

## **HUMAN IMPACT ON KUTTANAD WETLAND ECOSYSTEM - AN OVERVIEW**

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**Abstract:** Kuttanad is one among the unique wetland ecosystem in the country where human impact is severe which alter the structure, function, composition and services of the ecosystem. This study focusing on the threats to the ecosystem, especially due to anthropogenic activities, its causes and possible solutions. The study also analyses the history of human activities and its impact on this ecosystem and immediate steps to undertake to restore this human impacted landscape. The review clearly indicates that the man-made activities altered the ecosystem drastically and it is high time to act on it otherwise the unique ecosystem may loss its entire beauty and ecological significance and an immediate mass level eco-restoration programme is suggested. Proper implementation and monitoring of Kuttanad Package may do it for time-being. Since this package is a time bound one, a permanent long-term programme has to be developed and implemented to conserve this ecosystem.

**Keywords:** Kuttanad wetland ecosystem, Human impact, Kuttanad Package, Vembanad lake.

### **INTRODUCTION**

Kuttanad wetland is located at the southern portion of India's largest Ramsar site the Vembanad-Kole wetland. Primarily it is a deltaic formation of five river systems: Meenachil, Pamba, Manimala, Muvattupuzha and Achencovil, located in the fertile low-lying areas of Vembanad Lake. The Kuttanad wetland spread over the districts of Alappuzha, Kottayam and Pathanamthitta and forming a part of the Vembanad wetland system. The boundary of Kuttanad region is loosely defined and the extent of its area has been variously computed at different times, today it encompasses 79 revenue villages, 10 Taluks and 3 Districts (Dwivedi, 2011). Cherthala, Ambalapuzha, Chengannur, Kuttanad, Karthikappally and Mavelikara Taluks in Alappuzha Districts, Thiruvalla taluk in Pathanamthitta District and Changanassery, Vaikom and Kottayam taluks in Kottayam districts covering an area of 870 Sq. km (Hazard Center and People's Science Institute, 2006). The region encompasses vast stretches of backwaters, bordering mangrove formations, and rice fields, the latter mostly reclaimed from the shallow stretches of the lake during the recent past. The garden lands, or

the reclaimed *purayidams* or homesteads with coconut groves, fringed by canals and channels make this a land of richness and beauty (Thambatti and Padmakumar, 1999). Kuttanad, the deltaic formation of four major river systems confluencing into the Vembanad Lake lies 0.6 to 2.2 m below MSL. The region extends from 9°17' to 9°40' N latitude and 76°19' to 76°33' E longitude. It experiences warm climate with fairly uniform temperature throughout the year ranging from 21–36°C. Humidity in general is very high all through the year (Shari and Chitra, 2005). The average annual rainfall in Kuttanad is about 3,000 mm. Although distributed throughout the year, 60% rain is received during southwest monsoon (May-August) and 30% during northeast monsoon (October-November). During the months of June to November, the inflow into Kuttanad exceeds the inflow into the Vembanad Lake. During the months of December to almost mid-May, which coincide with summer, the reverse happens. There is a net decrease in the total inflow of the rivers into Kuttanad. This brings down the water level in the Vembanad Lake, which creates a reverse flow from the sea to the inland water body bringing the salinity all over the Lake and low lying downstream parts of rivers (Koonan, 2007). Based on the soils, geomorphology and salinity intrusion, Kuttanad is subdivided into six agro-ecological zones (Fig.1) viz., (i) Upper Kuttanad (ii) Kayal lands (iii) Vaikom Kari (iv) Lower Kuttanad (v) North Kuttanad and (vi) Purakkad Kari (Indo-Dutch Mission, 1989). Now this natural ecosystem is under severe human intervention of development and this paper analyses the human impact on Kuttanad wetland ecosystem its causes and solutions to conserve this natural landscape of great ecological significance.

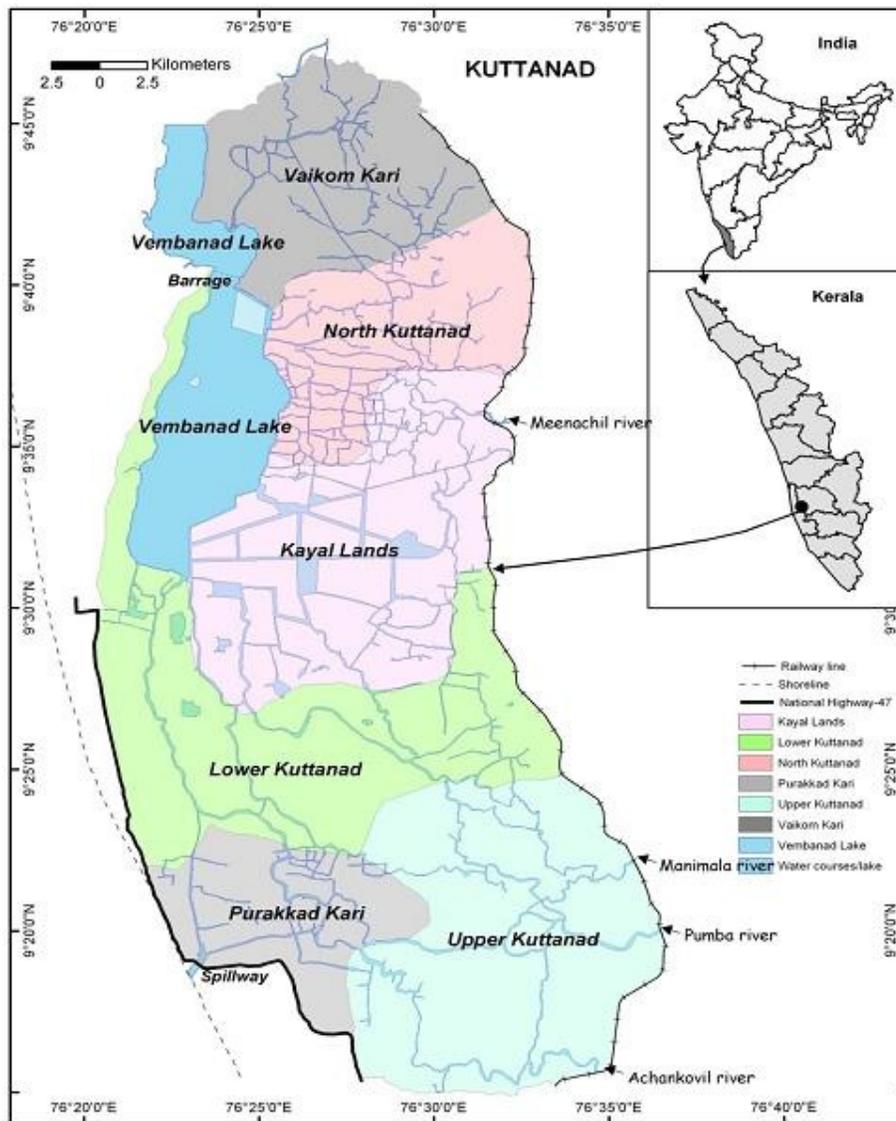


Figure 1. Six divisions of kuttanad wetlands ((Narayanan *et al.*, 2011)

### IMPORTANCE OF KUTTANAD WETLAND SYSTEM

. The KWS comprising of 32 Panchayats of Alappuzha district, 27 Panchayats of Kottayam district and 5 Panchayats of Pathanamthitta district is a predominantly agriculture belt of Kerala where people are dependent on farming & allied sectors like fishing, animal husbandry etc for their livelihood. Kuttanad in local language means ‘low lying lands’ is one of the most fertile regions of the world where rice is cultivated below sea level and this will be of great importance in view of the projected sea level rise caused by global warming. The soil is silty clay which is highly impervious facilitating paddy cultivation but is extremely acidic in reaction due to microbial oxidation of organic matter resulting in iron / aluminum

toxicity. The Kuttanad Wetland System (KWS) inclusive of the Vembanad lake is now receiving global attention since it is a unique wetland which permits one good crop of rice and one harvest of fish and an area of thriving water tourism where nature is at the peak of its beauty in this Ramsar site. In addition, Kuttanad is a biodiversity paradise. This unique ecosystem provides various ecosystem services such as biodiversity, agricultural production, fish production, aesthetic value, tourism etc.

A study from a selected panchayath in kuttanad area itself recorded 130 plant species with the tree element being below 10%. A total of 67 species of phytoplanktons and 7 species of zooplanktons, and similarly a total of 3157 phytoplankton units/litre and 256 zooplanktons unit/litre also been recorded (Alexander *et al.*, 2010).

Sudhikumar and Sebastian (2005) reported 94 species of spiders from agroecosystem of Kuttanad region. A recent long-term study on Avifauna identified 225 taxa of birds belonging to 15 orders and 59 families. Among the birds recorded, 38% were migrants. Fifty-five species were found to breed in the area (Narayanan *et al.*, 2011). European Roller *Coracias garrulus* recorded during this study is the first report of this species from Kerala. Among the bird species reported, ten are globally threatened. We have no comprehensive scientific quantitative information on ecosystem services of kuttanad wetlands, degradation of the ecosystem and the effect of degradation such as biodiversity loss.

The Kuttanad region has been under intense and increasing anthropogenic pressure over the years, which has adversely affected its ecology as well as the livelihood of the people. This has resulted in loss of flora and aquatic fauna, particularly the fish species and population, eutrophication of water bodies promoted by nitrate and phosphate leaching from farm fields, high level of pollution with organic, inorganic and toxic material locally generated and brought in by the rivers, aggressive spread of water hyacinth, poor drainage due to choked water ways, increasing intensity of flooding, shortage of potable water and proliferation of water borne parasites and predators affecting human health.

Kuttanad region and its community were facing severe agrarian distress for the last 5 decades owing to a variety of factors. Based on the request of the Govt. of Kerala to address the perennial problems faced in Kuttanad, the Union Govt. entrusted the Dr. M.S. Swaminathan Research Foundation, Chennai to conduct a scientific study of the region and suggest suitable measures to mitigate agrarian distress in Kuttanad. The MSSRF recommended a variety of interventions to be implemented as a Package with a total cost outlay of Rs. 1,840 crore which was accepted by the Govt. of India for funding under ongoing Central Sector Schemes.

Detailed Project Reports (DPRs) prepared by the State Govt. for different activities envisaged in the Package are under different stages of implementation

## **HUMAN IMPACT ON THE ECOSYSTEM**

History shows continuous and increasing human interaction in this unique ecosystem through various activities and one among them is Kuttanad Development Scheme

### **Kuttanad Development Scheme and its impact**

In the Kuttanad region the major resource for livelihood is the Vembanad lake be it in the form of reclaimed lands for paddy cultivation, fishing, tourism, etc. However, several human interventions combined with poor management has led to manifold conflicts in the region. Kuttanad Development Scheme was sanctioned by the State Government to solve the basic issues of this wetland system and KDS mainly consists three parts.

#### **1. THOTTAPPALLY SPILWAY**

The first step for development of Kuttanad was the construction of Thottappally spillway and the construction was started in 1951. The search for a permanent solution to the problem of floods and crop loss in Kuttanad has led to the construction of a spillway at Thottappally for the speedy drainage of flood water to the Arabian Sea. The spillway aimed to flush away extra floodwater from the Pampa, Manimala and Achenkoil rivers into the sea before it could flood Kuttanad. However, due to poor implementation, management and poor maintenance, salt water intrusion through the spillway has become a permanent concern for the farmers of the region. The construction of the spillway has not made any noticeable improvement in the control of flood.

#### **2. THANNEER MUKKAM BUND (A salt-water barrier)**

The second was the construction of regulator at Thaneermukkam to prevent salt water intrusion from the sea during 1955. The original plan was to construct the regulator at Thaneermukkam where the Vembanad lake is at its narrowest width. There was great pressure from the farmers side for stopping the salt water intrusion into the paddy lands during the lean season and high tides. It is again due to poor planning, management and implementation, the iron shutters on eastern and western portions were completed, but the middle portion remained incomplete. The structure keeps the water free of salinity and adding another crop in dry season. Before the construction of the Thanneermukkom regulator, the entire backwater area used to become saline or brackish during the pre-monsoon period. Thanneermukkam barrier has been successful in preventing the salinity intrusion during

summer, but the incomplete construction of the barrage with an almost one-third earthed up middle portion further slowed the flood water recedence during the monsoons which brought severe changes in the ecosystem.

In 1975, the farmers of Kuttanad started an agitation demanding the completion of the bund. Thousands of farmers worked for a couple of weeks free of cost and completed a permanent earthen bund in the middle of the lake joining eastern and western portions. The fisher folk of the area had always been opposed to the bund since they wanted salt water and fishes to enter for breeding and for better catch. They have been in direct regular conflicts with the farmers on the issue of regulating the operations of the iron shutters of the bund. The generally agreed period for the closing and opening of the bund is 15<sup>th</sup> December and 15<sup>th</sup> of March. However at times the bund is closed for longer periods due to pressure from the farmers lobby. On the other side the fishermen have been protesting and demonstrating against this and also demanding that the bund be kept open throughout the whole year. Even some farmer groups also now supporting this demand due to the negative impact of the bund on the agriculture and the larger wetlands system. The protagonists argued that, from 1976 onwards it has been protecting 20,000 ha of rice crop in kayal lands and North Kuttanad. The environmentalists opined that the developmental activities for the past five decades of which the major one is the closure of the regulator, have resulted in severe deterioration and transformation of this wetland ecosystem. When the regulator is closed, there is virtually no flow of water beyond it on the southern side making the entire Kuttanad a static pool. The periodic tidal inflow which used to flush the water body is completely prevented with the result that the drained water from the rice fields with heavy load of pesticides and fertiliser residues remains stagnant in the waterbody. Added to these pollutants, the human, animal and agricultural wastes, and industrial effluents that are emptied into the Kuttanad wetland system turned this rice bowl into a waste bowl.

### **3. ALAPPUZHA CHANGANASSERY ROAD**

The third part was the construction of 24 km long Alappuzha to Changanassery road in 1957. This road passes through the middle of Kuttanad. Later on, several roads and bunds were constructed across the low-lying floodplains. This has lead to blockages in the water flow and subsequently flooding in the region. Over a period of time several other factors have also lead to increasing conflicts like tourism promotion, modern agricultural practices, fresh water needs of the local population and dumping of municipal waste into Vembanad and the rivers flowing into it. These interventions also had a poor impact on the overall ecology of

the region, the agriculture productivity, fishing, fresh water requirements, public health and hygiene, etc.

### **History of human intervention in kuttanad wetland ecosystem**

In the geological past, the Kuttanad region was a part of the shallow coastal area of the Arabian Sea. As a result of a geological uplift, a shallow bay was formed into which several rivers discharged. The silt deposited at river mouths gave rise to the present delta and the shallow bay formed into a lake-lagoon backwater system opening on to the Arabian Sea through the Kochi barmouth. According to another theory, the entire sea was a dense forest, the legendary *Khandava vana* which caught fire and got engulfed by the sea during the succeeding geological ages. Years later, the sea receded, exposing the land which forms a part of the midland and coastal region of Kerala. This land was known as “*Chuttanadu*” meaning burned land and hence the name Kuttanad. The entire area has a semblance of dense forest, rich in organic residues and burnt wooden logs locally called as *kari*. With reference to elevation, geological formation and soil characteristics, Kuttanad deltaic formation is locally classified as karappadam, kayal and kari lands

1. 1880s Late 19<sup>th</sup> century, first phase of land reclamation in Kuttanad region.
2. 1888-1903 Second phase of land reclamation in Kuttanad.
3. 1912-1943 Third phase of land reclamation, nearly 5000 ha were reclaimed during this phase and the most renowned were 'Rani', 'Chithira', and 'Marthandam' blocks.
4. 1940 Rice Research Station at Moncompu was started to develop ideal varieties to assist farmers.
5. 1942 An agricultural workers union was formed in Kuttanad with the initiative of the Communist Party. The labour unionism helped to improve the service conditions of the organized labour of Kuttanad.
6. 1951 Thottapally Spillway construction started to drain flood water from the Kuttanad wetlands to Arabian Sea.
7. 1955 Construction of the Thaneermukkam regulator across the Vembanad lake was started to check the intrusion of saline water.
8. 1957 Construction of 24 km long link road between Alappuzha and Changanassery was completed in 1957 for easy communication and transport.
9. 1960s The whole area was converted to high yielding dwarf varieties.
10. 1965 Thottappally spillway commissioned

11. 1970 One of the major landmark in the history of kuttanad was the Lands Reforms Act implemented by Government of Kerala. Until that paddy cultivation in Kuttanad was done under a 3 tier system as Land Lord-Tenant-Labour. This system replaced with the enforcement of the Act and many of the tenants became owners of the land.
12. 1972 Government of Kerala launched the 1st Kuttanad Development Project to improve infrastructure for paddy cultivation in this region. The Kerala Land Development Corporation Ltd. was formed to implement it.
13. 1975 Thanneermukam regulator commissioned
14. 1978 The rice variety "Bhadra" was introduced as an alternate to the existing varieties used at that time
15. 1989 Govt. of Kerala entrusted Netherlands Govt. to study the Kuttanad wetland system and to recommend suitable measures for efficient water management considering the expertise of Netherlands in this field. The Netherlands Agricultural Identification Mission submitted its four volume report titled 'Kuttanad Water Balance Study'.
16. 1991 'Group Farming' introduced, result in a pace to paddy cultivation in Kuttanad region.
17. 1991 Outbreak of epizootic ulcerative syndrome which exhausted the fisheries in Vembanad to a large extent.
18. 1996-97 The outbreak of Japanese Encephalitis in Kerala had its origins in Kuttanad. At least 25 people died because of the disease in Kuttanad alone.
19. 2007 Govt. of India entrusted M.S. Swaminathan Research Foundation, Chennai to study the problems faced in Kuttanad and suggest remedial measures. MSSRF submitted its study report to Govt. of India identifying 15 tasks covering about 50 different activities to mitigate agrarian distress in Kuttanad Wetland System.
20. 2008 Govt. of India approved the study report and the interventions recommended by MSSRF as a package.
21. 2008 Govt. of Kerala initiated the implementation of package with the formation of the Task Implementation Committee.
22. 2010 Kuttanad Package, a set of interventions recommended by the M.S.Swaminathan Research Foundation to mitigate agrarian distress in Alappuzha & Kuttanad Wetland System was formally launched by Chief Minister of Kerala

**Major threat and issues to the wetland ecosystem of Kuttanad region as a result of continuous human interaction**

- a. Biodiversity loss
- b. Decrease in Agricultural production
- c. Depletion of aesthetic value
- d. Discharge of sewage
- e. Encroachment
- f. Flood and draught
- g. Habitat degradation due to developmental activities- such as buildings, roads, railways, bunds, township and other infrastructural developments.
- h. Mining
- i. Obstruction to navigation
- j. Over exploitation of resource
- k. Pollution
- l. Reclamation
- m. Scarcity of pure water
- n. Waterborne diseases
- o. Weed management

It is evident that the human influence made a drastic change in the ecosystem. A comprehensive management and conservation programme has to be developed and implemented by considering following suggestions.

1. Fragile areas to be protected legally
2. Social awareness on the importance of this unique ecosystem and its conservation through direct interaction, community/organization level, government level, local agencies and through medias
3. A professional co-ordination of officials, government organizations, supporting agencies, NGOs, community based organizations and public to address the issue and conserve this unique ecosystem
4. Highly focused long-term scientific research and generation of quantitative information on different aspects of the ecosystem including biodiversity, ecological, socio-economical etc.
5. Long-term funding for scientific research and conservation programmes
6. Promotion of eco-friendly tourism

7. Proper implementation or re-constitution of existing laws based on current scenario
8. Social awareness at local level and enhance the role of local people in the conservation efforts
9. Development and implementation of large-scale eco-restoration programmes

**The main components of the Kuttanad Package include**

- i. Construction of outer bunds around 'padasekharams'
- ii. Renovation of the Kuttanad Wetland System.
- iii. Modernisation of the Thanneermukkam Barrage (TMB) & Thottapally Spillway (TSW)
- iv. Regulation of floodwater near CD & Rani-Chitra Blocks.
- v. Construction of Orumuttus across Kariyar
- vi. Conducting a Research on TMB operation and kayal ecology
- vii. Supply of farm machinery to farmers
- viii. Certified seed production for Kuttanad & Onattukara
- ix. 1<sup>st</sup> Paddy cultivaton & promoting sesamum cultivation for Onattukara
- x. Coconut rejuvenation in Kuttanad
- xi. Establishment of agri-clinics in Kuttanad
- xii. Strengthening research & training
- xiii. Integrated livestock and crop production in garden land
- xiv. Paddy fish integration
- xv. Cluster based cage culture& establishment of fish hatcheries
- xvi. Ranching, revival for productivity of pearl spot
- xvii. Systematic program for elimination of water hyacinth
- xviii. Promote mangrove restoration along the banks of Vembanad kayal and Kayamkulam
- xix. Promote farm tourism
- xx. Install roof top rainwater harvesting & use of domestic toilet linked to ferro cement septic tanks either individually or in clusters.

Let us hope, for time-being, the Kuttanad Package will find a solution for the various problems facing by KWS. The Kuttanad Package after implementation supposed to help to preserve the unique Kuttanad ecosystem, increase the rice production and productivity and improve the standard of living of the farmers of the region by way of reduced cost of cultivation and improved income. In addition, this may help for the sustainable development of the region by protecting the ecosystem in the best possible way. At the same time, it is

noteworthy that Kuttanad Package is a time-bound one and a permanent monitoring, management and conservation system is to be developed and implemented to protect this ecosystem on a long-term basis.

### **Conclusion**

Kuttanad is changing at a faster pace mainly because of anthropogenic activities, it is high time to act on it otherwise the unique ecosystem may lose its entire beauty and ecological significance. A large number of voluntary organizations, government agencies, individuals and communities are involved in their whole effort to conserve Kuttanad, which has to be coordinated. A massive eco-restoration programme and conservation and management strategy involving all sectors of society is recommended to conserve this important ecosystem. For the time-being, implementation of Kuttanad package could be an efficient tool to find solution for majority of the problems already identified. This package may further protect the ecosystem from various human interactions and disturbances. Since Kuttanad Package is a time-bound one, a comprehensive management and conservation strategy on a permanent basis is essential to restore and protect this human impacted landscape.

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