ALBERTA INNOVATES

Agriculture & Environment

Environmental Innovation Program

Water Innovation Focus Area

Managing and Predicting the Impacts of Mountain Forests, Water Storage and Climate Change on Downstream Water

This project investigates the management and prediction of mountain water-supply reliability through surface, groundwater and major rivers. The project leverages the world renown Canadian Rockies Hydrological Observatory and new modelling to investigate the role of forest management on surface and groundwater supply generation in mountain headwaters. Focusing on the role of forest management on snow accumulation and snowmelt, evapotranspiration and runoff generation and the role of wetlands and groundwater in transmitting water, the study will diagnose the interplay of these processes towards headwater streamflow generation using process-based hydrological models.

Land use, land cover and climate changes in Alberta's Rocky Mountains and Foothills will have large and interacting effects on water storage in headwaters and downstream water supplies.

FUNDING DETAILS

RECIPIENT:
University of Calgary, Dr. Alain Pietroniro

PARTNERS:
University of Saskatchewan, University of Waterloo, Alberta Environment and Protected Areas, Global Waters Futures

PROJECT DATES:
APR 2023 – MAY 2027

TOTAL BUDGET:
$ 1,793,000

AI FUNDING:
$ 670,000

APPLICATION

Project outcomes will inform water policy for improved river basin management and water-use in Alberta. Improved understanding of land use impacts and landcover change on headwater hydrology will inform best practices for restoration of hydrological function and resilience.

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PROJECT GOALS

The goals of this project are to:

i. Improve our understanding and modelling of forest, snow, wetland and groundwater hydrological processes in complex mountain basins;

ii. Diagnose the management potential of forests and wetlands to assess impacts on reliable water supplies for the future; and

iii. Use the improved models to show improved skill in water supply predictions, including under climate change.

The opportunity here is to build on recent and ongoing enhanced mountain hydrometeorological observations of snow, wetland and forest water balances, streamflow and groundwater processes, to ensure advances in knowledge are incorporated into the next generation cold regions mountain hydrological modelling systems to inform water policy, water management, and best practices.

BENEFITS TO ALBERTA

Through improved understanding of wetland, forest and mountain hydrology in the Canadian Rockies this project will provide benchmarks against which an assessment of landscape change that can influence the resiliency of Rocky Mountain water supply can be made. Combining hydrological datasets with advanced models, the project will determine the effects of climatic variability/change and anthropogenic disturbance on southern Alberta's water supply, under historic and future climate scenarios. Collectively, this allows for the establishment of climate and land cover change tipping points that will help quantify the resiliency of water supplies from Alberta's Rocky Mountains – critical because most of Alberta's water supply originates in mountain and foothill environments.

10 publications

8 HQPs trained

1-3 policies / practices influenced

4 knowledge mobilization workshops

CURRENT STATUS

Jun 2024 – In progress

The project completed year 1 data collection. Early results underscore the importance of advanced hydrometeorological observations in enhancing our understanding and modeling of hydrological processes in complex mountain basins. Key findings emphasize the intricate dynamics of wetland and forest ecosystems, revealing the significant roles of microtopography, vegetation, and snowmelt timing in evapotranspiration (ET) and groundwater recharge. Enhanced models, integrating these insights, demonstrate improved predictive capabilities for water supply forecasts, crucial for effective water resource management under changing climatic conditions.