

EGU2020-1109

<https://doi.org/10.5194/egusphere-egu2020-1109>

EGU General Assembly 2020

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Catchment land use and river morphological changes effect on flow and pollution load of Halda River: implication in integrated river management

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Halda River originated and ends inside Bangladesh, is a unique natural carp spawning habitat that underwent a massive channel modification, intensive land use and land cover changes across its basin both in the upstream and downstream area over the decades. The carp fish breeding habited is heavily disturbed that marked by a significant reduction in fish spawning in recent years. The fish habitat of this river is reported as critically endangered in many studies. However, these problems are not studied in a hydrological perspective apart from fish spawning characterization and water quality nexus. We have studied the flow regime of the catchment for different seasons and its effects on water quality, siltation, and erosion of this river at 12 cross-sections at the upper course and middle course. Water level and discharge data that are available from the regulatory authority, Bangladesh Water Development Board for the last 40 years at an upstream cross-section and rainfall data at 4 stations of the catchment were studied and integrated to understand nutrient load using QSWAT. The upstream-downstream linkage is heavily regulated followed by the construction of an earthen dam and rubber dam on its major tributaries at upstream for irrigation to the agricultural land that was revealed from this study and field visits. Moreover, basin land-use and land-cover change would have a significant contribution to sediment dynamics eventually causing siltation and erosion in downstream cross-section. The increase in agricultural land that altered forest vegetation would affect runoff characteristics and water quality. We have reported that the change in sediment load and siltation in its downstream and at different hydraulic structure points (here sluice gate, irrigation canals, and embankments) would be attributed to land-use change and flow regulation. This study reports the relationship to the hydraulic response viz. discharge, the water level of this river system to the catchment land use and siltation. Floods are more likely to occur in the downstream region compared to the upstream region in the same hydro-meteorological regime in this basin as it revealed from the river section changes over time.