INTEGRATION OF REMOTE SENSING DATA WITH A FLOOD SIMULATION MODEL IN GIS FOR FLOOD HAZARD MAPPING AND FLOOD PREDICTION FOR EARLY WARNING IN BAGMATI RIVER, NEPAL

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ABSTRACT

Nepal, occupying the central part of the Hindu-Kush Himalayan belt covers an area of 147,181 square kilometer between India and China. About 6000 rivers and rivulets drain Nepal. Rugged topography, young geology and monsoon climate, all combine to produce high rate of runoff, erosion and sedimentation rendering the country highly vulnerable to water induced disasters and flood is one of the main recurring natural hazards. The Terai (plain area in the southern part) amounting to only 17% of the total area of the country is regarded as the grainary of Nepal and the problem of flooding in this region is of utmost concern.

The objective of this study is to integrate flood simulation model and remote sensing (RS) data with the available topographic and socio-economic data in a geographic information system (GIS) environment for flood hazard mapping of in the Bagmati River in Terai region of Nepal. Hydrologic model in combination with digital elevation model (DEM) is useful in delineating inundation area extent and flood depths in areas for which satellite images capturing peak floods are not available.

Flood hazard maps were prepared for a fifty-year flood considering inundation area, flood depth, land use type and population affected. An area of 360 km^2 of the 87 Village Development Committees (VDC) was estimated to be affected by flood with 183 km^2 having a flood depth of greater than 1.0 m. The total area of 87 VDCs is 808 km^2 and nearly about 45% of the total area was inundated by the flood. Dry season satellite images in combination with existing land use map can be used for updating land use in the flood affected areas. A flood hazard ranking system was designed by combining flood extend, flood depth, landuse types and population using the matrix multiplication method. Ranking was done from 1 to 18, designating hazard ranks from 1-6 as low, 7-12 as medium and 13-18 as high. It was found that 17, 19 and 51 VDCs fell under the rank of high, medium and low respectively. The right bank of the river between 10 km and 30 km was identified as the main spilling reach and recommended for structural countermeasures. Identification of such critical river sections would ensure a better use of limited resources. The hazard map was linked with flood level at an upstream river station by rating curve so that it could be used as an early warning tool for generating flood level vs. potential loss maps. It was suggested that all buildings within the inundated area be constructed having plinth level 0.50m above high flood level for a 50-year flood. The results obtained in this study would provide essential information for flood plain management aimed at containing flood damages in future.

***Key words**: Remote Sensing, GIS, modelling, flood hazard mapping and early warning.*