

## ABSTRACT

The cycling of water is binding land and atmosphere and it is the driving mechanism of existence of life on the Earth. Human interference with hydrological cycle is resulted in increasing water scarcity. Since 1970s, various approaches of water resource management and water scarcity indicators have been evolved to examine this water availability quandary. Although, sustainable ways to link water resource management with land-use planning has not explored explicitly. This research focuses on developing suitable methods and tools for integrating land and water planning towards alleviating water-crisis over an urbanizing landscape.

Hydro-meteorological, spatial and socio-economic components that affect stock and supply of water resource have been identified throughout this research. Considering functional inter-relationship of all the components and guided by the principles of water-balance of a region, Water Adequacy Index (WAI) and Per capita Water Adequacy (PWA) have been derived for quantifying the level of water-crisis. Hydrologic Sensitivity Index (HSI) has been developed to assess the impact of different pattern of land-use on hydrological processes. Efforts to keep score of HSI within 0.35 to 1.0 have been found to be sustainable for maintaining balance of hydrological cycle. The indices of WAI, PWA and HSI along with the proposed Water Sensitive Planning Estimator (WSPE) have been used as key assessment and control tools in water sensitive urban planning across different spatial scales of study area in Gangetic West Bengal.

Additionally, a deviation from standard quality approach has been developed for evaluating qualitative acceptability of accessible water resource for specific human usage across the selected micro-watersheds of middle-Kangsabati and Saraswati-Hugli sub-basins of Paschim Medinipur and Hugli district, respectively. This research concludes by proposing an integrated planning approach for managing land and water resource as a function of bi-directional interdependence across different spatial scales of hydrologic units.

Inclusion of qualitative factor in quantifying water adequacy and cost-benefit analysis in process of determining sustainable planning options will enhance utility and applicability of this integrated approach of sustainable land and water resource planning in future.

**Keywords:** Hydrological cycle, *Hydrologic sensitivity*, *Land-use planning*, *Urban Planning*, *Water-balance*, *Water resource management*, *Water scarcity*.