CANADIAN MOUNTAIN NETWORK

RESEARCH PROJECT SUMMARY

From the Mountains to Our Tables: Freshwater Security in Three Canadian Eastern Rocky Mountain Watersheds

Water resources that originate in mountains are a critical yet vulnerable resource, which are currently at risk from climate change and the release of contaminants into the atmosphere. Snow and glaciers cover high-altitude regions, so climate change profoundly affects downstream hydrology and water temperature, with consequent effects on biodiversity and ecosystem function. Volatile organic contaminants (VOCs), historically used at lower elevations for pest control and industrial applications, have also cold-condensed into high-altitude snow packs and glaciers, where they have been continually stored as glaciers have grown. This research program documented the impacts of climate change on the quality and health of glacially-fed freshwaters in the eastern slopes of the Rocky Mountains.

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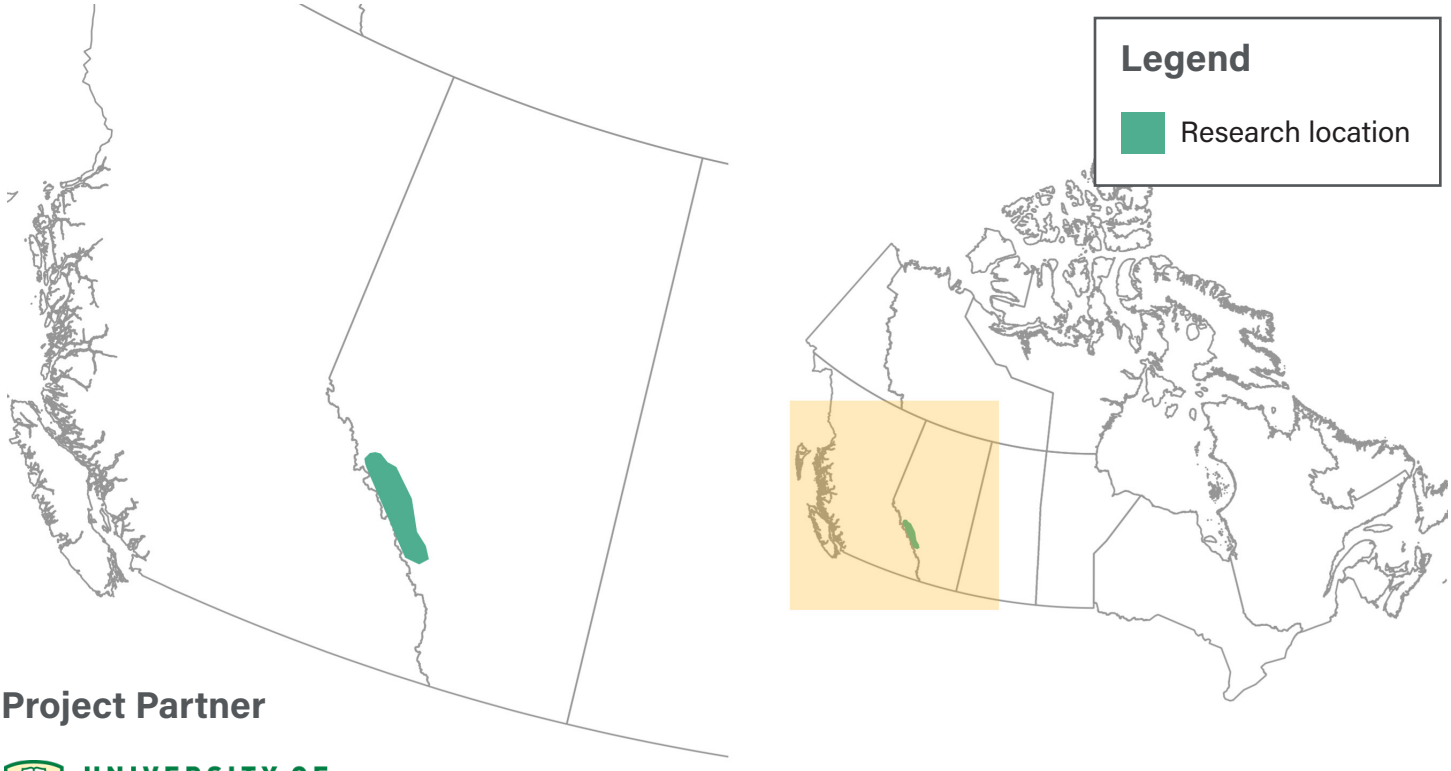

Project Partner

UNIVERSITY OF ALBERTA

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Objectives

The extent of glacial influence on downstream biogeochemistry, contaminant release, biological communities and their function has been largely unknown. This study (1) quantified the full suite of physicochemical properties in three glacial rivers; (2) assessed the community structure and function of microbial and benthic bioindicators of changing water temperatures and organic carbon/nutrients/sediment loads melting out of glaciers; (3) quantified the intra- and inter-annual changes in aspects of river metabolism; and (4) quantified the thermal tolerances of different mountain fish.

Research Plan

This multi-disciplinary and multi-sector project focused on the headwaters of three glacierized watersheds in Banff and Jasper National Parks (the Bow, North Saskatchewan and Athabasca). To meet the project objectives, we tracked changing glacier surface temperatures, daily snow cover, contemporary nutrient deposition via ice cores, runoff biogeochemistry, ecosystem metabolism, biodiversity and function, and metagenomics and metatranscriptomics throughout the research locations.

Key Outcomes & Impact

The collected data continues to be analyzed and interpreted, and continued impacts will be made as results are presented at conferences and published in peer-reviewed scientific literature. Preliminary findings included (1) determining that concentrations of nutrients and contaminants are highest near glaciers as they release large amounts of particulate matter. Concentrations of these nutrients and contaminants drop and stay low at sites as you move downriver. (2) We found that concentrations are only part of the story, as shown by dissolved nitrogen concentrations that were somewhat similar at downriver sites despite the fact the volume of water in the rivers increased as we moved downriver. (3) Most phosphorus was found on particles, not dissolved in the water. (4) Aquatic microbial community composition in the rivers varied between the snowmelt period and later summer. The overall makeup of benthic algal communities changes dramatically as you move downriver. (5) Rates of primary production are relatively low compared to rates of ecosystem respiration in some of the river sites. (6) Water temperatures increase downriver of the glaciers, but never get above 14°C.

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