

ABSTRACT

The Vembanad Kole Wetland in Kerala, particularly the northern *kole* lands, holds ecological importance and is crucial for paddy cultivation due to its fertile, nutrient-rich soil. However, managing seasonal flooding and water resources presents significant challenges. This study, conducted in Thrissur's North *kole* lands, used hydrological modelling and spatial analysis to address these issues. By digitizing 132 padavus in ArcGIS, a spatial map of the *kole* lands was created, allowing estimation of accumulated runoff volumes based on water levels, spatial maps and DEM data. The Enamakkal and Idiyanchira regulators, which manage outflows from the *kole* lands, were incorporated into simulation and optimization models due to a lack of operational policies. *Kole* lands were classified into three zones based on elevation and a zone-wise dewatering schedule and crop calendar were prepared. New cropping patterns were proposed for crop calendar and corresponding two optimization models were developed for the regulators to minimize water deficit for cultivation. The study estimated a maximum runoff accumulation volume of 122.67 Mm³, with canal storage capacities between 29.0 and 53.86 Mm³ in 2022. Zone classification covered 35.65% (Zone -I), 36.13% (Zone- II), and 28.25% (Zone- III) of the total area. Field surveys in 2022 revealed that 197 petti and para, 50 vertical submersible pumps, and 16 vertical propeller pumps in present in Thrissur north *kole*. Based on the available pump capacities and accumulated runoff volume, a zone-wise dewatering schedule was developed for the *kole lands*, with the required dewatering time ranging from 0 to 20 days. Crop Calendar 1 (August-April) with a water demand of 135.67 Mm³, and Crop Calendar 2 (September-April) requiring 175.28 Mm³ were estimated using CROPWAT. The optimization models reduced water deficits by 9.84 Mm³ for Crop Calendar 1 and 33.27 Mm³ for Crop Calendar 2. Additionally, it increased canal storage, thereby enhancing water utilization and supporting sustainable double cropping practices. The study provides valuable insights for flood control, efficient dewatering, and sustainable crop management in the *kole* lands.