WATER MANAGEMENT IN WALAWE BASIN USING SYSTEM DYNAMICS SIMULATION MODELING

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Walawe river basin, located in the south of Sri Lanka has a total drainage area of 2442 km^2 and receives an average annual rainfall of 1750 mm. The water resources system in the basin consists of two major reservoirs, namely, Samanalawewa reservoir and Udawalawe reservoir, and other components such as irrigation schemes and power plants. The top most Samanalawewa reservoir on the Walawe river supplies irrigation water to Kaltota irrigation scheme (880 ha) located just downstream of it, in addition to hydropower generation. The Udawalawe reservoir supplies irrigation water to downstream lands located on both banks of the river through right and left bank canals. This water passes through two small hydropower plants built at the Udawalawe dam. The total land area irrigated on the right bank is about 11400 ha while that on the left bank is about 6110 ha. Development of additional land for irrigation of about 5340 ha has been commenced on the left bank.

The paper presents a model developed based on System Dynamics (SD) principles for the decision making for effective water resources utilization in the Walawe river basin. SD is a rigorous method of system description, which facilitates feedback analysis, usually via a simulation model, of the effects of alternative system structure and control policies on system behavior. Understanding of the system and its boundaries, identifying the key variables, representation of the physical processes or variables through mathematical relationships, mapping the structure of the model and simulating the model for understanding its behavior are the major steps that are carried out in the development of a system dynamics model. SD applications for water management decision making are rarely found. However, the SD model that incorporates the complexities and interaction among different activities in the Walawe river basin proves the usefulness of our modeling approach in terms of strategic decisions on water sharing to help all water-use sectors of the basin.

The case of irrigation water supply with the new irrigation system development under the Udawalawe reservoir is compared to the present condition, and considerable water deficit is observed. However, additional water management scenarios, with possible crop diversification may be analyzed to draw better water management plans. Moreover, the model can be used to develop better operational rule curves for the reservoirs based on a large number of simulations.