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Mountain Pine Beetle Ecology Program Quicknote #2
EcoHydrology Project

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June 2010: Rainfall interception losses in mature lodgepole pine forests at risk from Mountain Pine Beetle attack

The hydrologic impacts of Mountain Pine Beetle (MPB) attack are driven by stand-scale changes in water cycling that reduce evaporative water losses due to rain/snow interception by the forest canopy and understory layers, in addition to reduced canopy transpiration after trees attacked. The change in water cycling of previously healthy forests after MPB attack is being studied near Robb, AB. to help understand and predict likely hydrologic changes including increased runoff generation in MPB affected forests. Rainfall interception losses were studied during two (2008-09) growing seasons to document pre-MPB attack rainfall interception losses in mature-healthy pine stands before MPB attack using rain gauges (troughs and stemflow gauges) to document the total capacity of the stands to capture and store rainfall during rain storms.

The region near Robb, AB. generally receives 75% of total annual precipitation during the May-Sept. growing period. Preliminary results show that during the 2008 and 2009 growing seasons 208-198 mm (46-47% of May-Sept. rainfall) was intercepted (and subsequently lost to evaporation) by the overstory canopy of healthy pine stands in the study area. Rainfall intercepted by the forest floor moss and litter layers resulted in an additional 143-145 mm (31-34% of seasonal precipitation) of water loss from below the canopy. Collectively, these two components of rainfall interception accounted for 343-351 mm among these two growing seasons, representing a total evaporative loss of 77-81% of total May-Sept. growing season rainfall.

Growing season	Precipitation (mm, May-Sept)	Canopy Interception (mm, %)	Litter Interception (mm, %)	Total Interception (mm, %)
2008	457	208 (46%)	143 (31%)	351 (77%)
2009	422	198 (47%)	145 (34%)	343 (81%)

The total interception storage losses are governed by both interception storage capacity of the canopy and forest floor litter layers along with the distribution of rainfall event sizes that occur during any given season. The maximum rainfall interception storage capacities were 8.1 and 6.4 mm per rainfall event for the overstory canopy and forest floor litter layers, respectively. Thus, total rainfall interception losses during the summer would be higher in a season with many smaller storms compared to a season with fewer but larger rain storms. Because the west-central regions of Alberta's foothills tend to have more frequent, small storms, the water losses from rainfall captured in forest canopies can be very high.

While initial post-attack changes in interception losses are being measured this season, large changes are not expected because of needle retention during the "red attack" phase. Larger decreases in these evaporative losses are expected in coming seasons as needles are shed during transition into "grey attack" phases.

The study is scheduled to run until 2012.

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