LINEAR PROGRAMMING MODEL FOR WATER RESERVOIR MANAGEMENT

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Water reservoir management is one of the important topics in operations research due to its practical necessity. This study presents a linear programming model for a water release plan in water reservoir management, mainly to satisfy the irrigation water needs. A linear programming model is built to determine which proportions of the lands should be used for the cultivation of crops according to the available water. The proportions of crop cultivations are also addressed in the proposed model for crops with varying water consumption. While maximising the proportions of lands to be cultivated, the constraints, storage continuity, maximum and minimum capacities of the storages, linking constraints, water demand constraints, and lower bounds for crop cultivation proportions are considered in the model. A case study of the Udawalawe irrigation scheme is considered to demonstrate the applicability of the proposed model. Udawalawe reservoir is mainly used for irrigation purposes. There are two main canals of Udawalawe reservoir, and in this study, we focus on the left bank irrigation scheme and assume that the water release for the left and right banks are equal. Evaporation losses and spillage are not considered. The left bank canal feeds about 10,065 hectares of paddy and other crops, mainly sugarcane and banana. For the case study, 64 tanks, including reservoirs, 75 regions (lands) for crop cultivations are considered. A linear programming model with 2,805 variables, 600 inequality constraints, and 1,063 equality constraints was obtained and solved using MATLAB®. By solving the proposed model, the optimum proportions of lands to be used for cultivation and the proportion of paddy and other crop cultivation were obtained. With the proposed model, decision-makers in the related field are benefitted from providing a cultivation plan according to the availability of water.

Keywords: Crop water allocation, Linear programming, Water reservoirs