CANADIAN MOUNTAIN NETWORK

RESEARCH PROJECT SUMMARY

Managing groundwater resources in mountainous areas: planning for and adapting to drought conditions

This project was driven by two key challenges encountered when managing groundwater resources in areas susceptible to drought. First, measuring drought is a complex process, particularly in mountain regions due to their geographic diversity and complex regional microclimates. Second, drought affects water allocation decision-making as the BC Water Sustainability Act requires that environmental flow needs be considered in water allocation decisions. This research addressed a number of research priorities and information gaps related to assessing groundwater responses to environmental conditions, developing groundwater drought indicators, and identifying drought sensitive aquifers in the Okanagan Basin.

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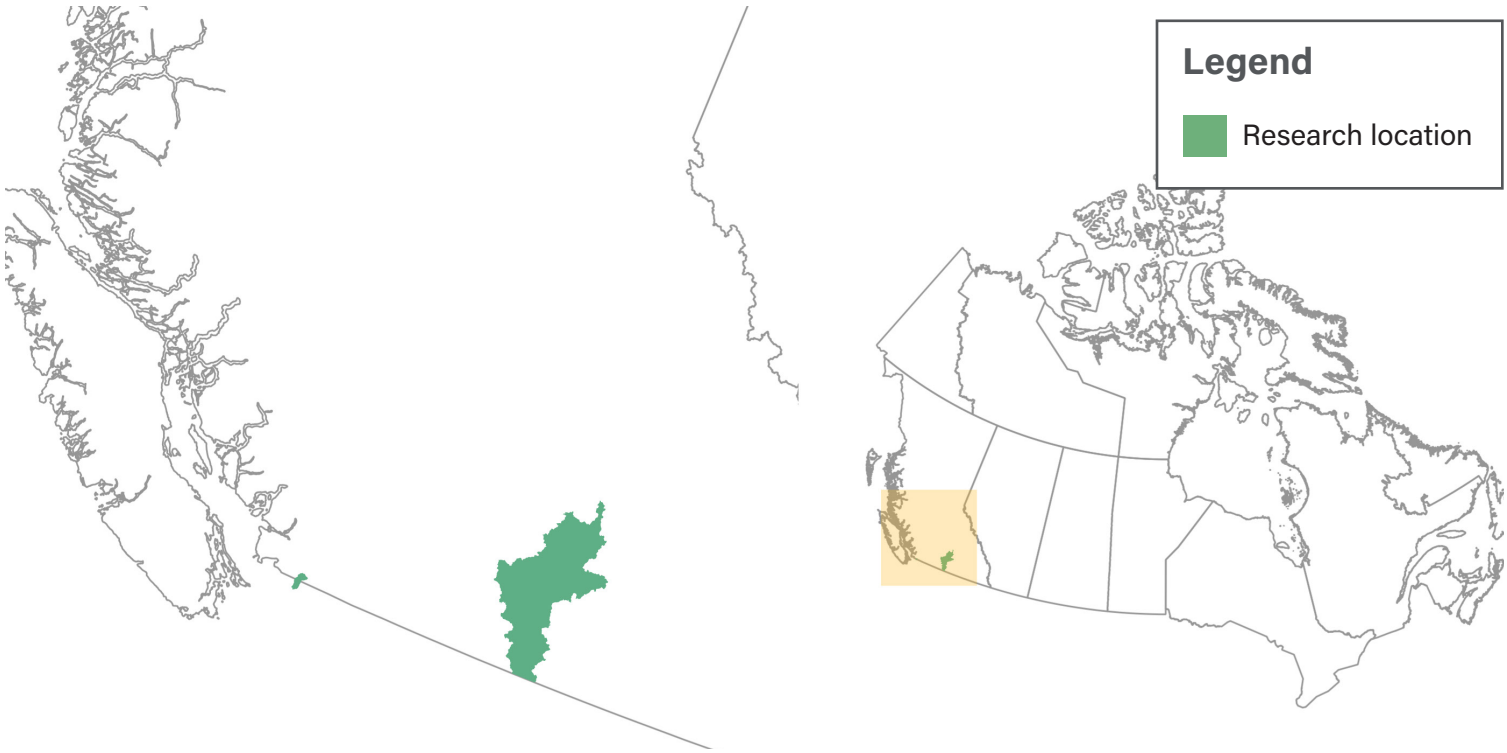

Project Partners

University of Alberta

University of Victoria

SFU Simon Fraser University

British Columbia

Okanagan Basin Water Board

Syilx Okanagan Nation Alliance

Managing groundwater resources in mountainous areas: planning for and adapting to drought conditions

Objectives

This project explored groundwater drought in British Columbia (BC) through a combination of data analysis, field studies and modeling studies. The goals of the project were to (1) develop early warning indicators of groundwater drought, and (2) identify which aquifers are susceptible to drought in the Okanagan basin. Specifically, this research evaluated how the groundwater level responses in different aquifers across the mountain regions of BC vary between drought and non-drought years.

Research Plan

1) We co-analyzed historical data (snow, temperature, precipitation, streamflow) and groundwater level data from Provincial Observation Wells to classify the groundwater level responses in aquifers across the province. 2) We used Generalized Additive Models (GAMs) to identify climate variables that are associated with summer groundwater levels and that can be used as early warning indicators of summer groundwater drought in different regions. 3) We evaluated the Standardized Groundwater Level Index (SGI), developed in the UK, to characterize the magnitude of past drought conditions in aquifers. 4) Finally, we mapped the sensitivity of aquifers to drought in the Okanagan Basin.

Key Outcomes & Impact

- In total, 97 observation wells across the province were able to be classified based on their drought response mechanism, and 66% were found to be streamflow-driven and 34% were recharge-driven. The results of this classification were used to better understand the response of aquifers to drought.
- Predictor variables were identified for summer groundwater levels in South Central BC and the Fraser Valley. The findings showed that different regions are influenced uniquely by the different climate variables, and these variables can be used as early indicators of summer groundwater drought in the respective regions.
- The Standardized Groundwater Level Index (SGI) was found to be effective at indicating which wells had pronounced responses to periods of drought in each region. Furthermore, we found that the SGI can be affected by water use in aquifers, so its usefulness as a tool needs to be assessed on a regional basis.
- The final outcome was a rating scheme that incorporates aquifer hydraulic properties and degree of groundwater pumping (well density) and a map of the susceptibility of aquifers to drought. The map for the Okanagan Basin identified five highly susceptible aquifers and 23 moderately susceptible aquifers.

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