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OPTIMIZING IRRIGATION THROUGH CONJUNCTIVE WATER MANAGEMENT IN THE CHALAKUDY RIVER BASIN

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Abstract

Effective irrigation water management is essential in humid tropical regions like Kerala, India, where surplus rainfall in the monsoon months' contrasts with acute water shortages in the summer. The present study developed a linear programming-based optimization model for the Chalakudy River Diversion Scheme (CRDS) command area located in the central part of Kerala, India, to establish a stable conjunctive water use policy combining surface and groundwater sources. The study analyzed the major components of a conjunctive water management system, surface water, irrigated areas, and groundwater, separately and inter linked through the optimization model using different software tools. ERDAS Imagine and CROPWAT 8.0 software were used to prepare the land use map of the area and compute its irrigation requirement, respectively. Covering 80% of its cultivated land with irrigation-requiring crops, the area needs 46.90 Mm³ of irrigation water annually. Field measurements revealed low canal conveyance efficiency (51%) and high seepage losses due to factors such as aging infrastructure and waste blockages, making surface water alone insufficient. Groundwater potential was assessed using Visual MODFLOW, confirming its viability for conjunctive use. An optimization model, aiming to maximize relative crop yield, was developed and solved using LINGO 18.0. Simulation runs of the model for a normal rainfall year identified an optimal surface-to-groundwater use ratio of 76:24, ensuring adequate irrigation while maintaining sustainable groundwater levels.

Key words: canal irrigation, conjunctive use**,** CROPWAT 8.0, optimization model, visual MODFLOW software

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