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Impacts of MPB on Hydrology and Vegetative Redevelopment in Lodgepole Pine Forests of West-central Alberta, Phase II: Watershed-scale at Tri-Creeks

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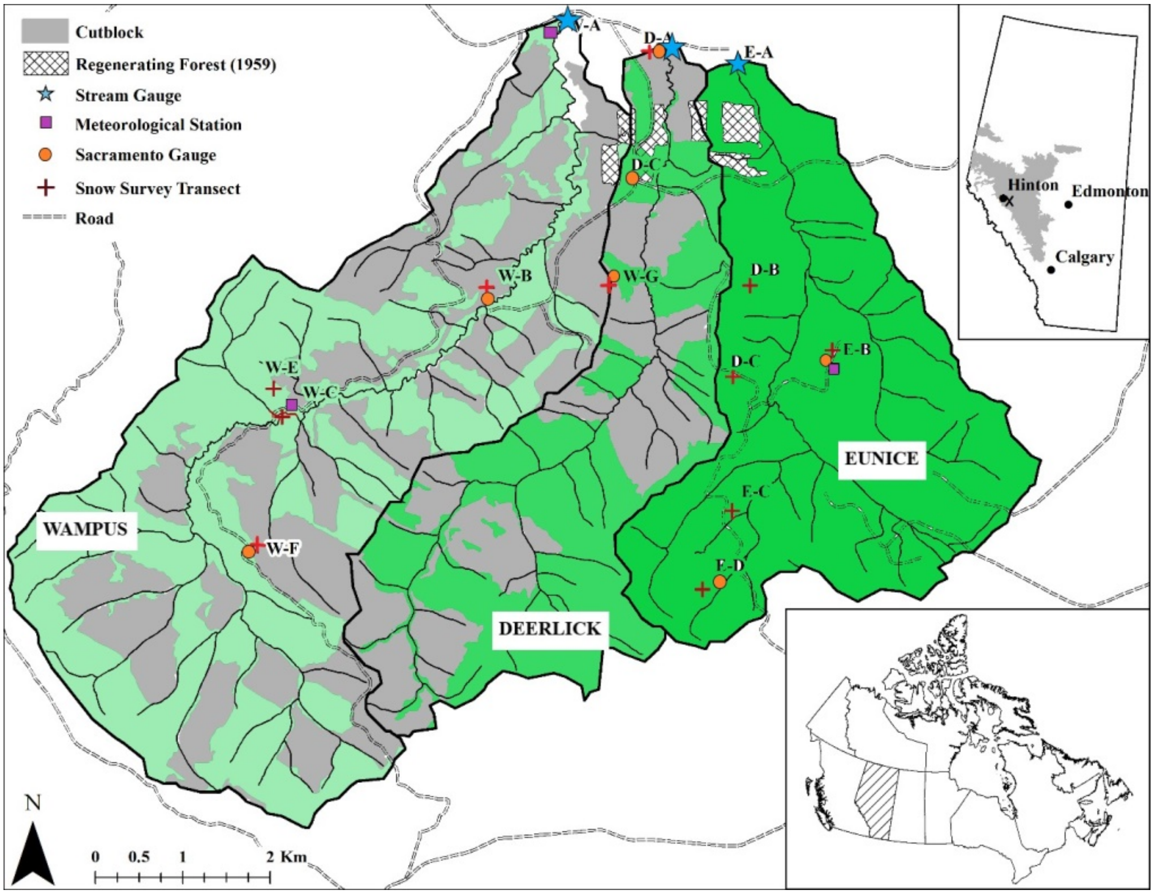
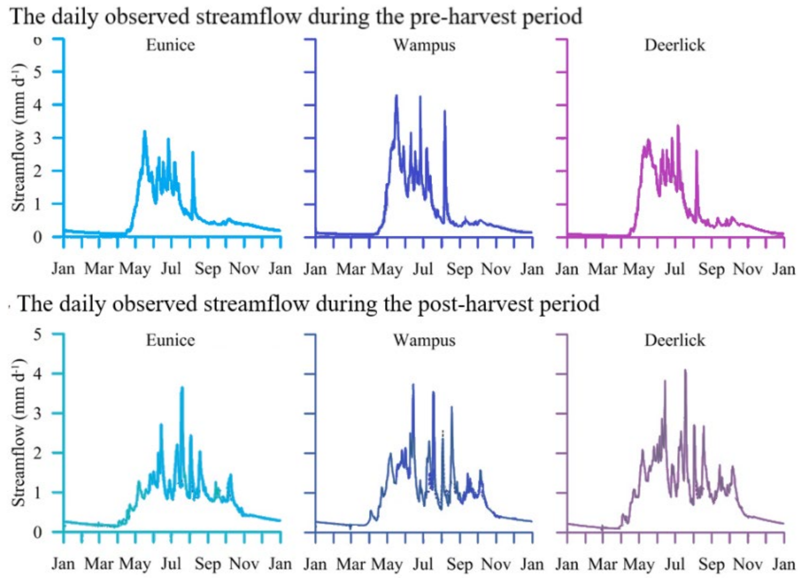
Forest cover loss can alter hydrologic processes that generate runoff, and thus, potentially change the amount of water delivered to a stream. The resilience of streamflow to forest harvest depends on the physical characteristics of the watershed. Foothills watersheds typically have harvestable timber throughout due to their lower elevation; therefore, may be more sensitive to forest disturbance and have increased potential for streamflow response. Unfortunately unstable climate patterns can mask hydrologic response to forest change,which can make it diffuclt to assess the impact to forest and climate change and watershed values, such as the endagered Athabasca Rainbow trout (*Oncorhynchus mykiss*).

The objective of this part of the project is to examine the effect of climate and different forest harvest levels on watershed--scale hydrology in Alberta's Foothills region. The three sub-watersheds at the Tri Creeks experimental watersheds established in 1965 were chosen: Eunice (control); Deerlick (64% clear-cut with streamside timber removal); and Wampus (52% clear-cut). In order to isolate effects of forest harvest from background climate variability, a combination of statistical and hydrological modelling approaches was used.



Results

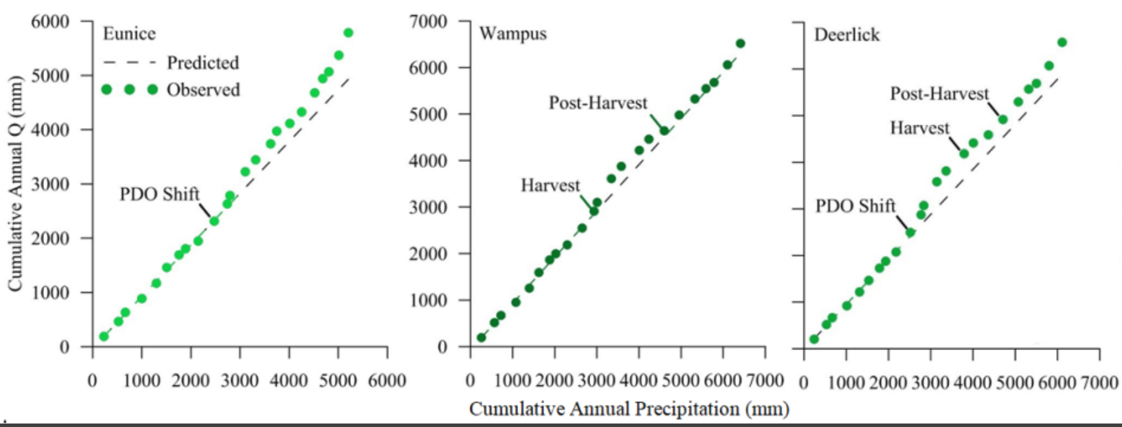


Based on meteorological data, the Pacific Decadal Oscillation (PDO) phase shift from negative (cold) to positive (warm) occurred in 1977. Positive winter PDO phase was characterized by warmer winter air temperatures, a shift in precipitation phase to more frequent, larger rainstorms, lower winter precipitation and less snowpack in Tri-Creeks which resulted in an earlier snowmelt, a delayed rising limb period of spring freshet, and increased streamflow during the low flow period.

Flows in Eunice Creek (control) showed an inter-annual variability of runoff associated with large annual storage changes (1-33% of precipitation). This result suggests antecedent soil conditions are important to subsurface processes that generate streamflow in Tri-Creeks and can buffer the change in precipitation inputs associated with the PDO phase change.

The streamflow response in Wampus Creek (52% clear-cut) during post-harvest period mimics changes observed in Eunice Creek in the warm PDO phase. Comparison of Deerlick and Eunice Creeks showed a different streamflow response to warmer winter air temperatures, lower winter precipitation, and lower snowpack in the warm PDO phase. The differences in average daily streamflow pre- and post-harvest in Deerlick Creek consisted of earlier snowmelt and increased streamflow during the low flow fall period associated to climate variability (warm PDO phase) and variation in precipitation. In general, modelling showed that annual runoff changes were associated with variation in effective precipitation during the post-harvest period.

Our results indicate that streamflow in the Tri Creeks watersheds was surprisingly resilient to forest harvest despite over 60% forest cover removal. This may be attributed to the hydrogeological condition that buffers the increased water inputs from forest harvest due to the large potential subsurface water storage. However, this buffering capacity can also conceal changes related to forest disturbance within the natural variability.



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