CHAPTER I

INTRODUCTION

Wetland forms an important ecosystem essential for existence of life on earth. Wetlands are integral part of river basins or extension of sea and are considered as one of the most productive ecosystems of earth constituting about six percent of earth's surface (Menon *et al*., 2023). According to Ramsar convention, wetlands are areas of marsh, fen, peat land or water bodies, whether natural or artificial, permanent or temporary, static or flowing, fresh, brackish or salt including areas of marine water, the depth of which at low tide does not exceed six metres. The characteristics of wetlands are soils that remain water logged or are submerged under water for whole or part of the year and the wetland biota depend upon and are adapted to this water logging or submergence during at least a part of their life cycle.

The imposing presence of Western Ghats as the eastern boundary of the state of Kerala with its western slopes merging with the midland plains and the zigzag boundary of the western sea coast all provide an ideal topographic feature for the development of a myriad forms of wetlands in this small strip of land at the southern tip of Indian peninsula. The 44 rivers that originate from the Western Ghats create and maintain all major wetlands of Kerala. Among the various states of the country, Kerala stands first in India, in having the largest area under wetlands (Nayar and Nayar, 1997).

Kerala has a total of 217 wetland units of which there are only 157 units that are having an area greater than 56.25 ha. (Nair and Sankar, 2002). The majority of the wetlands of Kerala are brackish, however, there are also a few fresh water wetlands also seen here. Ten new Ramsar sites (Wetlands of International Importance) were announced in August 2022. Altogether about sixty-four wetlands are declared as Ramsar sites in India (Ministry of Environment & Forests, Government of India, 2022**).** Three wetlands of Kerala, included in the Ramsar site are Vembanad–Kole, Ashtamudi and Sathankotta.

The Vembanad Kole Wetlands, located in Kerala, is considered internationally important as a rare or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region (Mitsch and Gosselink, 2000). Additional criteria for their significance include their role in supporting species, ecological communities, and populations of waterbirds and fish species. The *kole* wetlands, situated on the northern side of the Vembanad Kole Wetlands, are a floodplain ecosystem spanning the districts of Thrissur and Malappuram. These lands are submerged by floodwaters during the monsoon, with water levels managed through a complex network of canals, sluices, and regulators. This seasonal submersion makes the region a highly fertile zone for paddy cultivation, supporting the livelihoods of thousands of farmers. Effective water management is crucial for the *kole* lands, particularly in the context of climate change. Irrigation management, flood control, and dewatering practices are essential to ensure these lands remain cultivable and productive, highlighting the need for precise and efficient strategies.

In the northern *kole* lands of Thrissur, the monsoon season brings heavy rainfall, leading to significant runoff and water accumulation in both agricultural fields and canal systems. This accumulation serves as both a resource and a potential hazard; while it supports paddy cultivation, excessive water accumulation can lead to flooding. Accurate estimation of runoff is therefore crucial, as it directly influences water storage capacity in the *kole* lands and canal networks. Additionally, understanding the runoff accumulation in *kole* lands is crucial for planning dewatering schedules, a practice that allows farmers to drain water from their fields to cultivate paddy. The integration of remote sensing data, Geographic Information System (GIS) tools and hydrological models play a vital role in quantifying the volume of accumulated runoff.

The *kole* lands are designed for effective water storage and drainage, utilizing regulators such as the Enamakkal and Idiyanchira regulators to control the water flow. These regulators play a critical role in managing water levels by directing canal water into the fields also preventing saltwater intrusion. Since these are the primary exit points for water in Thrissur north *kole* lands, effective operation of the regulators is crucial for flood control. However, the lack of formal operational policies for these

regulators complicates the process, making simulation modelling an invaluable tool. By simulating various discharge scenarios, water managers can predict how different levels of discharge patterns affect canal water levels, aiding in the development of efficient strategies for flood mitigation and controlled water release plans. This involves the use of hydrological simulation model for the flood events and to assess the impact of different water release patterns for the agricultural productivity.

Double cropping, a common agricultural practice in the *kole* lands, requires careful water management throughout the year. The monsoon provides ample water for the first crop, but the second crop often faces water scarcity. An optimization model for water release scheduling at the Enamakkal regulator can greatly enhance this process. By accounting for water availability, canal storage, crop water requirements and historical rainfall patterns, the model optimizes the timing and amount of water released to ensure that crops receive sufficient water when needed. This strategic management enhances agricultural productivity and minimizes crop loss due to water stress.

The cultivation of paddy in *kole* lands is done by draining water from *kole* lands into canals by various types and capacities axial flow pumps. The timing and frequency of dewatering are very vital because they directly affect the double cropping as well as the canal storage. A well-designed dewatering schedule ensures that water drained from one zone can be used for irrigation of other zones without damaging the crops. The schedule can be developed based on the estimated water accumulation from the runoff estimation models and the discharge from the axial flow pumps.

In addition to dewatering, a crop calendar complements these strategies by guiding farmers on the best times for planting and harvesting based on anticipated water availability and the dewatering schedule. This calendar aligns agricultural activities with water availability, helping farmers make informed decisions thereby ensuring that sustainable use of water resources in the *kole* lands.

Hence, accurate estimation of runoff accumulation, simulation of regulator discharge, optimization of water release and dewatering schedules are essential for

effective water management for sustainable rice cultivation in the Thrissur North *kole* lands. Considering these aspects, this study has been taken up with the following specific objectives

1. Estimation of runoff accumulation and canal storage in *kole* lands during the monsoon seasons
2. Simulation of regulator discharge for flood water control
3. Optimization of water release at Enamakkal and Idiyanchira regulators to enhance double cropping in North *kole* lands
4. Preparation of dewatering schedule and crop calendar for better water management of *kole* lands