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Impact of land use change in and around lake and river basin catchments in semi arid region with developing economy

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Land use changes at catchment level and tail end regions of a fluvial systems bring in significant changes in the hydrological regime both in quality and quantity perceptions. Tammileru, an ephemeral river system, with around 1,587 km2 catchment supplemented by two smaller rivers viz Budameru and Ramileru debouch their fluvial discharges into Kolleru lake before they find their way into the Bay of Bengal through Upputeru. Kolleru lake, one of the largest natural freshwater systems in Asian region, extending to 960 km2, has shrunk in its size to less than 210 km2 resulting from drastic changes in land use in the last three to four decades. Urbanization all around these river basins and the lake supplemented by an exponential growth in intense agriculture and aquaculture activities in these fertile delta environments, have brought in unprecedented growth in economic and societal development. These developments have resulted in significant pollution of soil and water regime and the hydrological processes as a whole in the region.

During the last 3 decades the Kolleru lake and its surroundings have witnessed alarming levels of human induced environmental degradation with more than 85% of the area being converted into aquaculture ponds and multiple crop agriculture with enormous inputs of fertilizers and pesticides. The changes in land use pattern including agricultural practices like deep tilling, varied crop patterns, increase in individual land holdings in Tammileru basin alone have resulted in high sediment influx and eutrophication in the lake impinging on its essential hydrological characteristics like holding capacity and its functionality as a balancing reservoir as well as its ecosystems.

The huge fresh water resources of the lake being directed to use in aqua culture and agriculture have not only altered the quality, quantity and the dynamic behaviour of the water resources but also resulted in flash floods marooning huge urban and rural conglomerations for weeks together.

A multidisciplinary study including eco-hydrological and socio-economic aspects carried out in Tammileru catchment, the Kolleru lake and its neighbourhood indicated that the lake and its surrounding natural environments are still resilient and a strategic scientific approach with stakeholder's participation can restore the health of the lake near to its original serine condition. The model studies have demonstrated that the optimum hydrological behaviour of the lake can be retrieved if the lake boundary is maintained up to 1.7 m contour line with seamless morphology. Also the water quality of the lake can significantly be improved by the use of constructed wetlands in selected inlet locations with combination of classical treatment technologies and phyto-remediation. The studies reflect the scope for the use of a scientific approach to protect the natural environments within the framework of inevitable socio-economic developments mainly in developing nations with limited resources.