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Rainfall partitioning in three major types of forests in the Mid-hills of Nepal

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Naturally regenerating or planted forests of broadleaf and pine species occupy ca. 2.3 million ha (>52% of the total area) of the Mid-hills of Nepal and provide a range of forest products and ecosystem services to local and downstream populations. These forested catchments give rise to numerous rain-fed springs and streams that undergo wide fluctuations in seasonal flows because of the concentrated monsoon rainfall (June to September), steep topography and rapidly draining soils. However, current understanding of the hydrological functioning of these forested landscapes is limited, particularly concerning the changes in forest structure and composition through natural succession and anthropogenic disturbances related to forest use (mostly collection of firewood, litter and fodder). We measured gross rainfall (*P*), throughfall, stemflow and overland flow in three major forest types in a Mid-hills catchment of Central Nepal, viz.: a predominantly planted pine forest (PF, ca. 35 years old), natural broadleaf forest (BF) and a mixed pine-broadleaf forest (MF). Because of differences in the dominant products provided by the three forest types they are subject to different levels of use by the local population. The PF is used only occasionally (litter harvesting and leisure) while the MF and BF are used throughout the year for nearly all three products. For the period of study (June 2015 – December 2016), measured throughfall values for the PF, MF and BF were 77.5%, 73.7% and 72.0% of incident *P*, respectively, with corresponding stemflow values of 0.6%, 1.3% and 1.6%, resulting in rainfall interception values of 21.9%, 25.1% and 26.4% for the PF, MF and BF, respectively. Corresponding amounts of overland flow for the PF, MF and BF were 4.7%, 9.8% and 11.4% of net precipitation (throughfall + stemflow), reflecting the relative intensity of forest-use related disturbances. Consistent removal of biomass and associated effects on the forest floor were found to negatively affect soil hydraulic properties. Our results highlight the need to take into account the effects of differences in forest use intensity when evaluating the forest-water relationships in Nepal's Mid-hills as well as other locally used or managed forested landscapes in similar environments.