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## Planning for the Management of Indian Wetland Regions

As per the Millennium Ecosystem Assessment Board (2005), the global extent of wetlands is estimated to exceed 1.2 million square kilometres. Since 1900, the world has lost around 50% of its wetlands (Ramsar Convention Secretariat, 2013). The available estimates on the areal extent of wetlands in India vary widely from 1% to 5% of the geographical area but do support nearly one-fifth of the country's known biodiversity (Space Applications Centre, 2013). India has lost more than 38% of its wetlands in the last decade. In some districts, the loss rate has been as high as 88% (Vijayan, 2004). Wetlands serve a wide variety of roles including flood control, regulation of water quality, reducing sediment load, treating wastewater, recharge and discharge of ground water, and help in agriculture, pollution abatement, and the conservation of aquatic biodiversity. Their role is critical in a country like India with diverse climatic zones and a burgeoning population with its own challenges.



S. Kumar photograph

Kerala is one of India's fastest urbanizing states. Within the last 20 years (as per 2001 and 2011 government population censuses) it achieved a 83% urbanization rate, which is expected to increase with the changes in employment patterns and income sources. These changes need to be shaped within an effective sustainable plan for future development. In the absence of control measures, they prove critical in the destruction of natural resources and abandonment of rural patterns of livelihood. The study site, Kuttanad Wetland region, is located at the heart of Kerala and is one of the state's densest rural locations. The region is ecologically sensitive and known for its unique below sea-level farming practices that have continued for over 150 years.

Presently, Kerala is facing a shortage in its total agricultural production. The share of rice production from Kuttanad region is around 30% of the state's total production. However, the extensive use of pesticides and insecticides has led to severe ecological damage that could result in health issues and a reduction in productivity. Fisheries and duck rearing are also integral to this area, and should be encouraged and integrated along with existing agriculture and allied activities. The site also has the potential for industrial growth to provide alternative earning opportunities for skilled locals. Tourism occupies a 12% share of the state's GDP—Kuttanad, known as India's 'Venice of the East,' holds the largest share. Tourism-related activities are often isolated from or in conflict with other processes.

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My research focuses on the effective management of Indian wetland regions through the adoption of an integrated planning framework. Relying on data from primary surveys, group discussions, personal interviews and published literature, some of the key issues identified in the Kuttanad Wetland region include lack of clean drinking water, salinity, rise in vector-borne diseases, increase in cancer cases in many locations, and improper waste management, among other issues. Considering the needs of the various user groups (farmers, fishermen, hospitality sector) residing on the site, the study aims to realize their contribution towards economic development and model various possibilities that would ensure sustainable development. Social discussions and the management of various user groups here are necessary for the development of a community-friendly plan. Thus, my present research conceptualizes the wetland region as a single system with its various interconnected subsystems.

The key objectives of my research include: analyzing the available planning guidelines, models and techniques associated with the sustainable development of wetland regions; assessing the existing condition of the study area (system); identifying the control parameters that decide the system's functions; forecasting the demand and supply of infrastructure in the system; and evolving a plausible integrated and sustainable system development plan.

My research employs participatory planning strategies to reach a common consensus for the development of an integrated plan. The study is further supplemented through the case discussion of Ontario's Lake Simcoe and the process of framing of the Lake Simcoe Protection Act (2008) and the Lake Simcoe Protection Plan, which was done through a series of participatory strategies involving the needs of the various user groups residing in its watershed.

My research paves the way for the preparation of a wetland planning and management framework that can work as the schedule for the protection and management of wetland regions in India. The method of analysis relies on system dynamics technique, which can be modelled on the local requirements. This research into the wetland system presents a clear portrayal of the various interrelated subsystems that affect the system's growth. Secondly, the model is adaptable for both national and international conditions with replacements of criteria related to contextual necessities. It is also a critical study for the rehabilitation and resettlement strategies in the post-flood scenario in Kerala.

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