



The hydrological effects of harvesting at Boreal Plain, Alberta

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Unique hydrological characteristics of Boreal Plain environment such as sub-humid climate, deep glacial deposits, and significant heterogeneity in soil and vegetation type creates a complicated hydrology in the region. The study of hydrological effects of harvesting in Boreal Plain, which is occurring at an unprecedented rate for oil and gas exploration and timber harvesting, is necessary for a sustainable forest management. However there are a few previous studies addressing the hydrological effects of harvesting on quantity and quality of water in Boreal Plain. This paper reports on an on-going paired catchments experimental study at Alpac Catchment Experiment (ACE: 55N 112W) area near Lac La Biche, Alberta started in early 2005. A 2-km² catchment (H2) was harvested almost 70% in winter 2006. Later, the harvesting occurred sequentially within the bigger catchment (H1, 10 km²) i.e. 29% in 2007 and 19% in 2008 totally account for about 80% of aspen forest. Finally, the smallest catchments was harvested approximately 90% in summer 2008. The collected pre- and post harvest data have been used to assess the effect of harvesting on the catchment overall responses and soil moisture. The pre-harvest streamflow data collected at H1 and its reference catchment R1 show that unit area runoff of both catchments are matched fairly good, and may be used to assess changes in streamflow after harvesting. An increase in soil moisture and soil temperature after harvesting was observed in H2, but little to no change in streamflow response. This suggests the dominance of soil moisture in the catchment, which might be a promising indicator for tracking the effect of harvesting.

The field data is then used to drive the hydrological model MISBA to simulate the water and energy cycling in the Boreal Plain. By adding a reservoir to MISBA to simulate the significant soil storage characteristic of the Boreal Plain, and by applying different catchment discretization schemes based on soil properties and vegetation type, it is anticipated that MISBA can simulate the hydrology of the region realistically.