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Impact of morpho- and vegetation-dynamics on flood, erosion and ecology in large lowland rivers

Kshitiz Gautam[1,2], Sanjay Giri[2], Biswa Bhattacharya[1], and Gennadii Donchyts[2]
[1]IHE Delft Institute for Water Education, IHE Delft Institute for Water Education, Department of Hydroinformatics and Socio-Technical Innovation, Netherlands
[2]Deltares, Delft, Netherlands

Himalayan rivers in Nepal flow through the mountains with high gradient to emerge in lowlands as large rivers carrying enormous amount of discharge and sediments. They release significant quantity of sediment forming alluvial fan as a result of sudden decrease in gradient when they enter the lowland and gain braided form. This braided form has made the river morphologically more dynamic in nature. Division of channels into numerous anabranches leads to formation of temporary or permanent islands in between them. These islands in long run are either eroded gradually by the river channel or develop into vegetated islands. The development of vegetation may be long term with growth of trees or they may develop into grasslands that may be seasonal which is usually inundated during floods. The river channels and islands along with the surrounding floodplain with vegetation act as perfect recipe for the development of complex wetland ecosystem.

Koshi River in Nepal is among such rivers emerging from the mountains to flat plains of Terai thereby flowing into multiple channels within a large width of about 5 km, which is then controlled by Koshi Barrage at 41 km from the gorge. This dynamic river system feeds the Koshi Tappu Wildlife Reserve, a Ramsar site in the reach. The change in river course and vegetation of this large area which otherwise would be challenging to study can be done rather easily by the use of satellite imageries and cloud computing. Google Earth Engine (GEE) has been used in this study for analysing the morphological changes of the river as well as vegetation changes within the study area using the multiple satellite images taken at different times. NDWI has been calculated and used to identify the occurrence of water in the river channels, thus the morphological changes. While NDVI is used for intensity of vegetation. The temporal and spatial analysis of the morphodynamics and corresponding changes in vegetation is performed from 1987 to 2020 within the selected area.

The preliminary assessment of the results shows that the vegetation dynamics of the area has been affected by the continuous erosion and deposition caused by the morphological changes apparently due to the barrage. Over time, river has been channelizing and branching several times causing the existing islands to erode along with their vegetation as well as forming new islands with vegetation cover. This shifting of the river and resulting vegetation dynamics appear to have

affected the habitat of the wild water buffaloes (Arna) as well as, other endangered species native to the area. Additional analysis on the effect of river morphology and vegetation dynamics to the flood pattern and other ecological components will be carried out to support the initial findings and draw generalized conclusions.