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Contrasting sediment yield patterns before and after typhoon disturbance of a tropical fire-climax grassland and a 'reforest'

L. Adrian Bruijnzeel (1), Jun Zhang (2), and H.J. (Ilja) van Meerveld (3)

(1) King's College London, United Kingdom (sampurno.bruijnzeel@kcl.ac.uk), (2) Faculty of Science, VU University, Amsterdam, Netherlands (jzg290@outlook.com), (3) Department of Geography, University of Zurich, Zurich, Switzerland (ilja.vanmeerveld@geo.uzh.ch)

Decades of logging and slash-and-burn agriculture have turned vast tracts of land across the tropics into unproductive fire-climax grasslands. In the Philippines, more than two-thirds of the 6.5 million hectares under fire-climax grassland (17% of the total land area) were considered to suffer moderate to high erosion rates in the 1990s. Subsequently, the country initiated a major re-greening programme aiming, inter alia, for reductions in downstream flooding and sedimentation. However, the hydrological and geomorphological consequences of reforesting tropical fire-climax grasslands are still poorly documented. We instrumented and monitored two small headwater catchments on mafic rock near Tacloban, Leyte Island (Philippines) for their runoff and sediment production between June 2013 and May 2014: a 3.20 ha landslide-affected Imperata grassland and an 8.75 ha semi-mature multispecies reforestation. The area was hit by super-typhoon Haiyan on 8 November 2013, one of the largest events on record. Landslide surfaces covered 3.4% of the grassland catchment prior to the typhoon, which increased to 7.7% by activation of old slides and the formation of new ones during typhoon passage. No landslides occurred in the reforest. Post-Haiyan suspended sediment concentrations in the grassland stream were 3.5 times higher on average. The annual sediment yield of 27.4 t ha-1 (including ~8% bedload) of the grassland was heavily dominated by post-Haiyan transport (94%), with no obvious declining trend over time (indicating transport-limited conditions). Conversely, annual sediment yield from the reforest was low at 3.7 t ha-1 (including 8.4% bedload), whereas nearly two-thirds (64%) of the total yield (and all bedload) were produced during the first two months after typhoon passage. After this period of intensive flushing, suspended sediment concentrations dropped markedly, despite a period of renewed high rainfall in April 2014, suggesting the system became supply-limited, with sediment transported by the stream deriving mostly from bank scouring and collapse during large storm events. Reforestation was thus seen to have a strongly moderating effect, both on hillslope sediment production and catchment sediment yield, also during extreme events.