Higher Water Yield but No Evidence of Higher Flashiness in Tropical Montane Cloud Forest (TMCF) Headwater Streams

ABSTRACT

There have been conflicting findings on hydrological dynamics in tropical montane cloud forests (TMCFs)—attributed to differences in climate, altitude, topography, and vegetation. We contribute another observation-based comparison between a TMCF (8.53 ha; 1906 m.a.s.l.) and a tropical lowland rainforest (TLRF) (5.33 ha; 484 m.a.s.l.) catchment in equatorial Sabah, Malaysian Borneo. In each catchment, a 90◦ v-notch weir was established at the stream's outlet and instrumented with a water-level datalogger that records data at 10-min intervals (converted to discharge). A nearby meteorological station records rainfall at the same 10-min intervals via a tipping bucket rain gauge connected to a datalogger. Over five years, 91 and 73 storm hydrographs from a TMCF and a TLRF, respectively, were extracted and compared. Various hydrograph metrices relating to discharge and flashiness were compared between the TMCF and TLRF while controlling for event rainfall, rainfall intensity, and antecedent moisture. Compared to the TLRF, storm-event runoff in the TMCF was up to 169% higher, reflecting the saturated conditions and tendency for direct runoff. Instantaneous peak discharge was also higher (up to 6.6x higher) in the TMCF. However, despite high moisture and steep topography, stream responsiveness towards rainfall input was lower in the TMCF, which we hypothesise was due to its wide and short catchment dimensions. Baseflow was significantly correlated with API20, API10, and API7. Overall, we found that the TMCF had higher runoff, but higher moisture condition alone may not be sufficient to govern flashiness.