

Hydrogeomorphological changes due to channel Erosion and In-Channel Deposition to Gumara River in the lacustrine plain of Lake Tana (Ethiopia).

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Abstract

The contribution of river bank erosion to sediment yield has so far been poorly investigated. The main objective of this study is to investigate the Gumara River in the lacustrine plain of Lake Tana (Ethiopia). In-channel deposition and the contribution of bank erosion to the total sediment load at its outlet were analyzed using historical aerial photos. To this end, measured sediment concentration, aerial photograph analysis, field observation and discussion with the local people were conducted. The Environment for Visualizing Images (ENVI 4.2) and ArcGIS were used to estimate and analyze river bank erosion and in-channel deposition. The result of sediment analysis showed that, the sediment yield decreases from the upper reach to the lower reach during maximum flows during storm and increases during minimum flows with no rain. The sediment load at the upper reach of Gumara River (5.9 million tons i.e. 46.7 t/ha) is higher than in the lower reach (5 million tons i.e. 38.8 t/ha) of the river for maximum flow from the measurements of three months (June 2 to Sep. 2, 2012). This result indicates that the main source of the sediment during maximum flow is the upper catchment and 0.9 million tons of sediment were deposited between the two gauging stations. For minimum flow condition, the sediment load at the upper reach was 0.96 million tons and at the lower reach was 2.3 million tons. It indicates that 1.34 million tons of sediment loads is mobilized in the river channel within the same period. The analysis of aerial photographs of 1957 and the recent Google Maps (2014) show that the area occupied by the river has increased by 3.7 ha for the period of 57 years (annual mean expansion of 0.065ha corresponding to a sediment yield of 1649.7 ton/year. From these results, we conclude that channel erosion is not the major contributor to the total sediment load but in-channel deposition in Gumara River is significant. The major source of sediment for Gumara River is the upper catchment and the contribution of the lower catchment is low compared with the upper catchment because of its gentle slope and plainness.

Keywords: River bank, sediment yield, aerial photo, Google map, Gumara.