

Effects of Urban Development on Eco-hydrology of Rivers: A Case Study in the Kathmandu Valley Using GIS/RS

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Katmandu valley is facing the severe problems of uncontrolled urban growth both in terms of population and land area. Growth rate of population in the valley was 4.7% per year in the period 1981-2001. Using time sequential aerial photographs and recent satellite imagery, changes in landuse and pattern of urban growth has been analyzed in the GIS environment. The method is based on the geometrical rectification of the images using the EARDAS Imagine software and overlay of landuse and stream boundaries using a graphic software called Adobe Illustrator. Results indicate that urban dense area (open area less than 30%) increased by more than 3 times while moderately dense urban area (open area between 30 and 70 %) expanded by 4 times during the period of last 25 years. This resulted in the remarkable decrease in the agricultural land around the urban area. The urban development is taking place in a haphazard manner yielding adverse implications to the environment, especially eco-hydrology of holy rivers in the valley. Increase in peak flow and average flow in the main rivers, and gradual drawdown of groundwater storage have been noticed as a result of urbanization. Peak flows from the main river systems increased by 15% as a result of increase in urban landuse during the last one decade. Similarly, average daily monsoon flow in some tributaries is found to be increased by 12%. Between the period 1978 and 1984 a drawdown of 2m was detected in the groundwater of the valley. After that period, the drawdown continued as a result of increasing extraction which increased further by 5m by the mid 1990's. Depletion of groundwater storage is one of the big concerns today which can lead to acute water shortage in the valley.

Projection of the landuse change has indicated that if the present trend of the change continues, the whole valley floor will be filled up by urban settlements by 2024 leaving virtually no space for agricultural lands, which is the most important resource of the valley. This scenario draws the attention towards the urgent need to check rapid growth of urban area.

Sustainable urban development is only possible through systematic landuse planning. Immediate actions are necessary to check uncontrolled growth of haphazard settlement, and particularly to protect the river corridors from encroachment by squatters. In making the city systematic and hygienic, efforts of the government would not be sufficient, but equal participation of local bodies, media, and general public is a must. There must be strict supervision on the building construction as per the established engineering norms. Expansion of buildings into the undeveloped area must be checked. Public participation and awareness is extremely important for making Katmandu a beautiful and healthy city.

Keywords: landuse change; urbanization; population growth; GIS; Kathmandu