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Management approach of Keibul Lamjao National Park in Loktak Lake, Manipur using water balance analysis

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Keibul Lamjao National Park (KLNP) is situated in Loktak Lake which is a Ramsar designated and Montreaux record listed wetland. KLNP, the only floating national park in the world, is the only natural home of Manipur's brow-antlered deer popularly known as Sangai. Naturally, this natural park has ecological phenomenon of sinking during dry season and staying afloat during rainy season. The primary objective of this study is to formulate management approach for the conservation of KLNP by developing water balance models and correlating to the ecological processes of KLNP. Lake water balance models for two scenarios, Pre and Post Ithai barrage construction have been developed considering various parameters such as direct precipitation, runoff from the sub-basins, evaporation from the open water surface, evapotranspiration from Phumdis and domestic consumption. Hydropower generation, irrigation purposes and releases through the Ithai Barrage are also considered in Post Ithai barrage scenario. Run-off from each sub-basins have been simulated from hydrological-hydraulic models developed using Coupled MIKE SHE, MIKE 11 and SWAT. SWAT is used to model hilly terrain region of each hydrological-hydraulic models and runoff obtain from SWAT have been integrated as input data in MIKE SHE-MIKE11 models. Models have been calibrated and validated using observed runoff for hydrological-hydraulic models and observed lake water level for water balance models. The performance of each hydrological-hydrodynamic and water balance models have been assessed using Nash-Sutcliffe coefficient (E) and Coefficient of determination (R^2) and the overall efficiency is found to be greater than 0.80. The obtained results have been investigated for causal correlation with the deteriorating ecological condition of the national park to formulate management approach. Results demonstrate the requirement to consider ecology of KLNP while developing wetland water-level management plans.