



WCS
CANADA

Addressing Cumulative Effects of Climate Change in Yukon

**Yukon Fish and Wildlife Enhancement Trust
Final Report**

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PROJECT ACTIVITIES

What activities did you complete during your project?

From June 2020 – February 2021, we collated water quality data including total suspended sediments, dissolved oxygen, total organic carbon, and water temperature from 89 unique locations in the Dawson and Klondike River watersheds to investigate cumulative effects of human disturbance and climate change on salmon spawning habitat. For these locations, we extracted human disturbance data (i.e. area disturbed by placer mining and roads), climate stressors (i.e. precipitation, surface runoff, air temperature, wildfire footprint, and permafrost thaw), and terrain variables (i.e. elevation, stream order, and stream gradient). In addition, we conducted field work in the Beaver River watershed to collect water samples and test water quality in undisturbed regions during the month of August 2020 and to ground truth permafrost erosion Google Earth maps. Preliminary analysis is ongoing with results anticipated to be released in summer 2021.

We also conducted significant outreach and engagement with project partners and collaborators to align our goals, objectives, and outcomes of the project with other parties. Partners include Tr'ondëk Hwëch'in (TH), the First Nation of Na-cho Nyäk Dun (FNNND), Department of Fisheries and Oceans (DFO), Yukon Government (YG), and Environment and Climate Change Canada (ECCC). We met multiple times with these partners to discuss data gaps, regions of particular interest for wildlife monitoring and to collaborate with any ongoing wildlife monitoring that is also occurring in these areas. Finally, we initiated several planning meetings for upcoming avian monitoring scheduled for spring 2021 to discuss priority areas and species for our avian survey program.

How did your activities contribute to your goals and objectives?

The goals of this project were to investigate the cumulative impact of human disturbance and climate stressors on fish and avian populations and their habitat. Specifically, our objectives for 2020 were to (1) create a study design incorporating a variety of stressors at different levels of intensity, (2) investigate cumulative impacts of these stressors on salmon habitat, (3) make recommendations for cumulative effects assessment and protection of key regions and ecosystems, and (4) prepare for avian field work in 2021 through collation of data and study design planning.

We successfully created a study design to study salmon habitat (objective 1) and are in the process of designing a field program for avian monitoring (objective 4) in spring 2021. We have collected or collated water quality monitoring data for 103 unique locations across central Yukon, extracted disturbance and climate stressors for these locations, formatted and standardized data, and conducted preliminary analyses on their relationships. For avian field planning, we have collated historical bird monitoring data from the past 3 years, extracted landcover and disturbance data for these locations, and are currently in the process of selecting locations for the coming field season in collaboration with our partners. Analysis of the cumulative impact of multiple stressors (objective 2) is ongoing and is anticipated to be completed by summer 2021 with recommendations for cumulative effects assessment and protection of designated areas to follow shortly after (objective 3). Results and recommendations stemming from these analyses will be shared with all project partners and published in subsequent reports and peer-reviewed publications.

Note any variances to your goals, objectives or work plan and explain why they occurred.

We did not experience any significant variance in our goals, objectives, or work plan. The timeline of our original work plan is slightly delayed (by approximately 4 months) due to minor setbacks in collating existing data (such as incomplete datasets, data formats, and communication complexities due to the current COVID-19 situation). We ran into difficulties in collating permafrost thaw data for remote regions but have several potential substitute candidate datasets to consider which should be an equivalent replacement. As this is a two-year project, we are still on track to fulfilling all of our project goals within that timeframe.

Explain how the results of your work contributed to the protection, enhancement or restoration of fish, wildlife or their habitat.

Currently, both Indigenous and non-Indigenous governments in Yukon do not have a good understanding of cumulative effects and thresholds for maintaining healthy wildlife populations and ecosystems. Cumulative effects are the combined effects of multiple individual stressors on species or ecosystems over time and/or space. Stressors relate to all human-induced activities, including resource activities and climate-related variables. Thresholds, on the other hand, are a level of impacts due to a combination of stressors that ultimately trigger a management action. In land-use planning, a tiered threshold approach can often be used which includes “cautionary” and “critical” levels of cumulative effects to prevent a certain result or condition to occur or triggers a specific action. For example, a management action to limit/cap new sector and stressor development; conservation action to designate moratoriums or permanent protected areas; start captive breeding programs for endangered wildlife. Cumulative effects and thresholds are not well understood in northern ecosystems and particularly Yukon due to the lack of data and difficulties in collecting monitoring data across gradients of stressors and processes, at a broad enough scale, or over long enough periods to truly capture cumulative effects of disturbance. Yet, cumulative effects studies have been identified as a priority for regional environmental assessment and land use planning by Yukon Government and all Yukon First Nations.

Land bird and salmon breeding habitat in the Yukon is predominantly intact relative to southern boreal habitats. However, emerging threats and vulnerability from human impact and climate change, combined with declining populations and their importance to communities (particularly salmon) makes them valued target species. While considerable research has been conducted examining the influence of resource and climate related stressors on wildlife populations, understanding how these effects interact when multiple stressors co-occur is crucial for guiding effective conservation actions (e.g., selecting protected areas) or mitigation strategies (e.g., identifying thresholds or buffers). Results from this project will be used to: (1) identify stressors with the greatest threat to avian and fish populations, and (2) develop key conservation actions and thresholds of disturbance to protect significant regions, ecosystems, or habitats from negative impacts.

If you were to do the project again what would you do differently?

The availability of existing data is crucial for the success of this project, however existing datasets in northern Canada are often deficient, particularly in remote regions. More high resolution satellite imagery of land use and permafrost data within Yukon can help rectify this issue for our study, and data availability is something to take into account when planning future studies of this nature.

COMMUNICATIONS

What did you do to ensure your results were shared with the appropriate groups, people or governments?

We engaged in multiple meetings with TH, FNNND, YG, Fisheries and Oceans Canada (DFO), individual Academics, and ECCC to discuss project priorities, regions of interest, data availability, data sharing, and project objectives. These meetings occurred at regular intervals and were used to update project partners with the current status of the project, provide new findings, and discuss next steps so that all partners are continuously informed. The aquatic monitoring part of this project was shared through a storymap (<https://storymaps.arcgis.com/stories/8eba6b85803b4b56b6389abcc74708a8>) , and report to the Yukon River Panel, and will be presented as a seminar on February 10th as part of the Yukon Community Fish Practice Speaker Series (<https://yukonfga.ca/news/>). We also submitted an abstract to present research findings to the International Boreal Forest Research Association Conference in August 2021 and to be part of Above NASA Yukon-focus webinar series (https://above.nasa.gov/yukon_webinars.html) later this year. Project updates and photos are regularly shared through WCS Canada's social media platforms (Twitter: https://twitter.com/WCS_Canada and Facebook: <https://www.facebook.com/TheWCSCanada>). Lastly, we will be submitting our aquatic research findings to a peer reviewed international scientific journal later this year and will be communicating all research results and recommendations with our partners once finalized.

Describe how you recognized the Enhancement Trust and/or its mandate.

The Yukon Fish and Wildlife Enhancement Trust is acknowledged in all WCS Canada's annual reports of project and fundraising activities, presentations to partners and collaborators, and any future reporting or peer-reviewed publications that emerge from this project.

Identify any communication materials, strategies or techniques that you used to promote your project and its objectives.

In 2020 and 2021, the aquatic monitoring part of this project was featured on WCS Canada's social media platforms and was presented in the following formats:

- Storymap and report for the Yukon River Panel: "A Quest for Chinook Salmon in Central Yukon: A project in partnership with the First Nation of Na-cho Nyäk Dun to help guide conservation efforts" – Chrystal Mantyka-Pringle, December 2020.
(<https://storymaps.arcgis.com/stories/8eba6b85803b4b56b6389abcc74708a8/>)

- Yukon Fish Community of Practice Speaker Series: “Weaving together traditional and scientific knowledge to map key salmon spawning areas in the Beaver River watershed” – Chrystal Manytka-Pringle, February 2021. (<https://yukonfga.ca/news/>)

In addition, the figures and photos listed here were used during outreach and engagement to project and community partners.

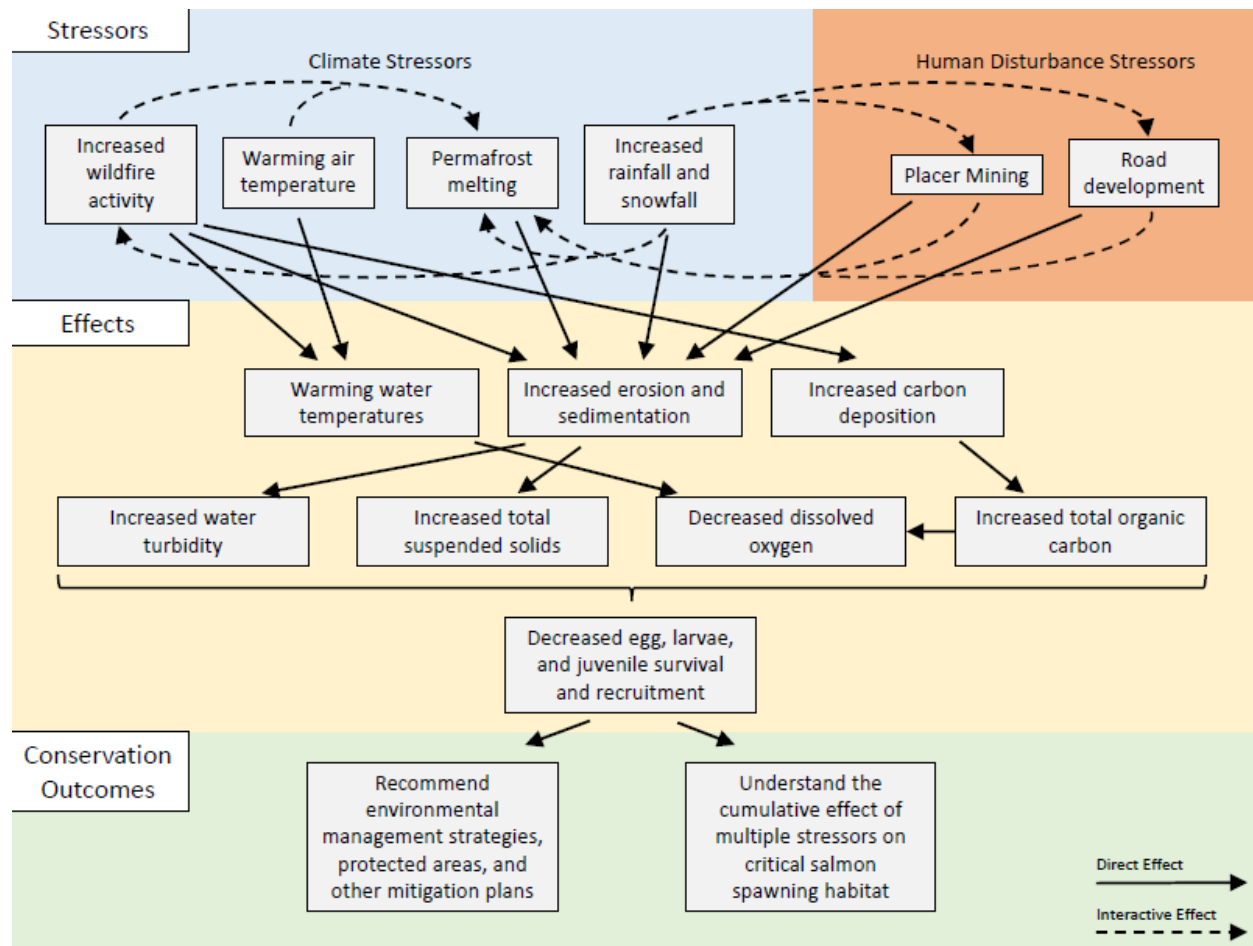


Figure 1. A conceptual model for the aquatic portion of this project. Direct effects of climate and human disturbance stressors on water quality metrics and the process in which they are impacted in relation to project objectives and conservation outcomes are indicated by solid arrows. Indirect effects through interaction with other stressors are indicated by dashed arrows.

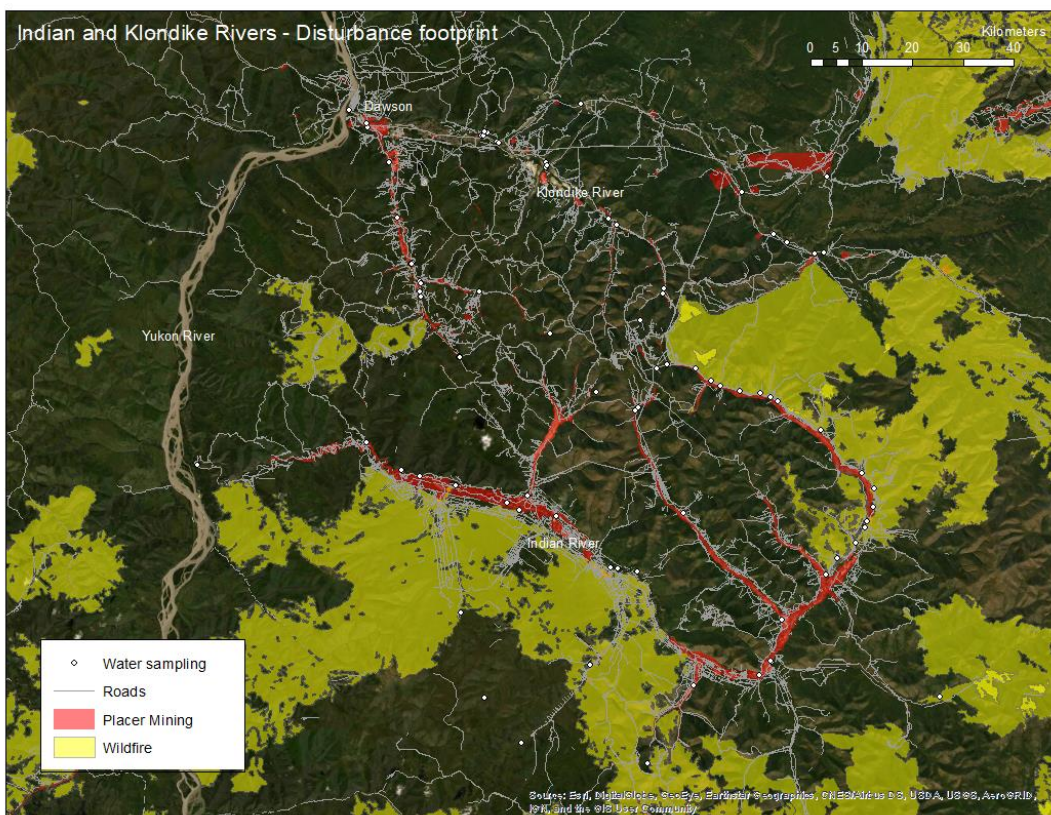


Figure 2. Water sampling locations within the Indian and Klondike River watersheds in relation to historical wildfire locations (yellow), placer mining (red), and roads (grey).



Image 1. Daniel Yip classifying Yukon streams by hand (October 15th, 2020; Photo credit: Chrystal Mantyka-Pringle)



Image 2. Chrystal Mantyka-Pringle sampling water quality in the Beaver River (August 26th, 2020; Photo credit: WCS Canada)



Image 3. Beaver River watershed taken by helicopter (August 26th, 2020; Photo credit: Chrystal Mantyka-Pringle)



Image 4. Seine netting for juvenile fish in the Beaver River (August 26th, 2020; Photo credit: Chrystal Mantyka-Pringle)

FINANCIAL REPORTS