland, and forest ecosystems.

Prior to NTBC's acquisition of this new conservation property, significant areas of mature Sitka spruce (*Picea sitchensis*) forest on the property were logged and impacted by other human activities . After logging, restoration actions were not implemented and logged areas have since been colonized by Scotch broom (*Cytisus scoparius*) and other non-native invasive plant species that prevent native vegetation from establishing. In some locations, regenerating forests are dominated by high densities of even-aged red alder (*Alnus rubra*) with a dense shrub understory, or lack tree canopy cover completely. These forests have reduced species and structural diversity, provide limited forage value for Roosevelt Elk (*Cervus canadensis roosevelti*), and limit movement by wildlife. In addition to the impacts from logging, gravel mining has resulted in the creation of two artificial wetlands. Although the wetlands have significant wildlife habitat value at present, they have over-steepened banks and lack shallow water habitat which limits use of the wetland by wildlife and amphibians.

The goal of this multi-year project is to restore and enhance previously degraded riparian and wetland habitat for wildlife, including a number of species of conservation concern. Activities in 2018-2019 targeted four major objectives that meet the actions identified in the FWCP Campbell River Watershed Action Plan. These objectives are outlined in Table 1:

Table 1: Project Objectives and FWCP Priorities (from FWCP 2018)

Goal	Goals and Objectives	FWCP Priority Action	Priority Level
1	Enhancing riparian forest habitat for Roosevelt Elk (*Cervus canadensis roosevelti*) and other wildlife	CBR.WAR.HB.25.0	P1
		CBR.WAR.HB.31.0	
2	Enhancing wetland habitat for species of conservation concern	CBR.WAR.HB.25.0	P1
		CBR.WAR.HB.31.0	P1
3	Restoring degraded riparian forest habitat previously impacted by logging and non-native invasive species	CBR.ALL.ME.09.01	P1
		CBR.WAR.HB.31.0	P1
4	Monitor Western Screech-owl Nest Boxes	CBR.ALL.ME.08.01	P1

From April 2018 to March 2019, we achieved the following key conservation outcomes:

- Thinned approximately 12500 m^2 of dense red alder forest to improve habitat for Roosevelt Elk;
- Improved access for wildlife and revegetated to 2000 m^2 of wetland riparian habitat and created 100 m^2 of shallow wetland habitat;
- Removed non-native invasive plants and re-vegetated a 1.2 ha field previously impacted by Scotch Broom;
- Maintained portions of additional fields previously dominated by Scotch Broom; and,
- Monitored and maintained 4 existing Western Screech-owl nest boxes.

These restoration activities have improved habitat for key species of conservation concern, including Roosevelt Elk, Great Blue Heron, Red-legged Frog, numerous species of breeding, migrating, and overwintering birds, as well as salmonids. Restoration activities are projected to continue over five years until 2023.

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1. Introduction

Background and Context

Since 1978, in recognition of the exceptional fish and wildlife values found in the Salmon River watershed, The Nature Trust of British Columbia (NTBC) and its partners in the Pacific Estuary Conservation Program have been actively securing habitat in the Salmon River estuary. In 2015, with support from FWCP and others, NTBC purchased 165 acres (66.8 ha) near the lower Salmon River as an addition to the Salmon River Estuary Conservation Area. This complements 257 acres secured since 1978. The new property contains a diverse mix of riparian, wetland, and forest ecosystems.

Prior to NTBC's acquisition of this new conservation property, significant areas of mature Sitka Spruce (*Picea sitchensis*) forest on the property were logged and impacted by other human activities . After logging, restoration actions were not implemented and logged areas have since been colonized by Scotch Broom (*Cytisus scoparius*) and other non-native invasive plant species that prevent native vegetation from establishing. In some locations, regenerating forests are dominated by high densities of even-aged Red Alder (*Alnus rubra*) with a dense shrub understory, or lack tree canopy cover completely. These forests have reduced species and structural diversity, provide limited forage value for Roosevelt Elk (*Cervus canadensis roosevelti*), and limit movement by wildlife. In addition to the impacts from logging, gravel mining has resulted in the creation of two artificial wetlands. Although the wetlands have significant wildlife habitat value at present, they have over-steepened banks and lack shallow water habitat which limits use of the wetland by wildlife and amphibians.

2. Project Goals and Objectives

The overall goal of this project seeks to improve the quality of existing habitat for wildlife within the Salmon River Estuary Conservation Area. Four specific objectives for this multi-year project are identified in Table 1.

Table 1: Project Goals/Objectives and Associated FWCP Priority Actions (from FWCP, 2018)

Task #	Project Objectives	FWCP Priority Action	Priority Level
1	Enhancing riparian forest habitat for Roosevelt Elk (*Cervus canadensis roosevelti*) and other wildlife	CBR.WAR.HB.25.0	P1
		CBR.WAR.HB.31.0	
2	Enhancing wetland habitat for species of conservation concern	CBR.WAR.HB.25.0	P1
		CBR.WAR.HB.31.0	P1
3	Restoring degraded riparian forest habitat previously impacted by logging and non-native invasive species	CBR.ALL.ME.09.01	P1
		CBR.WAR.HB.31.0	P1
4	Monitor Western Screech-owl Nest Boxes	CBR.ALL.ME.08.01	P1

3. Project Area

The Salmon River Conservation Area is located 60km north of the community of Campbell River within the municipal boundaries of the Village of Sayward and the Regional District of Comox Strathcona. The area is located within the very wet maritime Coastal Western Hemlock biogeoclimatic zone (CWHvm) and overlaps the Georgia Depression and Coast Mountain Eco-Provinces.

This project focused on the new conservation property acquired in 2015. The new property is located on the west bank of the lower Salmon River, north of Sayward Road (UTM Zone 10U: 292321E, 5582938N). The property is 66.8 ha in size (165 acres). Currently there is no public access and the access road is secured with a locked gate. The property contains a diverse mix of habitats including riparian, wetland, and forest. At the time of acquisition, the property showed signs of previous impacts from logging, land clearing and other anthropogenic activities.

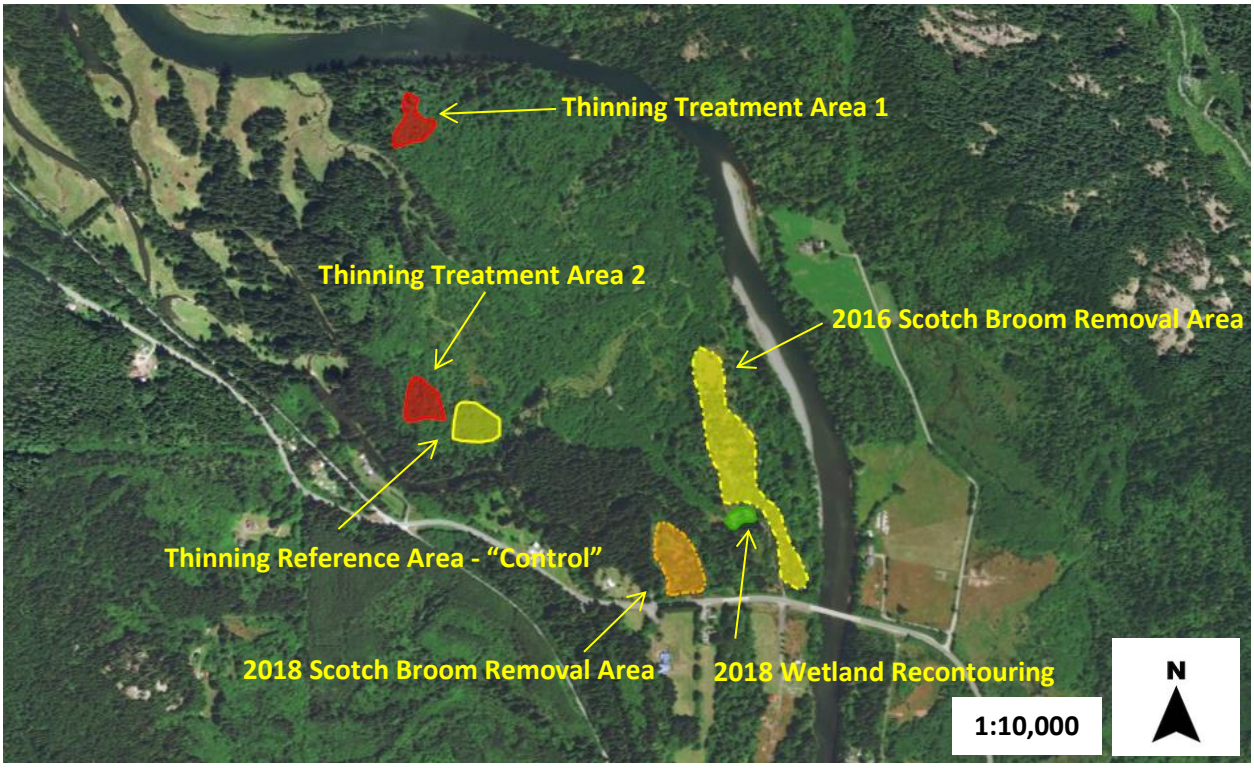

Figure 1. Map of Restoration Area indicating location of variable density thinning treatments, Scotch Broom removal areas, and wetland enhancements.

4. Methods

Objective 1: Enhancing riparian forest habitat for Roosevelt Elk and other wildlife

Physical Works

Riparian forest enhancements included: 1) thinning of dense young Red Alder forest stands, and 2) underplanting of thinned forest with native tree and shrub species. Three stands of dense Red Alder (*Alnus rubra*) ranging from approximately 3500-7000 stems/ha located within the conservation area were identified for treatment. Two stands of dense young alder forest were identified for thinning treatments and one stand was identified as a reference site for monitoring (Figure 1). The first stand (Thinning Treatment Area 1) covered an area of 6000 m^2 had a pre-treatment density of 7000 stems/ha. The second stand covered (Thinning Treatment Area 2) an area of 6400 m^2 and had a pre-treatment stand density of 5700 stems/ha.

Variable density thinning treatments were used to reduce stem density of red alders in each of the treatment areas. Overall, stem density was reduced to 4500 stems/ha in Treatment Area 1, and from 6000 to 2000 stems/ha in Treatment Area 2. Variable density thinning consists of:

- Gaps: removing all the trees in a 5 m diameter circle;
- Skips: leaving all trees; and,
- Thinned Matrix: removing trees at an even spacing, e.g. removing 1 out of every 2 or 3 trees.

Figure 2 displays an example of variable density thinning treatments.

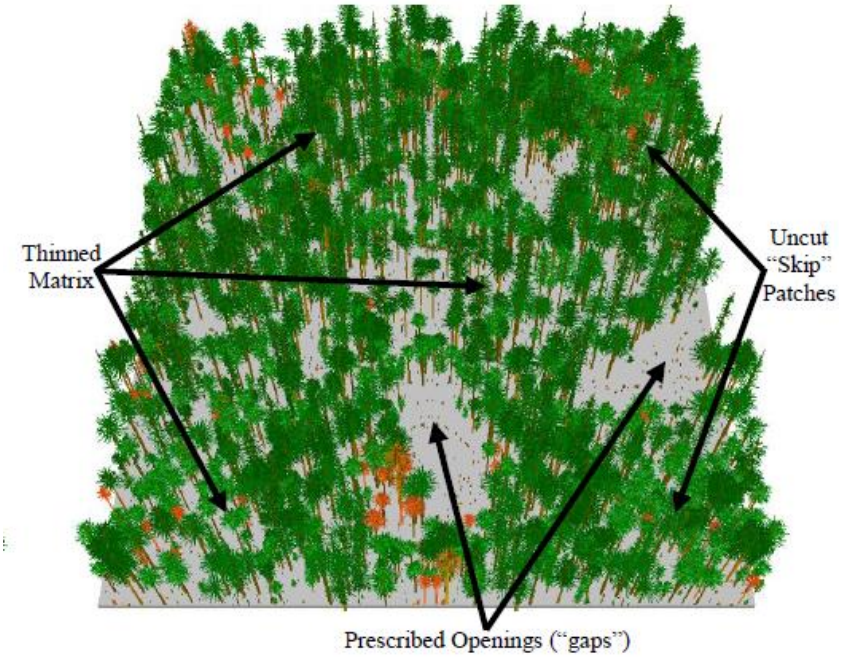

Figure 2: Example pattern of variable density thinning treatment (from Linders et al. 2010)

Variable density thinning treatments were applied to each of the two areas by crews from the K'omoks First Nation Guardian Watchmen. Downed wood was left on site. Underplanting in Treatment Area 2 was completed in March 2019. 150 Sitka Spruce (*Picea sitchensis*) and Red-osier Dogwood (*Cornus stolinifera*) were installed in the Treatment Area 2.

Monitoring

Baseline monitoring of the site included the establishment of three 5 x 5 m plots in each of the treatment and reference areas. Stem density of tree species and percent cover of understory species were recorded. Point count surveys for songbirds were completed in May and June 2018 at 10 locations starting within 2 hours of sunrise. Wildlife cameras were installed in June 2018 in 6 locations.

Objective 2: Enhancing wetland habitat for species of conservation concern

Physical Works

Enhancement activities were completed on 1 of 2 artificial wetlands created by past gravel mining activity on the property. In July 2018, an excavator was used to re-grade approximately 2000 m^2 (~ 40 linear meters) of wetland riparian area from a 0.5:1 slope to an 8:1 slope. A 100 m^2 wetland bench was excavated to a water depth of ~ 15 cm. In November 2018, a total of 400 native trees and shrubs were planted in the riparian area of the wetland, and 40 native wetland plants were installed in the shallow wetland bench. Native tree and shrub species included Sitka Spruce, Red Alder, Nootka rose (Rosa nutkana), Snowberry (*Symphocarpos albus*), Pacific Ninebark (*Physocarpus capitus*) and Hardhack (*Spiraea douglasii*). Wetland species included Kellogg's Sedge (*Carex kellogii*) and Cattail (*Typha latifolia*).

Figure 3 shows the location of the wetland enhancement works.

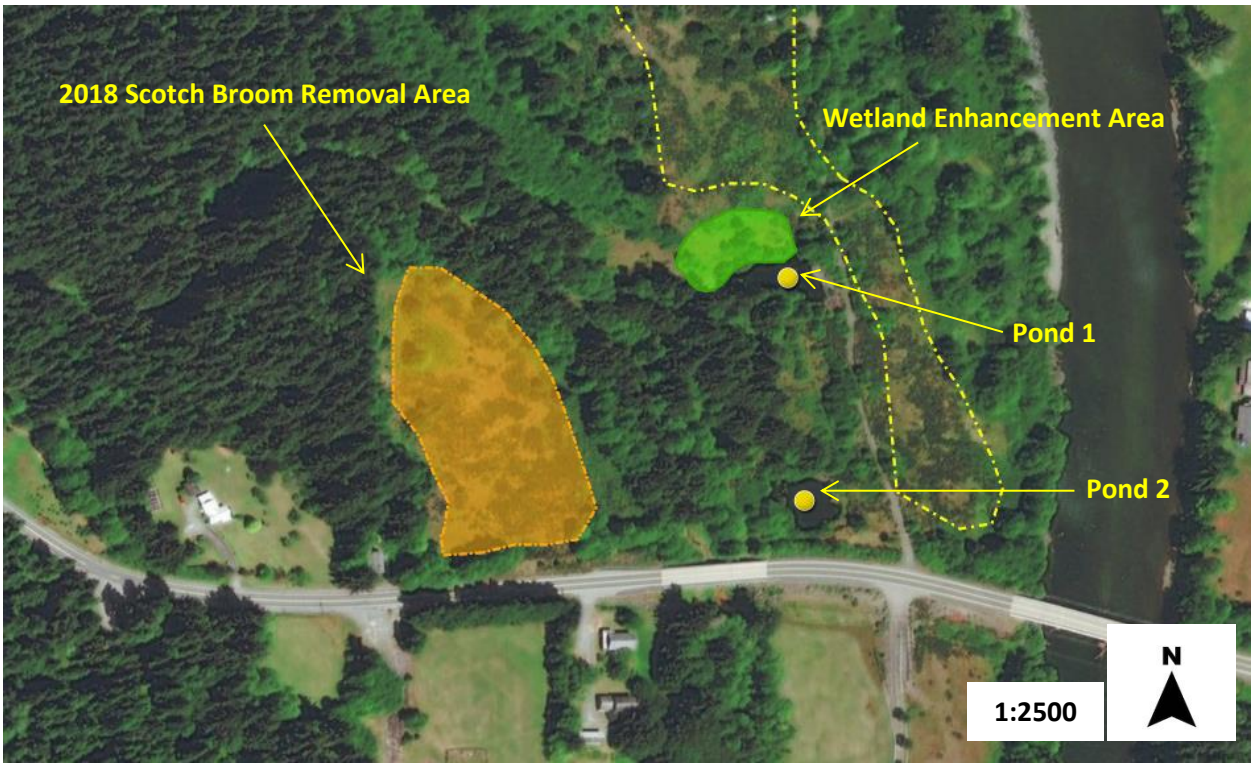

Figure 3. Location of wetland restoration area and ponds and 2018 Scotch Broom removal area.

Monitoring

Monitoring of the site included the completion of an amphibian egg mass survey on April 17, 2018 and the installation of a wildlife camera in June 2018.

Objective 3: Restoring degraded riparian forest habitat previously impacted by logging and non-native invasive species

Physical Works

Approximately 5 ha of land in the conservation area had been previously logged and invaded by Scotch Broom (*Cytisus scoparius*). Two activities were targeted to meet this objective:

- Maintaining approximately 4 ha of land previously cleared of Scotch Broom in 2016 and replanting with native vegetation where appropriate; and,
- Removing Scotch Broom from a 1 ha area adjacent to Hammond Creek and replanting with native vegetation.

Maintaining the 4 ha of land previously cleared of Scotch Broom in 2016 presented challenges. Assessments of the site in June 2018 indicated high levels of Scotch Broom recruitment, beyond which was possible to clear by hand with field crews. As such, high priority sites were selected remove Scotch Broom and establish shade plants to out-compete re-growing Scotch Broom. In November 2018, 64 plants were installed in three “islands” of plants were installed to test a new approach to revegetating these areas. Native plant species included Sitka Spruce, Red Alder, Pacific Ninebark and Nootka Rose. Approximately 400 m2 of land was fenced off around these plantings to prevent herbivory and allow for easier maintenance of the site.

In September 2018, approximately 1.2 ha of mature Scotch Broom was removed by excavator from the riparian area of Hammond Creek (see Figure 3). Scotch Broom was piled on site left to decompose. In

November 2018, 884 native plants were installed to revegetate the cleared site. Species planted include Sitka Spruce, Red Alder, Nootka Rose and Snowberry.

Monitoring

In June and July of 2018, plant survivorship and density of Scotch Broom was assessed using photo-monitoring and vegetation surveys. Survivorship of previous plantings (installed 2016) was assessed, and the density of Scotch broom regrowth was assessed qualitatively.

Objective 4: Monitor Western Screech-Owl Nest Boxes

Monitoring

In July 2018, four nest boxes were monitored and maintenance performed. The nest boxes were originally installed in 2016.

5. Results and Outcomes

In summary, we achieved the following outcomes from April 2018 to March 2019:

- Thinned approximately 12500 m^2 of dense red alder forest to improve habitat for Roosevelt Elk;
- Improved access for wildlife to 2000 m^2 of wetland riparian habitat and created 100 m^2 of shallow wetland habitat;
- Removed non-native invasive plants and re-vegetated a 1.2 ha field previously impacted by Scotch Broom;
- Assessed and maintained portions of 4 ha of fields previously dominated by Scotch Broom that were cleared in 2016; and,
- Monitored and maintained 4 existing Western Screech-owl nest boxes.

Further details for each objective are provided below.

Objective 1: Enhancing riparian forest habitat for Roosevelt Elk and other wildlife

Variable Density Thinning and Underplanting

Variable density thinning treatments resulted in a reduction of stem density from ~7000 to 3500 stems/ha and from ~ 6000 to 2000 stems/ha in Treatment Areas 1 and 2, respectively. The total area thinned is approximately 12500 m^2. Alder stems were left on site to decompose. A total of 150 Sitka Spruce and Red-osier Dogwood plants were installed in the understory after thinning was completed. Figures 3 and 4 show Treatment Area 2 before and after the variable density thinning treatments were completed, respectively.

Figure 4: Forest prior to thinning in Area 2, July 2018.

Figure 5: After thinning in Area 2, December 2018.

Monitoring

Baseline Vegetation Surveys

A total of 18 species were observed in the study area, consisting of a variety of native shrub, tree, and understory plant species (Table 2). Salmonberry (*Rubus* spectabilis) was the most dominant species present (69% cover), followed by sword fern (*Polystichum munitum*) (13.7% cover) (Figure 6). No non-native species were observed. Other native plant species occurring in the project area included: Lady Fern (*Athyrium filix-femina*), Spiny Wood Fern (*Dryopteris expansa*), Thimbleberry (*Rubus parviflorus*), False Lily-of-the-Valley (*Maianthemum dilatatum*) and Sweet-scented Bedstraw (*Galium trifolum*).

Table 2: Plant Species Richness

Treatment Area	Species Richness
1	14
2	13
Control	16
Total	**18**

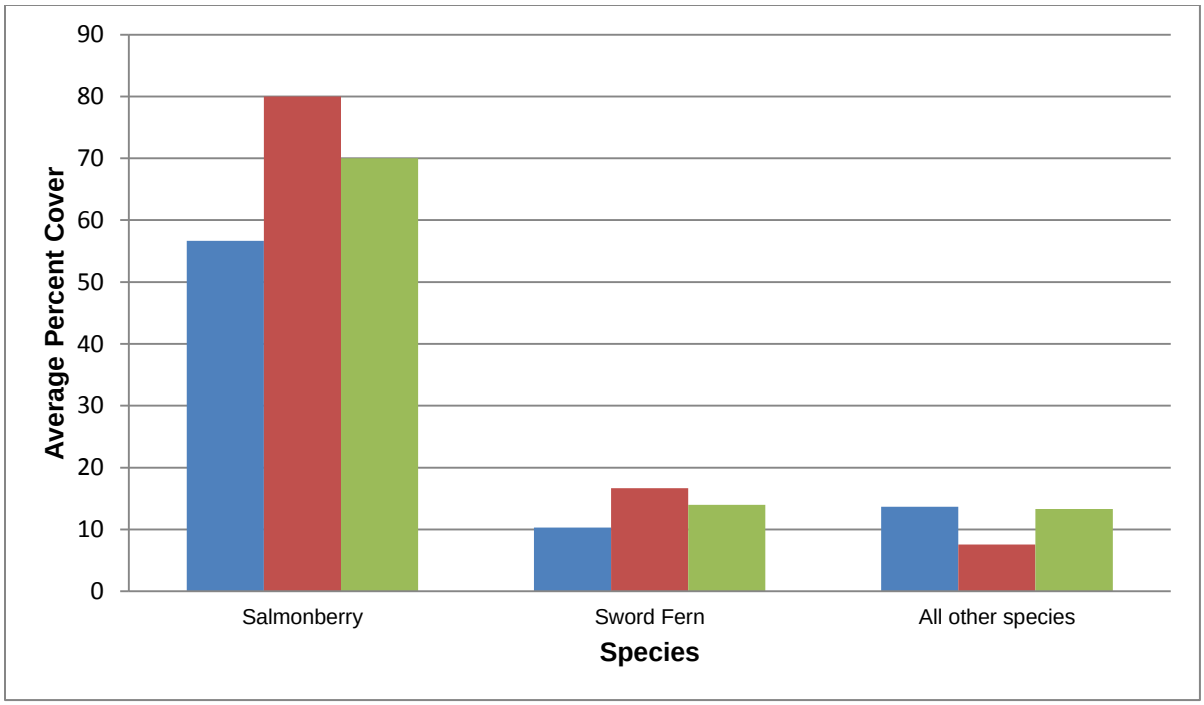

Figure 6: Percent cover of dominant plant species in the study area (Blue = Treatment Area 1, Red = Treatment Area 2, Green = Control).

Red alder was the most dominant tree species (Table 3); Sitka Spruce was present in low abundance. Treatment Area 1 had the highest density of Red Alder stems/ha. Average number of stems/ha ranged from 3480 in the control area to 6920 in Treatment Area 1. Average diameter at breast height (DBH) ranged from 29.5 cm to 39.4.

Table 3: Density and Size of Red Alder in Treatment Areas

Treatment Area	Average # Red Alder / Plot*	# Stems / ha	Average DBH**
1	17.3	6920	29.5
2	14.3	5720	29.9
Control	8.7	3480	39.4

* 5 x 5 m plot, 3 plots per treatment area
** DBH = diameter at breast height

Songbird Surveys

In total, 33 species were recorded during point count surveys conducted in May and June. A total of 19 species were migratory. A total of 26 species were recorded in May; 23 species were recorded in June. The most abundant species observed were: American Robin, Swainson's Thrush and Warbling Vireo, Black-headed Grosbeak and Yellow Warbler (Table 3).

Table 4: Five most common songbird species observed

Species*	May 26, 2018	June 9, 2019	Total # of Observations	Breeding Evidence**
American Robin	18	17	36	CF
Swainson's Thrush*	11	18	29	M
Warbling Vireo*	11	14	25	A
Black-Headed Grosbreak*	15	6	21	T
Yellow Warbler*	9	12	21	T

* Migrate south for the winter and occur at this site for breeding
** CF = carrying food for young, M = multiple singing males, A = Agitated behavior or anxiety calls of adult, T = permanent territory presumed. See Barry 2018 for more detailed descriptions.

Three species of conservation concern were identified during the point counts or during site visits: Great Blue Heron, Black Swift and Band-tailed Pigeon (Table 4). A complete report of the point count surveys is included in Appendix A.

Table 5: Observed bird species of conservation concern on the property during 2018 surveys.

Species*	May 26, 2018	June 9, 2019	Total # of Observations	Breeding Evidence*
Black Swift	0	2	2	X
Great Blue Heron***	-	-	-	H
Band-tailed Pigeon	-	-	-	H

* X = species observed/heard during breeding season but not in breeding habitat, H = species observed during breeding season in suitable nesting habitat..
** Observed by incidental observation, not during point counts

Wildlife Monitoring

Wildlife cameras captured images of three species: Black Bear (*Ursus americanus*), Columbian Black-tailed Deer (*Odocoileus hemionus columbianus*), and Roosevelt Elk (Table 5). Roosevelt Elk were the most abundant species present in the project area.

Table 6: Species observed on wildlife cameras in order of capture frequency

Common Name	Scientific Name
Roosevelt Elk	*Cervus canadensis roosevelti*
Columbian Black-tailed Deer	*Odocoileus hemionus columbianus*
Black Bear	*Ursus americanus*

Objective 2: Enhancing wetland habitat for species of conservation concern

Physical Works

A total of 2000 m^2 of wetland riparian habitat was regraded to a slope of approximately 8:1 (Figure 3). An additional 100 m^2 of shallow wetland habitat was created (Figure 4). Four large wood structures were installed to increase habitat complexity in the pond. A total of 400 native trees and shrubs were planted in upland areas of the restoration site, and 40 native wetland plants were installed in the shallow wetland bench.

Figure 7: Regrading slope adjacent to pond.

Figure 8: Shallow wetland bench.

Monitoring

Amphibian Egg Mass Surveys

A baseline amphibian egg mass survey in the restored wetland recorded one Red-legged Frog egg mass (*Rana aurora*) and 21 Northwestern Salamander (*Ambystoma gracile*) egg masses in the restoration site. Surveys completed on the adjacent artificial wetland (unrestored) observed 3 Northwestern Salamander egg masses and 1 potential but unconfirmed Red-legged Frog egg mass. Table 6 provides a summary of the findings.

Table 7: Amphibian Egg Mass Survey Results

Common Name	Scientific Name	# Egg Masses in Pond 1*	# Egg Masses in Pond 2*
Northwestern Salamander	*Ambystoma gracile*	21	3
Red-legged Frog	*Rana aurora*	1	1**

* Pond 1 refers to the artificial pond where the restoration work was conducted. Pond 2 refers to the pond closest to Sayward Road. See Figure 1 for details.
** Likely but not confirmed due to the degree of breakdown in the egg mass.

Wildlife Monitoring

A wildlife camera installed adjacent to the wetland captured two species: Columbian Black-tailed Deer (*Odocoileus hemionug columbianus*), and Roosevelt Elk (Table 7). Roosevelt Elk were the most abundant species present. The southern extent of the regraded area was used extensively by both

Roosevelt Elk and Columbian Black-tailed Deer in the fall months. Black Bear (*Ursus americanus*) were observed in the area in December 2017 and are known to use the area.

Table 8: Species observed on wildlife cameras in order of capture frequency

Common Name	Scientific Name
Roosevelt Elk	*Cervus canadensis roosevelti*
Columbian Black-tailed Deer	*Odocoileus hemionus columbianus*

Objective 3: Restoring degraded riparian forest habitat previously impacted by logging and non-native invasive species

Physical Works

A total of 1.2 ha of Scotch broom was removed from the riparian area of Hammond Creek. Vegetation maintenance in fields previously cleared of Scotch Broom in 2016 was targeted to a restricted area (~ 400 m^2) of re-growth, as there was too much re-growth to address by the available crews.

Monitoring

Planting survival

A survey of plantings installed in 2016 observed 178 plants with only 14 dead plants found in a 1 ha area. Although many plants had survived, the majority of plants had been heavily browsed by Roosevelt Elk. Species browsed most heavily by Roosevelt Elk included: Western Red Cedar (*Thuja plicata*), Western Hemlock (*Tsuga heterophylla*) and Twinberry (*Lonicera involucrata*). Sitka Spruce plants were not typically browsed.

Photo Monitoring

Photo monitoring of the previously cleared sites showed significant re-growth of Scotch Broom across the site. Figures 7 and 8 show the re-growth of Scotch Broom in previously cleared sites and the cleared areas near Hammond Creek, respectively.

Figure 9: Re-growth of Scotch Broom in August 2018 in previously cleared fields

Figure 10: After removal of Scotch Broom in field adjacent to Hammond Creek in September 2018.

Objective 4: Monitor Western Screech-Owl Nest Boxes

Monitoring

Monitoring of Western Screech-owl nest boxes indicated no use of the nest boxes by the target species.

6. Discussion and Recommendations

Significant progress was made in restoring and enhancing a diversity of habitats for wildlife species including Roosevelt Elk, amphibian species and songbirds. This multi-year project is seeking to address long-term ecological degradation on the property caused by logging and gravel extraction, as well as the impacts of Scotch Broom, a non-native invasive species. Works completed in 2018-2019 (Year 1 of this project) build on efforts initiated in 2016 including wetland enhancements, invasive species management, and planting of riparian species. On-going restoration activity and maintenance of existing restoration sites is expected to continue over the next 5 years at a minimum to ensure the long-term sustainability of the project.

The main challenges experienced in Year 1 of the project included:

- Delays due to fire risk and cold weather: Due to the dry and hot summer conditions in 2018, variable density thinning treatments had to be delayed until November 2018; this in turn delayed the timing of underplanting planned for the fall. Cold temperatures and snow in February and March 2019 delayed underplanting until late March 2019.

- Machinery breakdowns: The excavator used to re-grade the wetland area and remove Scotch Broom broke down a few occasions, causing delays to the overall project.

- High incidence of elk herbivory reducing the growth and survival of plantings: Herds of resident Elk located in the Salmon River Estuary Conservation Area severely impacted the survival and growth of past plantings. This has slowed the re-establishment of a native tree canopy to shade out re-growing Scotch Broom.

- Re-growth of Scotch Broom seedlings: In the late summer of 2018, Scotch broom seedling regrowth was significant. Control of Scotch Broom in 2019 will need to focus on flowering plants in previously cleared areas to prevent the re-establishment of mature Scotch Broom.

None of these challenges are expected to impact the long-term sustainability of the existing or future restoration actions on the property.

Recommendations

To address the above challenges, the following recommended adaptive management actions are being taken in 2019-2020:

- Elk exclusion fencing is being installed in around a portion of the plants installed in 2018 to prevent elk browse until the plants are established and can handle additional browse from elk;

- Additional efforts are being placed on managing Scotch broom regrowth in 2019, including the control of re-growing plants while they are flowering in May and June and the establishment of “islands” of native plants designed to enhance canopy cover and out-compete Scotch Broom seedlings;

- New contractors will be identified for machinery in 2019 to avoid delays for machine work; and,

- All works with the potential to cause fires will be scheduled for the late fall and winter.

7. Acknowledgements

We gratefully acknowledge the financial support of the Fish and Wildlife Compensation Program for its contribution to the project. We would also like to acknowledge the support of the K'omoks First Nation and Habitat Conservation Trust Foundation North Island Conservation Fund for their on-going support of the project.

8. References

Barry, K. 2018. Breeding Bird Surveys at the Salmon River Estuary: May – June 2018. Prepared for The Nature Trust of British Columbia. August 2018.

Fish and Wildlife Compensation Program (FWCP), 2018. Campbell River Watershed Action Plan. August 2018. 36pp. Retrieved from: http://fwcp.ca/app/uploads/2018/08/Action-Plan-Coastal-Region-Campbell-River-Watershed-FINAL-Aug-20-2018.pdf.

Linders, M. J., W. M. Vander Haegen, J. M. Azerrad, R. Dobson, and T. Labbe. 2010. Management Recommendations for Washington's Priority Species: Western Gray Squirrel. Washington Department of Fish and Wildlife, Olympia, Washington.

Appendix A

Breeding Bird Surveys at Salmon River Estuary: May-June 2018

Breeding Bird Surveys at Salmon River Estuary: May-June 2018

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Introduction

The Salmon River estuary is a highly productive coastal environment located on the east coast of Vancouver Island. It is known to be an important stopping point for migrating waterfowl, shorebirds and passerines, and it provides significant habitat to several fish and mammal species. For many years, The Nature Trust of British Columbia (TNTBC) and its partners have been actively securing habitat in the Salmon River Estuary to conserve these habitats. In 2015, TNTBC purchased 165 acres near the lower Salmon River as an addition to the Salmon River Estuary Conservation Area. The property acquired in 2015 ("the riparian property") contains a diverse mix of habitats including riparian, wetland, and forest.

The goal of the current project was to conduct additional breeding bird surveys on the riparian property, following up from initial breeding bird surveys conducted in 2016. The data collected will provide information on the abundance, species composition, and breeding activity of songbirds using this habitat.

Nesting season on the east coast of Vancouver Island generally occurs between late May and late June, although raptors and resident songbirds (e.g. Chestnut-backed Chickadee, Red-breasted Nuthatch, Golden-crowned Kinglet, some sparrows) often start nesting earlier. In May, many neotropical migrants arrive in BC to breed after travelling north from their overwintering grounds in southern US, and central and south America. There is still much that is unknown about specific migration patterns of migratory species although geolocator research is providing new insights for some species (Fraser et al., 2018).

In terms of conservation status, numerous migratory songbirds are undergoing population declines in the Americas. One group showing consistent declines are aerial insectivores, which include swifts, swallows, nightjars, and large flycatchers. These species are dependent on flying insects throughout the year, and are particularly sensitive to impacts from pesticides as well as to changes in insect availability due to climate change (Partners in Flight https://www.partnersinflight.org/resources/the-plan/).

Methods

Songbird surveys were completed at 10 sites at the riparian Salmon River property acquired in 2015 (Table 1, Figure 1). Point count surveys were conducted on May 26, 2018 and on June 9, 2018, starting within 2 hours of sunrise. Surveys took approximately 2 hours to complete.

Table 1. UTM for Point Count Locations surveyed in May and June 2018 (Zone 10U)

Point Count Station Number	UTM (Easting, Northing)
1	292325.41, 5582941.26
2	292297.87, 5583086.86
3	292273.97, 5583306.90
4	292227.23, 5583476.75
5	292096.15, 5583643.90
6	291744.09, 5583797.82
7	291788.59, 5583459.72
8	292166.22, 5583406.56
9	292202.07, 5583215.43
10	292170.03, 5583097.78

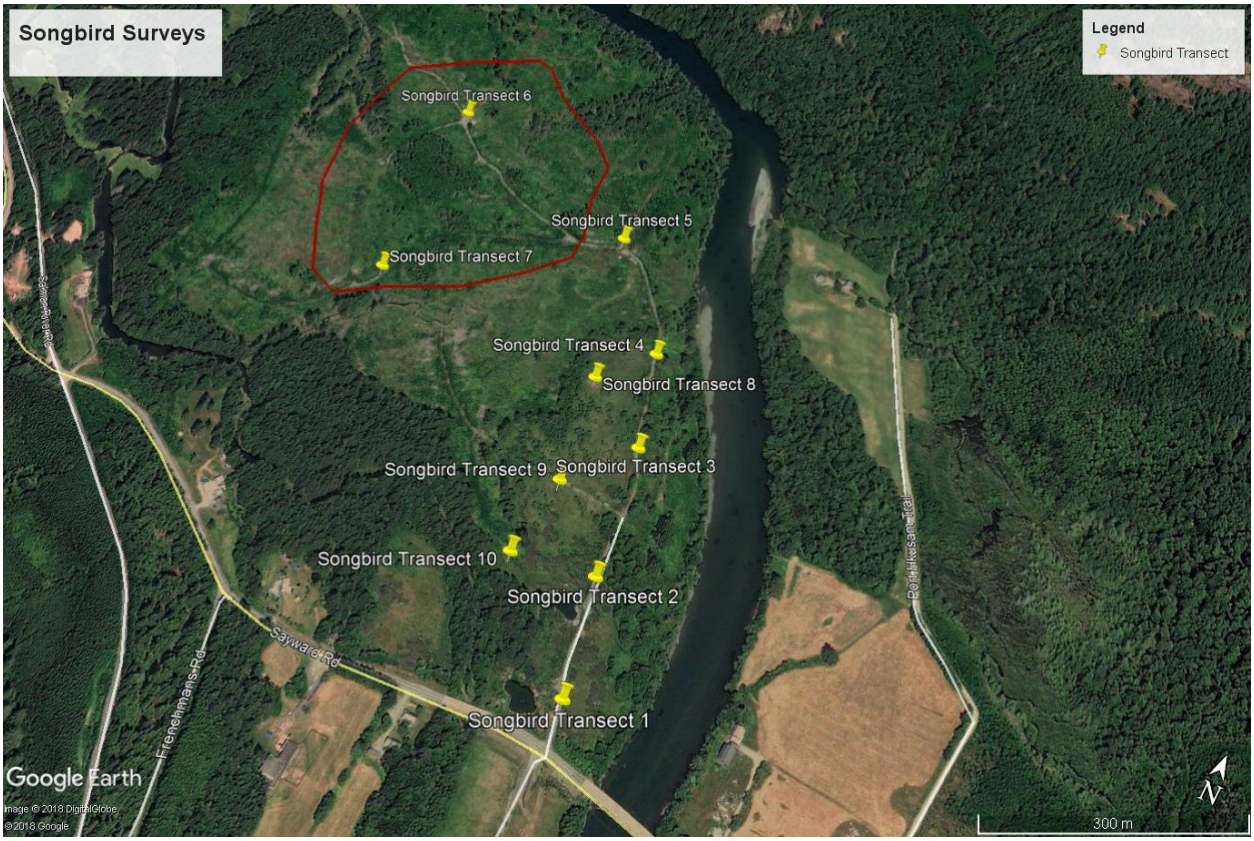

Figure 1. Locations of point count sites 1-10 at the Salmon River riparian property acquired in 2015 (red circle identifies proposed restoration site).

Methods generally followed the North American Breeding Bird Survey (BBS) protocol (https://www.pwrc.usgs.gov/bbs/index.cfm). However, point count stations at the riparian property were located closer than the BBS method, about 300-500m apart, to ensure good coverage of the property. All point counts were timed for 3 minutes in duration. Surveys were done in good light conditions with no precipitation (Table 2). At each site, all birds seen or heard during the 3-minute survey period were recorded and counted. Incidental observations of birds seen or heard outside the 3-minute window were recorded separately (Table 3). Additional bird observations were also recorded at the adjacent conservation property on May 25, 2018 by walking Kelley's Trail (Table 4).

All bird observations were entered into the eBird online data warehouse, www.ebird.ca

Results & Discussion

In total, 20 point counts were conducted at the Salmon River riparian property during 2018: 10 counts in May and 10 counts in June. Weather conditions were recorded during each sampling period (Table 2).

Table 2. 2018 survey dates, times and weather at Salmon River estuary.

Date	Start Time	End Time	Weather start	Weather end	Wind
May 26, 2018	06:42	08:37	Clear, 10°C	Overcast, 13°C	Nil
June 9, 2018	06:32	08:22	Clear, 10°C	Partly cloudy, 12°C	Nil

Overall abundance and species composition

In total, 33 species were recorded at the Salmon River riparian property during point count surveys in May and June combined (Table 3; Figures 2 and 3). Of these, over half were migratory (19 species), meaning that they occur in this area during the breeding season and migrate south for the winter months.

Species richness (number of species) was slightly greater in May with 26 species recorded, while 23 species were recorded in June. Species composition differed slightly between May and June. In May, the most abundant species were (in order): American Robin, Black-headed Grosbeak, and equal numbers of Swainson's Thrush and Warbling Vireo. In June, the most abundant species were: Swainson's Thrush, followed by American Robin and Warbling Vireo.

Point count surveys are based on the assumption that singing birds are on their breeding grounds and defending their territory against others. In other words, males are detected more than females who do not typically sing, so it's important to note that this method may underestimate the total numbers of individuals present.

Table 3. Total counts of each species at the Salmon River estuary (all point count stations combined). Those marked with an * migrate south for the winter and occur at this site for breeding. Refer to Appendix 1 for definitions of Breeding Evidence Codes.

Common Name	Species Code	May 26, 2018	June 9, 2018	Total	Breeding Evidence
American Robin	AMRO	18	17	35	CF
Swainson's Thrush*	SWTH	11	18	29	M
Warbling Vireo*	WAVI	11	14	25	A
Black-headed Grosbeak*	BHGR	15	6	21	T
Yellow Warbler*	YEWA	9	12	21	T
Orange-crowned Warbler*	OCWA	8	3	11	M
MacGillivray's Warbler*	MGWA	2	5	7	A
Black-throated Gray Warbler*	BTYW	4	2	6	S
Yellow-rumped Warbler*	YRWA	4	2	6	S
Spotted Towhee	SPTO	4	2	6	CF
Northern Rough-winged Swallow*	NRWS	6		6	H

Common Name	Species Code	May 26, 2018	June 9, 2018	Total	Breeding Evidence
Pacific-slope Flycatcher*	PSFL	2	4	6	S
Song Sparrow	SOSP	2	2	4	S
Hammond's Flycatcher*	HAFL	2	1	3	S
Rufous Hummingbird*	RUHU	1	2	3	D
Common Raven	CORA	1	1	2	H
Black Swift*	BLSW		2	2	X
Varied Thrush	VATH	2		2	S
Brown-headed Cowbird*	BHCO	1	1	2	S
Ruby-crowned Kinglet	RCKI		2	2	S
Cedar Waxwing	CEDW		2	2	NB
Northern Flicker	NOFL		1	1	H
Chipping Sparrow*	CHSP	1		1	S
Belted Kingfisher	BEKI	1		1	H
Red-breasted Sapsucker	RBSA	1		1	H
Violet-green Swallow*	VGSW		1	1	H
Anna's Hummingbird*	ANHU	1		1	H
White-crowned Sparrow	WCSP	1		1	S
Townsend's Warbler*	TOWA	1		1	S
Turkey Vulture*	TUVU		1	1	X
Golden-crowned Kinglet	GCKI	1		1	S
Oregon Junco	ORJU		1	1	H
Pacific Wren	PAWR	1		1	S
Total		**111**	**102**	**213**	

Some species that were observed during May point counts were not recorded in June, namely: Northern Rough-winged Swallow, Varied Thrush, Chipping Sparrow, Belted Kingfisher, Red-breasted Sapsucker, Anna's Hummingbird, White-crowned Sparrow, Townsend's Warbler, Golden-crowned Kinglet, and Pacific Wren.

Similarly, species recorded during June point counts that were not observed in May included: Black Swift, Ruby-crowned Kinglet, Cedar Waxwing, Northern Flicker, Violet-green Swallow, Turkey Vulture, and Oregon Junco.

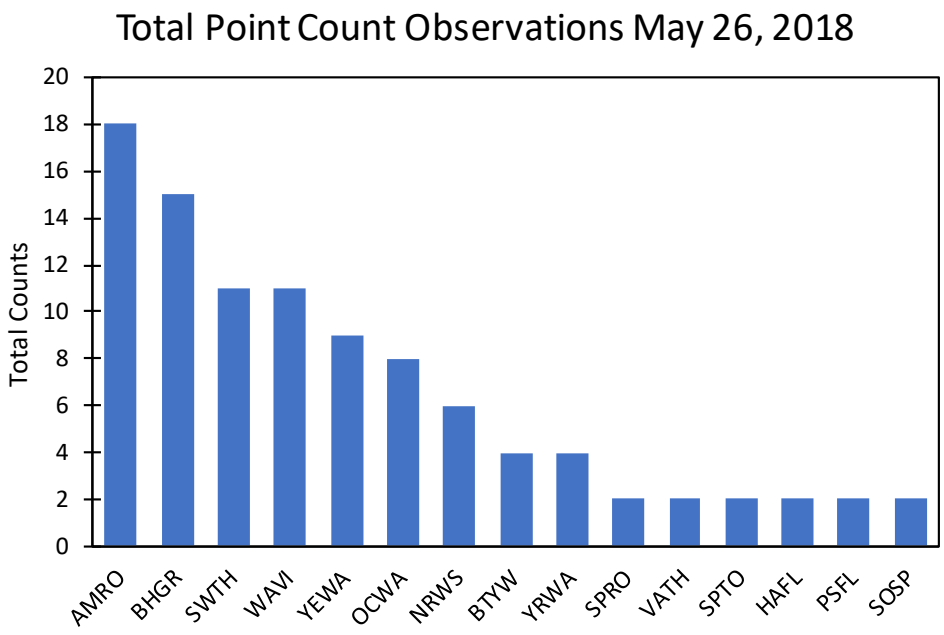

Figure 2. Total observations recorded in point counts on May 26, 2018 (only those species with a count greater than 1 are shown).

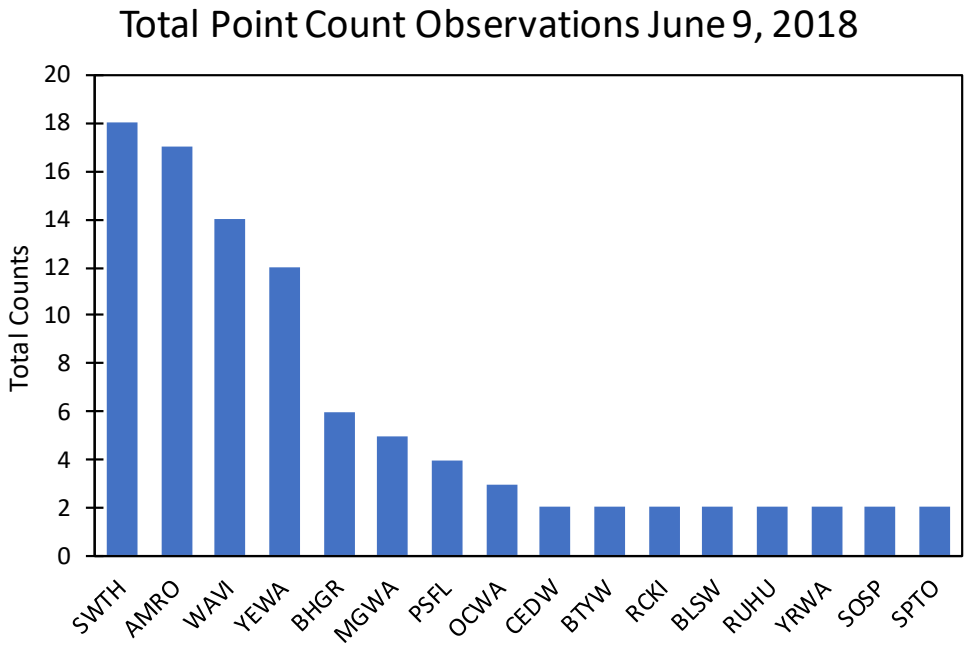

Figure 3. Total observations recorded in point counts on June 9, 2018 (only those species with a count greater than 1 are shown).

Migratory Species

Based on the May and June point count surveys, the four migratory species for which the highest number of observations were recorded included Black-headed Grosbeak, Swainson's Thrush, Warbling Vireo and Yellow Warbler. Both Swainson's Thrush and Yellow Warbler are long-distance migrants, while Black-headed Grosbeak and Warbling Vireo are medium-to-long distance migrants. See Appendix 2 for more information about these species.

Observed Breeding Evidence at Salmon River Estuary:

Several songbird species were observed showing evidence of breeding at the site. Breeding evidence can be assessed by observing the behaviour and activity of individual birds. Some behaviours indicate that breeding is "probable", while other behaviours can be used to confirm breeding at the site (see Appendix 1).

The highest level of breeding evidence was recorded for American Robin, Spotted Towhee and Cedar Waxwing indicating that these 3 species were breeding at the site near where they were observed. Although not observed during a specific point count, breeding was also confirmed for Ruffed Grouse since a female was observed with her 5 small chicks.

Probable breeding was observed for another 7 species (Swainson's Thrush, Warbling Vireo, Black-headed Grosbeak, Yellow Warbler, Orange-crowned Warbler, MacGillvray's Warbler, Rufous Hummingbird).

Incidental Observations

Some species were recorded separately during the point counts when they were seen or heard outside the 3-minute window (Table 4).

Table 4. Incidental Observations recorded at riparian property during point counts (additional species not seen during 3-minute point counts)

May 26, 2018		**June 9, 2018**	
Species	**Breeding Evidence**	**Species**	**Breeding evidence**
Turkey Vulture	H	Belted Kingfisher	H
Northwestern Crow	H	Ruffed Grouse	FY (female with 5 chicks)
Violet-green Swallow	H	Chestnut-backed Chickadee	H
European Starling	H	Golden-crowned Kinglet	H
Cedar Waxwing	H	European Starling	H
Wilson's Warbler	H	Northern Rough-winged Swallow	H
		Band-tailed Pigeon	H
		Red-breasted Sapsucker	H
		Great Blue Heron	H
		White-crowned Sparrow	H

Incidental bird observations were recorded at the adjacent Salmon River estuary property on May 25, 2018 (Table 5). Many of these species were also observed at the riparian property, however more water-dependent species (eg., Mallard, Common Merganser) were seen from Kelley's trail since this area is adjacent to tidal estuary habitat.

Table 5. Incidental observations recorded on May 25, 2018 at Kelley's trail. Start time: 18:30, End time: 19:15.

Common Name	Number
Canada Goose	1
Mallard	40
Common Merganser	14
Great Blue Heron	1
Bald Eagle	1
Belted Kingfisher	2
Northern Flicker	1
Pacific-slope Flycatcher	2
Warbling Vireo	1
Golden-crowned Kinglet	2
Ruby-crowned Kinglet	1
Swainson's Thrush	5
American Robin	12
Varied Thrush	1
Yellow-rumped Warbler	2
Townsend's Warbler	1
Savannah Sparrow	1
Song Sparrow	2
Spotted Towhee	1

Conclusions and Recommendations

Results of this project support the fact that the Salmon River riparian property acquired in 2015 provides key breeding habitat for many songbirds including neotropical migrants and aerial insectivores. Aerial insectivores observed during May and June 2018 included Pacific-sloped Flycatcher, Hammond's Flycatcher, Black Swift, Northern Rough-winged Swallow, and Violet-Green Swallow. These species all rely on habitats with abundant insects in order that they have sufficient food for breeding.

Three species at risk were observed during this project: Great Blue Heron, Black Swift and Band-tailed Pigeon. Great Blue Heron *fannini* subspecies is listed as Special Concern on SARA Schedule 1. Black Swift has Endangered status according to the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), however it has not been listed under the federal Species at Risk Act. Band-tailed Pigeon is listed as Special Concern on SARA Schedule 1.

Future surveys at this property would be beneficial in subsequent years. Surveys should be conducted during the May to June period to capture the peak breeding season for songbirds.

References

The Cornell Lab of Ornithology, All About Birds, www.allaboutbirds.org

National Audubon Society. www.Audubon.org

Fraser, K.C., Amélie Roberto-Charron, Bruce Cousens, Michael Simmons, Michael Simmons, Ann Nightingale, Amanda C. Shave, Renée L. Cormier, and Diana L. Humple. 2018. Classic pattern of leapfrog migration in Sooty Fox Sparrow (Passerella iliaca unalaschcensis) is not supported by direct migration tracking of individual birds. https://doi.org/10.1642/AUK-17-224.1

Rosenberg, K.V., J. A. Kennedy, R. Dettmers, R. P. Ford, D. Reynolds, J.D. Alexander, C. J. Beardmore, P. J. Blancher, R. E. Bogart, G. S. Butcher, A. F. Camfield, A. Couturier, D. W. Demarest, W. E. Easton, J.J. Giocomo, R.H. Keller, A. E. Mini, A. O. Panjabi, D. N. Pashley, T. D. Rich, J. M. Ruth, H. Stabins, J. Stanton, T. Will. 2016. Partners in Flight Landbird Conservation Plan: 2016 Revision for Canada and Continental United States. Partners in Flight Science Committee. 119 pp. https://www.partnersinflight.org/resources/the-plan/

Sauer, J. R., J. E. Hines, J. E. Fallon, K. L. Pardieck, Jr. Ziolkowski, D. J. and W. A. Link. The North American Breeding Bird Survey, results and analysis 1966-2013 (Version 1.30.15). USGS Patuxtent Wildlife Research Center 2014b. Available from http://www.mbr-pwrc.usgs.gov/bbs/.

Appendix 1: Breeding Evidence Codes

Breeding Evidence (listed in increasing confidence level)

OBSERVED
X Species observed/heard during its breeding season but in non-breeding habitat (no evidence of breeding).

POSSIBLE BREEDING (least confidence)
H Species observed during its breeding season in suitable nesting **habitat**.
S **Singing** male present, or breeding calls heard, during its breeding season in suitable nesting habitat.

PROBABLE BREEDING
M **Multiple** singing males (7 or more) found during one visit within the same area, during the breeding period in suitable nesting habitat.
P **Pair** observed during their breeding season in suitable nesting habitat.
T Permanent **territory** presumed through registration of territorial song, or the occurrence of an adult bird, at the same place, in breeding habitat, on at least two days, one week or more apart, during its breeding season. "T" is not to be used for colonial birds, or for species that might forage or loaf a long distance from their nesting site e.g. kingfisher, Turkey Vulture, and male waterfowl.
D Courtship or **display** between a male and female or 2 males, including courtship feeding or copulation.
V Adult **visiting** probable nest site.
A **Agitated** behaviour or anxiety calls of an adult.
B **Brood** patch on adult female or cloacal protuberance on adult male.
N **Nest**-building or excavation of nest hole (woodpeckers and wrens). Both groups may build dummy or roosting nests so nest-building alone is not enough to confirm breeding.

CONFIRMED BREEDING (most confidence)
NB **Nest building** (by all except wrens and woodpeckers) or adult carrying nesting material
DD **Distraction display** or injury feigning.
NU **Used nest** or egg shell found (occupied or laid within the period of the study).
FY Recently fledged young (altricial) or downy (precocial) young, incapable of sustained flight *or* restricted to nesting area by dependence on adults
AE **Adults** leaving or **entering** nest site in circumstances indicating occupied nest but contents unknown (including birds on nest and entering nest cavities.)
FS Adult carrying **faecal sac**.
CF Adult **carrying food** for young.
NE **Nest** containing **eggs**.
NY **Nest** with **young** seen or heard.

Appendix 2: Species Information for 4 Neotropical Migrants: Black-headed Grosbeak, Swainson's Thrush, Warbling Vireo and Yellow Warbler

Black-headed Grosbeak:

Black-headed Grosbeak breeds in western North America. It is a large bird with a strong bill for cracking tough seeds. The male Black-headed Grosbeak is very colourful with orange and yellow flanks and a black head. The song is a melodious and long robin-like song. Its preferred habitat is mixed woodlands and edges from mountain forests to thickets, with some large trees and a diverse understory. They breed in complex habitats with a diversity of plants and nearby access to water. This songbird is a medium to long-distance migrant which spends the winter months in central Mexico. Black-headed Grosbeak populations are stable or increasing throughout their range (North American Breeding Bird Survey). Although human development has impacted their habitats, Black-headed Grosbeaks appear to be somewhat adaptable (The Cornell Lab of Ornithology, All About Birds).

Male Black-headed Grosbeak (from www.allaboutbirds.org)

Swainson's Thrush:

More often heard rather than seen, Swainson's Thrush are brownish, shy, but vocal birds that live in forested habitats. They prefer closed-canopy forest and their breeding habitat is a mix of deciduous and coniferous forest. The song is a distinctive flute-like, upward-spiraling melody that breeding males use to defend territories and attract mates. Swainson's Thrushes are long distance migrants and typically overwinter in Mexico, Central or South America. Although relatively common, Swainson's Thrushes have been gradually declining across their range (North American Breeding Bird Survey). Partners in Flight estimates a global breeding population of 100 million, with 28% spending some part of the year in the U.S., 72% in Canada, and 7% in Mexico. The short breeding season may increase their sensitivity to disturbance on nesting grounds. Other issues that can impact their breeding include human activity and development, and invasions of nonnative plants. During spring and fall migration, significant numbers of Swainson's Thrushes are killed due to collisions with windows, radio and cell-phone towers, and tall buildings (The Cornell Lab of Ornithology, All About Birds).

Swainson's Thrush, both male and female have the same colour pattern (from www.audubon.org)

Warbling Vireo:

Warbling Vireos are fairly plain birds with gray-olive upperparts and white underparts washed with faint yellow. Their song is very rapid and repetitive with undulating variable notes. They stay high in deciduous treetops, where they move methodically among the leaves hunting for caterpillars. This species is fairly widespread in North America where they breed. They are a medium- to long-distance migrant and spend the winter in Mexico and central America. During breeding season, Warbling Vireos occur in mature deciduous woodlands and are rarely found in purely coniferous forests. Their winter range is much smaller than their breeding range. Warbling Vireos are numerous and their numbers experienced a slight overall increase according to the North American Breeding Bird Survey. They tend to decline in herbicide-thinned deciduous forests. Warbling Vireos also die from collisions with communications towers and other tall structures during nighttime migration (The Cornell Lab of Ornithology, All About Birds).

Warbling Vireo, both male and female have the same colour pattern (from www.allaboutbirds.org)

Yellow Warbler:

Yellow Warblers are small songbirds with a black eye and rounded heads. Males are a bright yellow with reddish streaks on the underparts and the female is duller yellow overall. Yellow warblers breed in shrubby thickets and woods, and are often found in riparian areas near streams, river and wetlands. They are a long-distance migrant and spend the winters in mangrove forests of Central and South America. Yellow Warblers are one of the most numerous warblers in North America but their populations have been slowly declining according to the North American Breeding Bird Survey. Conservation threats include habitat loss and degradation, brood parasitism from Brown-headed Cowbirds, and collisions with buildings when they migrate at night (The Cornell Lab of Ornithology, All About Birds).

Male Yellow Warbler (from www.allaboutbirds.org)