The effect of catchment area and flashfloods on controlling sediment export of the Geba catchment, northern Ethiopia

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Sediment transport by water has been one of the most important land degradation processes in the Northern Ethiopian highlands. Studies on flash floods and sediment yield at the intermediate catchment scale (100 – 10 000 km2) are hardly available in the Ethiopian highlands. The objectives of this study were: i) to assess the magnitude of flashfloods and associated sediment export in the Geba catchment, and ii) to assess the importance of catchment area in controlling sediment yield at intermediate catchment scale. Flashfloods and suspended sediment concentration measurements were conducted during the rainy seasons (July – September) of 2004-2007 in ten monitoring stations of Geba catchments. Discharge was determined using the velocity-area method. Depth-integrated suspended sediment samples were taken for estimating the sediment yield. The catchment area was generated from DEM (Digital Terrain Model) derived from 90m Shuttle Radar Topographic Mission (SRTM). The subcatchment areas (A) vary between 130 and 4,592 km2. The extreme suspended sediment concentration was found to be 96.7 kg m-3, and the area specific sediment yield (SSY) ranges between 497 and 6,543 t km-2 year-1. The decreasing relationship between A and SSY developed for Ethiopian conditions underestimate the sediment yield for medium-sized catchments. The higher than expected SSY for medium-sized catchments can probably be explained by the geomorphologic characteristics of the Ethiopian highlands. The majority of sediment export occurs during a few short but intense flash floods. Sediment export rates in the Ethiopian highlands are mainly controlled by the occurrence and magnitude of flash flood events. The erosion control program in the Ethiopian highlands should not only focus on the reduction of hillslope erosion rates but also on the magnitude of the flash floods.

Keywords: Sediment yield, flashflood, catchment area, Geba catchment, northern Ethiopia