

The effects of placer mine revegetation on breeding bird communities 2026 YFWET Report



Pine Grosbeak
Credit: Ron Knight

Wildlife Conservation Society Canada
Northern Boreal Mountains Program



Austin Zeller
Chrystal Mantyka-Pringle

February 2026

Summary

Abstract

Wildlife Conservation Society Canada (WCS Canada) is conducting a multi-year study on breeding birds in revegetating placer gold mines in the Klondike Goldfields, Clear Creek, Mayo, and Keno areas of central Yukon. This research examines how breeding bird species and populations respond to revegetation over time, compared to unmined habitats, considering their specific habitat requirements. In 2025, we completed the third and final field season for this project, which builds on previous data collection in 2023 and 2024. In July 2025, we completed an engagement exercise, where we met in person with 8 placer mine operators in the Goldfields and had email/phone correspondence with 24 additional individuals. The primary goal of this outreach was to gather information on reclamation techniques and land use history of the area to better inform our statistical models. These activities in turn strengthened our connection with the placer mining community, prompting miners to ask informed questions and share their perspectives on our research and on other conservation initiatives related to land use planning. In addition to this outreach, we conducted vegetation surveys at 10 sites to assess levels of natural revegetation and better understand post-mining successional species compositions. Our team has been working on analysis using data from across 837 survey stations (168 sites). Final model results are nearing completion and indicate significant negative impacts of mining disturbance on old-growth/ habitat specialist species, including Townsend's Solitaire, Pine Grosbeak, and Townsend's Warbler. We also highlight that many species, e.g., Yellow Warbler, Fox Sparrow, and Wilson's Warbler, are significantly positively affected by the revegetation occurring within inactive placer mine sites. We have shared our data and a project summary report with our two First Nation partners (Tr'ondëk Hwëch'in and FNNND) to support their land stewardship efforts. Our team is now nearing completion of a draft manuscript for this study, which will provide valuable insights into the long-term ecological recovery of mined landscapes.

Context

WCS Canada is a national non-government science organization that conducts research on species and ecosystems to inform conservation decisions. Our role is to provide long-term, site-based research and scientific syntheses that inform policy and practice and support the implementation of effective conservation measures. We do this by providing technical advice and engaging relevant decision-makers at all levels, from local to federal. WCS Canada's Northern Boreal Mountains Program is conducting research on the cumulative effects of mining, roads, and other disturbances throughout the Yukon. Cumulative effects are changes to the environment caused by past, present and future human activities, and encompass habitat alterations, pollution, climate change, harvesting and invasive species. This research will inform regional land use planning intended to balance multiple land uses while maintaining the ecological and cultural values of ecosystems.

Since 2023, we have been studying breeding birds in placer mines undergoing natural revegetation, using nearby unmined areas as reference sites. This study focuses on placer mining because it is the greatest source of human-caused surface disturbance in central Yukon. To better understand the cumulative effects of mining and associated roads, trails and survey lines on wildlife, we selected songbirds as study species because they are useful ecological indicators. Breeding songbirds require specific habitats, so detecting a certain species tells us relevant information about current local habitat conditions. In 2021, we surveyed songbirds in relation

to the amount of disturbance in a given area, and in 2023, 2024, and 2025, we researched songbirds in relation to the age-since-mining (i.e. stage of vegetation regrowth) of sites.

Objectives

WCS Canada's Northern Boreal Mountains cumulative effects research aims to inform regional land use planning and other land-based decisions by addressing the following primary objectives:

- Understand the cumulative effects of human disturbance on wildlife and important habitats.
- Inform management targets by ensuring that disturbance thresholds are scientifically justifiable for the needs of wildlife populations and ecosystems.

The breeding bird study outlined in this report addresses the following research question:

- Do revegetating placer mines support similar avian communities to those found in unmined habitats, and how long does it take for avian communities to stabilize after mining?

Activities/ Methodology

Site Selection

This study included data from revegetating mined sites and unmined reference sites. In 2023 and 2024, we conducted breeding bird and habitat surveys in revegetating mines and unmined riparian areas in the Klondike Goldfields, Clear Creek, Mayo, and Keno areas. Riparian areas are habitats at the edges of watercourses and waterbodies, and often have unique physical properties, functions and species. These sites were chosen to represent a range of ages-since-mining, to investigate how avian communities (populations of multiple species) change as mines revegetate. For riparian reference sites, we selected sites near waterways intended to represent a pre-disturbed state, both within the same watersheds as mines, and in separate unmined watersheds. Each site was comprised of 2-9 survey stations where one autonomous recording unit (ARU) was deployed to survey for birds (Figure 1). We extracted disturbance, habitat, and revegetation data at each station within a 150-meter radius (Figure 1).

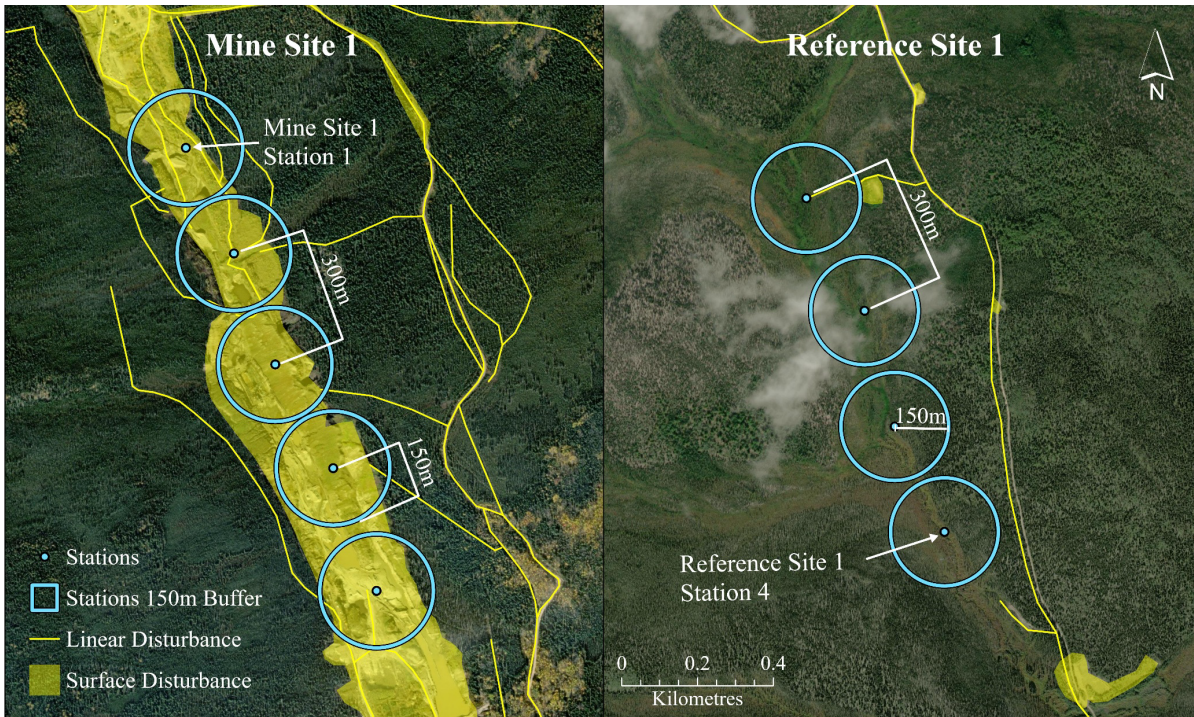


Figure 1. Comparison of the anthropogenic disturbances present at a mine site versus a reference site. Yellow outlines represent anthropogenic disturbance (roads and surface disturbance), while blue points represent survey stations. Blue circles represent the survey radius (150 meters). Each station is approximately 300 meters apart.

Bird Data

We collected bird data during the 2023 and 2024 field season (May-July). At each study site, we conducted bird surveys at each of 2-9 stations, spaced at least 300m apart. We surveyed breeding birds at each survey station using autonomous recording units (ARUs). ARUs record sound on the landscape and were set to a recording schedule which detected bird songs and calls at each station for 1-4 weeks. The acoustic data collected via ARUs was compiled and uploaded to the open data platform WildTrax (www.wildtrax.ca) where trained observers tagged instances where they were able to identify bird species. From these tags we can estimate species abundances at each survey site to determine what environmental or anthropogenic variables effect these abundances.

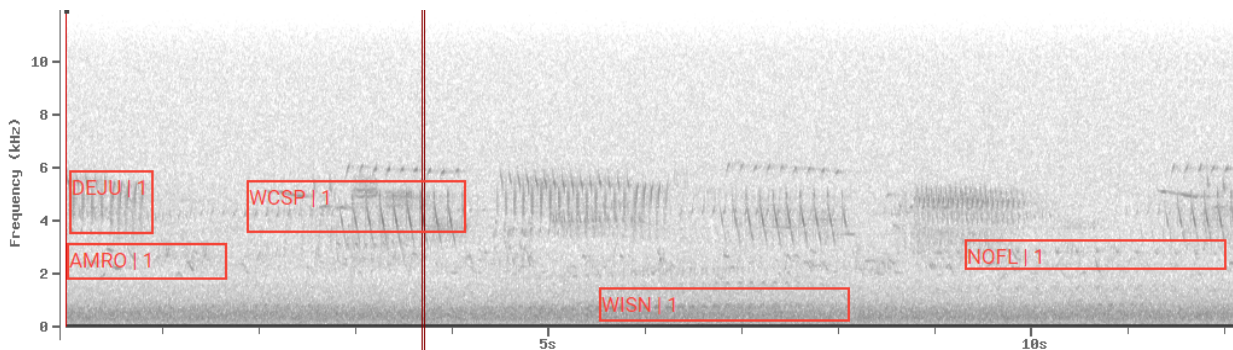


Figure 2. A spectrogram of an ARU recording. Bird songs and calls are tagged with red rectangles. The 4-letter codes indicate the bird species: DEJU = dark-eyed junco, AMRO = American robin, WCSP = white-crowned sparrow, WISN = Wilson's snipe, NOFL = northern flicker.

Disturbance, Revegetation, and Habitat Data

We compiled disturbance, habitat and watercourse data within 150m of each survey station (Figure 2). Human-caused surface and linear disturbances (roads and trails) were extracted from existing disturbance maps available on GeoYukon (October 2022 version), and updated with ArcGIS Pro World Imagery, Sentinel 2 and SPOT satellite imagery (up to June 2024). Surface disturbances include mined areas, urban development and forestry cut blocks, while linear disturbances include roads, trails and survey lines. Within surface disturbances, we mapped disturbed bare ground and disturbed vegetated habitats derived from Sentinel 2 satellite imagery. In addition to disturbance data, we extracted the Normalized Difference Vegetation Index (NDVI) from satellite imagery (Sentinel 2), to estimate the level of vegetation regrowth occurring at our sites at the time of survey. Habitat values were extracted using the NASA ABoVE dataset, which allowed us to estimate the percent area covered by coniferous forest, deciduous forest, and shrubs at a site. Additionally, we used wetland inventories produced by Government of Yukon (2023) and Ducks Unlimited (2021) to estimate percent area covered by wetlands at a site. All disturbance and habitat data are currently being incorporated into statistical models to explore overlaps in bird communities between mined sites with different degrees of vegetation regrowth and undisturbed riparian areas in the same watersheds as mining and separate undisturbed watersheds.

Field Validation and Outreach

In 2025 we completed a mining engagement field season with the goal of validating our vegetation regrowth dataset (NDVI) with local knowledge. Because the revegetation data was collected via satellite imagery, validation was valuable to correct any errors in NDVI values attributed to satellite resolution. To do so, we identified placer mine operators working within our study sites and a team of two WCS Canada staff established communications with a total of thirty-two placer mine operators across the study area. Our goal during this engagement was to understand the disturbance history at our sites. Initially, we contacted operators via email (n=28) and asked the following questions about sites within their operating area:

- What year was the area last mined or used, before 2023?
- Have there been any reclamation activities (spreading topsoil, contouring slopes) in the area?
- What year did you notice small herbaceous plants (fireweed, horsetails, etc.) regrowing after mining?
- What year did shrubs (willows, small alders, etc.) start growing?
- What year did you notice vegetation grow to be approximately 1.5 meters tall?
- What year did you notice spruce tree growth (if any)?

In July 2025, a team of two WCS Canada staff visited eight operators onsite to get a firsthand understanding of the history of ten study sites and strengthen our relationships with individuals within the placer mining industry. During site visits, operators shared with staff their knowledge about the disturbance history of the site and how they witness vegetation regrowth occurring more broadly across their operating area. WCS Canada staff took photographs of vegetation regrowth and notes on disturbance history which will continue to integrate within statistical models in 2026. WCS Canada staff noted that all operators were appreciative for these onsite visits and conversations. Many individuals expressed interest in learning more about ways they can help declining species such as the Bank Swallow and were receptive to future collaboration.



Left: Technician Clara Reid evaluating revegetation during an onsite visit. Right: Transcribed notes of disturbance history taken onsite as described by a placer mine operator.

Preliminary Results

We supplemented the data collected in the 2023-2024 field seasons with Environment and Climate Change Canada's Boreal Bird Monitoring Program (2017-2018) and WCS Canada's 2021 boreal bird monitoring field season to generate the following preliminary results. We analysed 168 sites across Central Yukon.

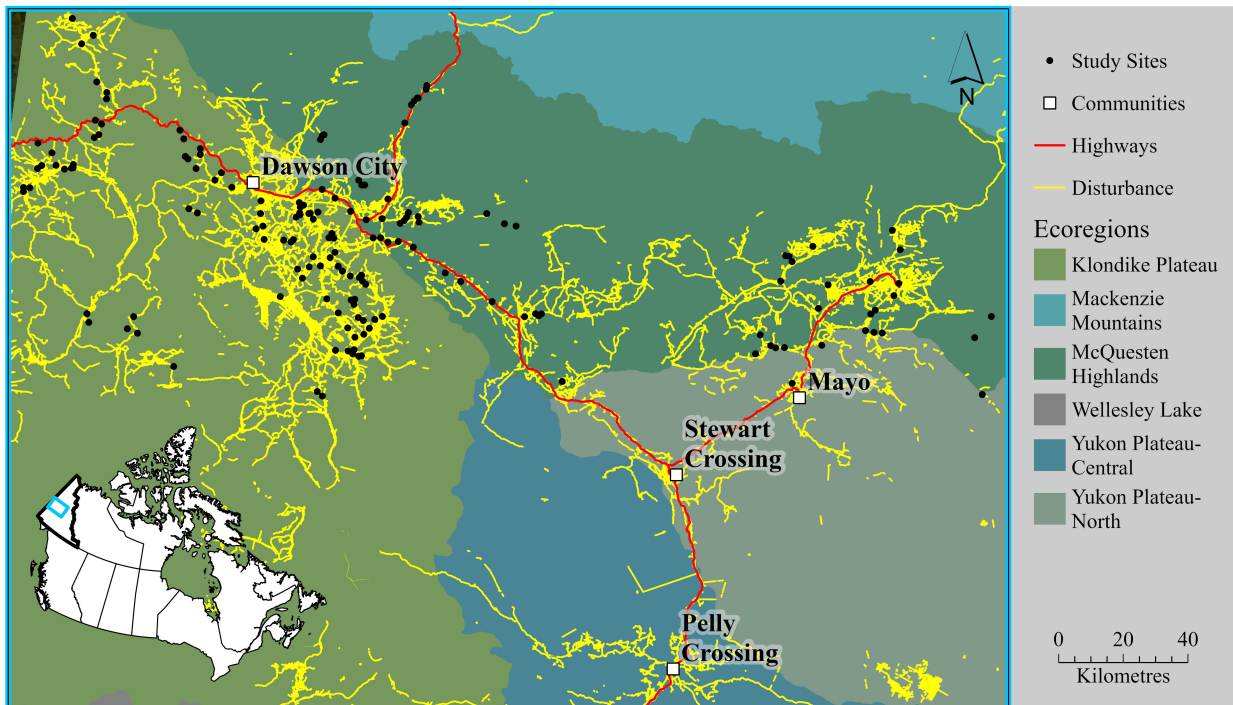


Figure 3. Map of study area in Central Yukon. Black points represent study sites across Central Yukon. Ecoregions, defined by Government of Canada (2013), are shown in shades of green. Anthropogenic disturbance (surface and linear disturbance) is represented by yellow. Nearby community centres are displayed by white squares. Insert shows the position of our study area (blue) in the context of Canada.

Our preliminary results have demonstrated that anthropogenic disturbances had a significant negative effect on coniferous mixedwood, deciduous forest species while shrub and wetland species were positively affected (Figure 4). Species demonstrated specific relationships with various disturbance features. Overall, Townsend's Solitaire abundance was the most negatively affected by mining related disturbances, while Wilson's Warbler abundance benefits the most. Roads and trails (linear features) had a significant positive effect on 15 species abundances (4.2% of all species modelled), and a significant negative effect on 3 species (8% of species). Surface disturbance showed a mixed response on species abundances (9 species positive [25%], 10 negative [28%]), while revegetation also had a mixed effect (11 positive [31%]; 11 negative [31%]). Species such as Rusty Blackbird, Lesser Yellowlegs, and Bohemian Waxwing did not have strong relationships with disturbance, suggesting that their abundances are more linked to available natural habitat.

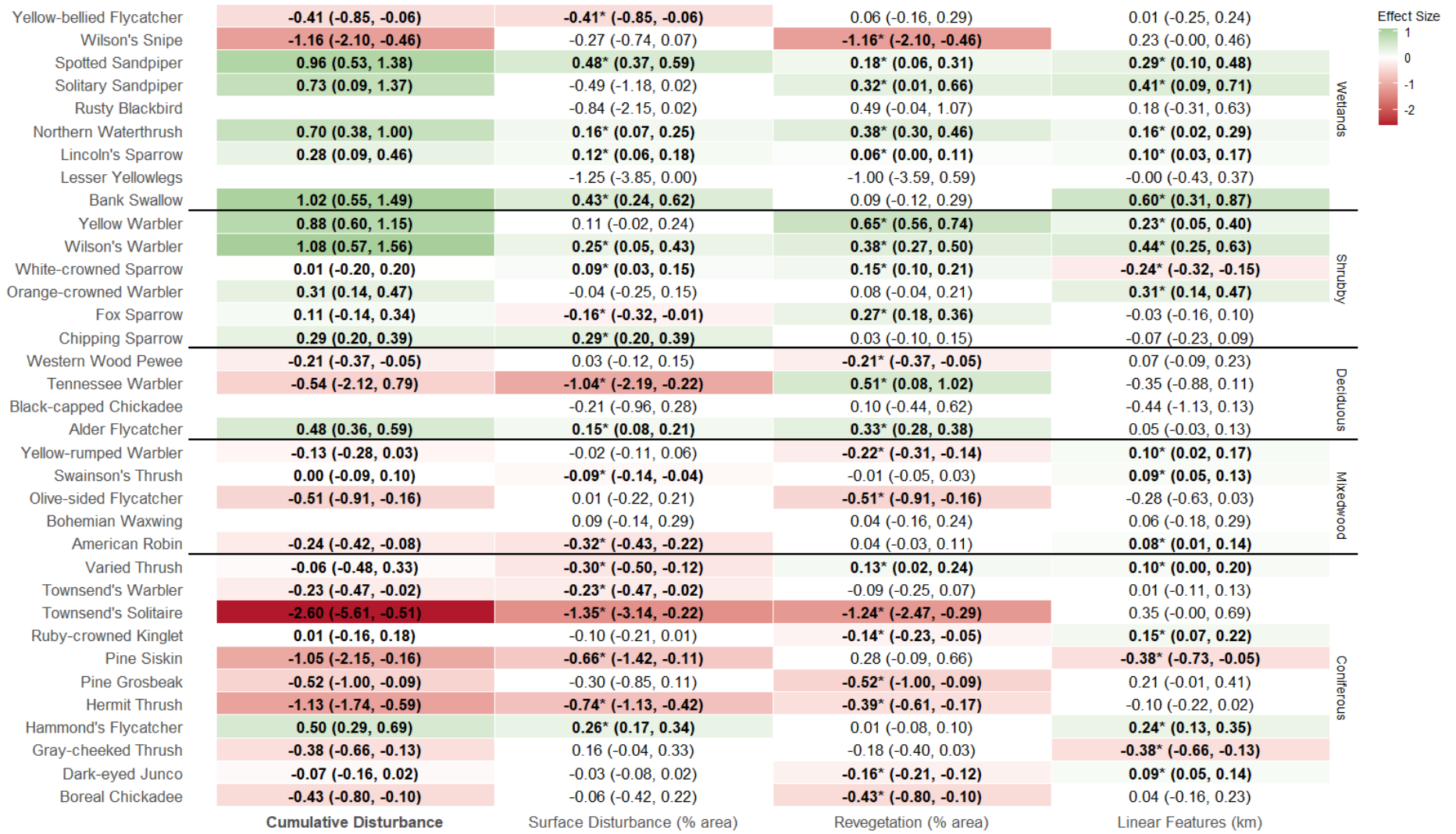


Figure 4. A heatmap of the effect size (how much a species is affected) by each disturbance variable (x-axis) effect on species abundance. Species are displayed on the left y-axis, and general habitat associations are displayed on the right y-axis, with horizontal black lines separating habitat groups. Effect size is represented visually through color - darker means stronger positive effect (green), or negative (red), only statistically relevant relationships were assigned a color. The effect size is displayed in the center of each tile. Cumulative disturbance is the summation of all statistically relevant disturbance variables' effect size.

Communications

In 2025, we communicated the initial results, methods, and importance of this project through presentations, and attendance at local community events. In addition to these events, we had frequent communications during the 2025 field season with members of the placer mining community to improve awareness and convey key messaging on the research study to the mining industry. In all formal presentations and written communications materials, YFWET was acknowledged as a partner in funding the project.

- Zeller, A., Reid C, & Mantyka-Pringle C. Impacts of placer mine revegetation on songbird communities in Central Yukon. Poster presentation at the Yukon Biodiversity Forum. April 12th, 2025, Whitehorse, YT.
- Zeller A., Brown M, Yip D & Mantyka-Pringle C. The Cumulative Effects of Placer Mining on Breeding Birds in Central Yukon. Project presentation at the Wildlife Society, October 7th, 2025, Edmonton, Canada
- Zeller A & Mantyka-Pringle C. Breeding Birds in Placer Mines. Yukon Placer Mining Forum. Whitehorse, YT, November 15th, 2025



Photo: Austin Zeller speaking at The Wildlife Society Conference in Edmonton, Alberta, October 7th, 2025.

Acknowledgements

We would like to thank several individuals and project partners for their support in guiding this project's objectives, reviewing site selection and preliminary data modelling, lending gear, assistance in the field, and providing data for the sole purposes of understanding cumulative effects and evaluating the value of placer mine habitat revegetation for avian communities in the Yukon. Organizations that are partnering on or supporting this project are Tr'ondëk Hwëch'in First Nation, Yukon Government – Department of Environment, Environment and Climate Change Canada, First Nation of the Na-cho Nyäk Dun, Ducks Unlimited Canada, University of Alberta, and University of Saskatchewan. Photos in this report are from WCS Canada unless otherwise noted.

Funders



Yukon South Beringia
Priority Place Initiative



Environment and
Climate Change Canada
Environnement et
Changement climatique Canada



Weston Family
Foundation



Appendix

Table 1. List of species detected during sampling. n represents the number of sites a species was detected at (out of 168).

| Species Common Name | Scientific Name | n sites | n detections |
|---------------------------|--------------------------------|---------|--------------|
| Swainson's Thrush | <i>Catharus ustulatus</i> | 125 | 3765 |
| Dark-eyed Junco | <i>Junco hyemalis</i> | 122 | 2847 |
| American Robin | <i>Turdus migratorius</i> | 117 | 1453 |
| Yellow-rumped Warbler | <i>Setophaga coronata</i> | 116 | 1050 |
| Ruby-crowned Kinglet | <i>Corthylio calendula</i> | 103 | 1013 |
| Lincoln's Sparrow | <i>Melospiza lincolnii</i> | 99 | 1740 |
| Canada Jay | <i>Perisoreus canadensis</i> | 98 | 581 |
| White-winged Crossbill | <i>Loxia leucoptera</i> | 98 | 533 |
| Varied Thrush | <i>Ixoreus naevius</i> | 92 | 515 |
| Alder Flycatcher | <i>Empidonax alnorum</i> | 91 | 1887 |
| White-crowned Sparrow | <i>Zonotrichia leucophrys</i> | 88 | 1814 |
| Chipping Sparrow | <i>Spizella passerina</i> | 86 | 358 |
| Redpoll | <i>Acanthis flammea</i> | 80 | 283 |
| Fox Sparrow | <i>Passerella iliaca</i> | 72 | 799 |
| Orange-crowned Warbler | <i>Leiothlypis celata</i> | 67 | 308 |
| Townsend's Warbler | <i>Setophaga townsendi</i> | 63 | 495 |
| Hammond's Flycatcher | <i>Empidonax hammondii</i> | 62 | 450 |
| Hermit Thrush | <i>Catharus guttatus</i> | 60 | 497 |
| Northern Waterthrush | <i>Parkesia noveboracensis</i> | 60 | 779 |
| Spotted Sandpiper | <i>Actitis macularius</i> | 59 | 251 |
| Common Raven | <i>Corvus corax</i> | 57 | 166 |
| Yellow Warbler | <i>Setophaga petechia</i> | 57 | 817 |
| Boreal Chickadee | <i>Poecile hudsonicus</i> | 56 | 128 |
| Yellow-bellied Flycatcher | <i>Empidonax flaviventris</i> | 52 | 205 |
| Northern Flicker | <i>Colaptes auratus</i> | 45 | 97 |
| Wilson's Warbler | <i>Cardellina pusilla</i> | 44 | 197 |
| Pine Grosbeak | <i>Pinicola enucleator</i> | 43 | 93 |
| Pine Siskin | <i>Spinus pinus</i> | 43 | 87 |
| Western Wood-Pewee | <i>Contopus sordidulus</i> | 42 | 265 |
| Bank Swallow | <i>Riparia riparia</i> | 41 | 222 |
| Gray-cheeked Thrush | <i>Catharus minimus</i> | 40 | 181 |
| Bohemian Waxwing | <i>Bombycilla garrulus</i> | 38 | 94 |
| Solitary Sandpiper | <i>Tringa solitaria</i> | 38 | 79 |
| Wilson's Snipe | <i>Gallinago delicata</i> | 38 | 129 |

| | | | |
|--------------------------------|----------------------------------|----|-----|
| Canada Goose | <i>Branta canadensis</i> | 35 | 92 |
| Violet-green Swallow | <i>Tachycineta thalassina</i> | 34 | 123 |
| Common Yellowthroat | <i>Geothlypis trichas</i> | 27 | 147 |
| Gray Jay | <i>Perisoreus canadensis</i> | 27 | 49 |
| Black-capped Chickadee | <i>Poecile atricapillus</i> | 24 | 45 |
| Olive-sided Flycatcher | <i>Contopus cooperi</i> | 23 | 70 |
| American Three-toed Woodpecker | <i>Picoides dorsalis</i> | 22 | 35 |
| Rusty Blackbird | <i>Euphagus carolinus</i> | 22 | 62 |
| Lesser Yellowlegs | <i>Tringa flavipes</i> | 20 | 55 |
| Ruffed Grouse | <i>Bonasa umbellus</i> | 20 | 37 |
| Savannah Sparrow | <i>Passerculus sandwichensis</i> | 19 | 202 |
| Townsend's Solitaire | <i>Myadestes townsendi</i> | 19 | 57 |
| Tree Swallow | <i>Tachycineta bicolor</i> | 12 | 26 |
| Warbling Vireo | <i>Vireo gilvus</i> | 12 | 21 |
| Tennessee Warbler | <i>Leiostyris peregrina</i> | 11 | 32 |
| Belted Kingfisher | <i>Megasceryle alcyon</i> | 8 | 13 |
| Hairy Woodpecker | <i>Dryobates villosus</i> | 8 | 9 |
| Herring Gull | <i>Larus argentatus</i> | 7 | 12 |
| Red-winged Blackbird | <i>Agelaius phoeniceus</i> | 7 | 21 |
| Say's Phoebe | <i>Sayornis saya</i> | 7 | 16 |
| Green-winged Teal | <i>Anas crecca</i> | 6 | 14 |
| Semipalmated Plover | <i>Charadrius semipalmatus</i> | 6 | 11 |
| Short-billed Gull | <i>Larus brachyrhynchus</i> | 6 | 20 |
| American Wigeon | <i>Mareca americana</i> | 5 | 6 |
| Common Nighthawk | <i>Chordeiles minor</i> | 5 | 9 |
| White-throated Sparrow | <i>Zonotrichia albicollis</i> | 5 | 20 |
| Yellow-bellied Sapsucker | <i>Sphyrapicus varius</i> | 5 | 6 |
| Blackpoll Warbler | <i>Setophaga striata</i> | 4 | 12 |
| Great Horned Owl | <i>Bubo virginianus</i> | 4 | 8 |
| Red-breasted Nuthatch | <i>Sitta canadensis</i> | 4 | 6 |
| Boreal Owl | <i>Aegolius funereus</i> | 3 | 4 |
| Cliff Swallow | <i>Petrochelidon pyrrhonota</i> | 3 | 3 |
| Common Loon | <i>Gavia immer</i> | 3 | 7 |
| Northern Shrike | <i>Lanius borealis</i> | 3 | 3 |
| Red-necked Grebe | <i>Podiceps grisegena</i> | 3 | 3 |
| American Dipper | <i>Cinclus mexicanus</i> | 2 | 2 |
| American Pipit | <i>Anthus rubescens</i> | 2 | 2 |
| Black-backed Woodpecker | <i>Picoides arcticus</i> | 2 | 5 |
| Horned Grebe | <i>Podiceps auritus</i> | 2 | 2 |
| Least Flycatcher | <i>Empidonax minimus</i> | 2 | 3 |
| Mallard | <i>Anas platyrhynchos</i> | 2 | 2 |
| Northern Hawk Owl | <i>Surnia ulula</i> | 2 | 10 |
| Red-tailed Hawk | <i>Buteo jamaicensis</i> | 2 | 4 |
| American Kestrel | <i>Falco sparverius</i> | 1 | 1 |

| | | | |
|------------------------|---------------------------------|---|---|
| Bald eagle | <i>Haliaeetus leucocephalus</i> | 1 | 1 |
| Golden-crowned Kinglet | <i>Regulus satrapa</i> | 1 | 2 |
| Merlin | <i>Falco columbarius</i> | 1 | 1 |
| Northern Goshawk | <i>Accipiter gentilis</i> | 1 | 1 |
| Northern Pintail | <i>Anas acuta</i> | 1 | 1 |
| Northern Shoveler | <i>Spatula clypeata</i> | 1 | 1 |
| Sora | <i>Porzana carolina</i> | 1 | 3 |
| Spruce Grouse | <i>Canachites canadensis</i> | 1 | 1 |
| Trumpeter Swan | <i>Cygnus buccinator</i> | 1 | 4 |

YFWET Budget

Project Period: April 2025 to Feb 2026

WCS Revegetated Placer Mine for Avian Community-Year 3

| Expenditure Categories | Budget Item | Projected Cost | Original Projected YFWET Cost | Actual YFWET Cost | Receipts Included |
|---|---|----------------|-------------------------------|-------------------|-------------------|
| 1. Capital Expenses (equipment, machinery) | | | | | |
| | 1. ECCC staff salary and benefits | 4,000.00 | | | |
| | 2. Tr'ondëk Hwëch'in government staff time | 4,000.00 | | | |
| | 3. Ducks Unlimited Canada – provision of wetland inventory map | 2,000.00 | | | |
| | 4. WCSC Staff Salary and benefits | 36,760.70 | | | |
| | 5. University of Alberta staff salary and benefits | 2,000.00 | | | |
| | 6. NDVI Contract | 15,000.00 | | | |
| 2. Wages, Contract Services | 7. Research Assistant salary and benefits | 96,562.50 | 13,045.00 | 13,045.00 | No |
| 3. Office and Administrative Expenses(telephone, printing, postage) | | | | | |
| | 1. Administrative overhead | 25,344.21 | 1,955.00 | 1,955.00 | No |
| 4. Travel Expenses (accommodation, food, transportation) | | | | | |
| | 1. Field Cost - Travel, accommodation, fuel, per diem, etc. | 7,400.00 | | | |
| | 2. Training and conference travel | 2,500.00 | | | |
| 5. Materials and Supplies | | | | | |
| | 1. Research Assistant - Office equipment and Supplies (hard drives, monitor, office supplies, printing ink) | 3,000.00 | | | |

| | | | | |
|----------------------|---|---------------------|--------------------|--------------------|
| | 2. Field equipment (waders, personal safety gear, bearspray, tents, camping equipment, sat phone) | 1,000.00 | | |
| 6. Facility Expenses | 1. Rent and utilities (post doc only) | 6,738.17 | | |
| 7. Other | | | | |
| | Total | \$206,305.58 | \$15,000.00 | \$15,000.00 |