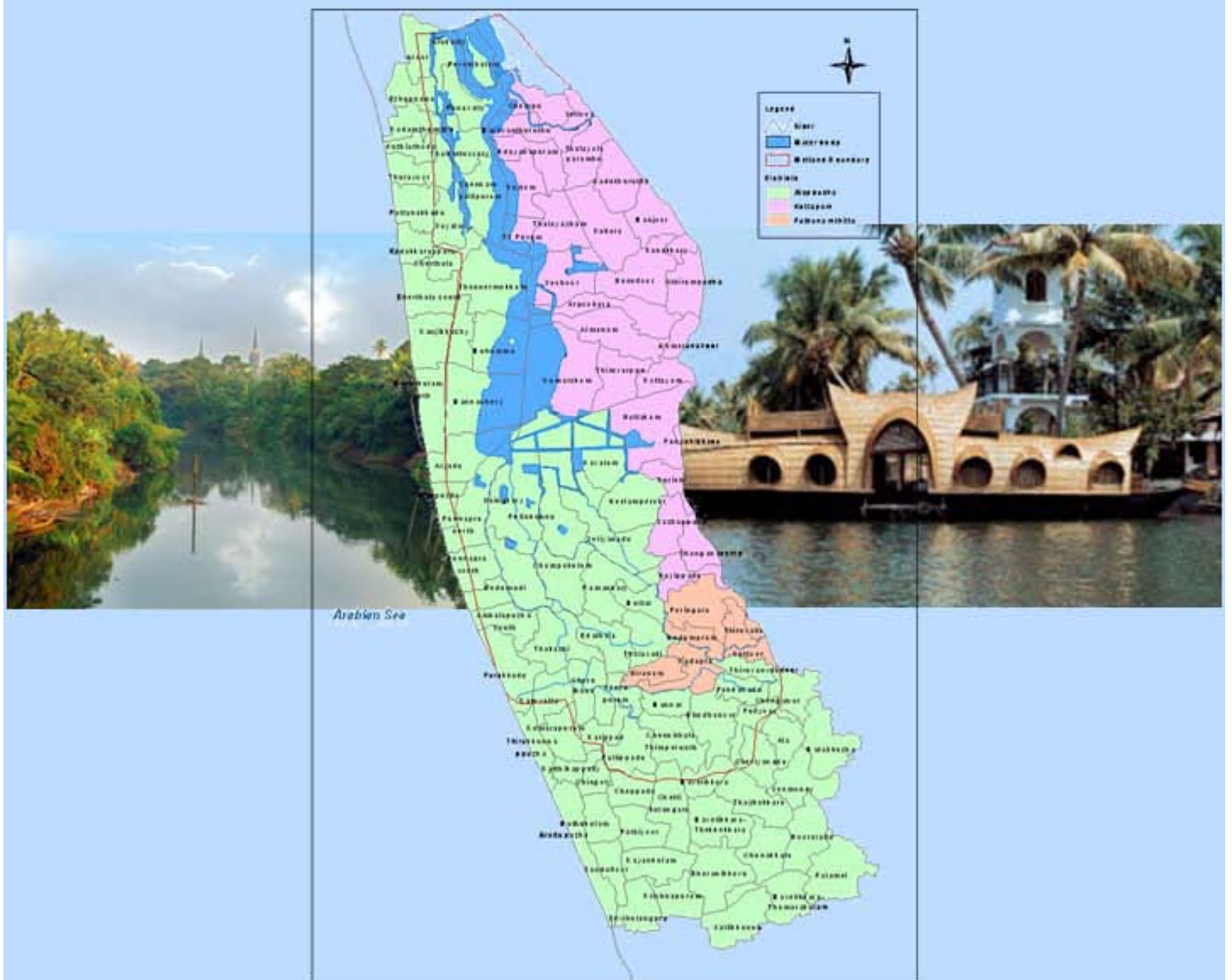


# Measures to Mitigate Agrarian Distress in Alappuzha and Kuttanad Wetland Ecosystem



M. S. SWAMINATHAN RESEARCH FOUNDATION

# **Measures to Mitigate Agrarian Distress in Alappuzha and Kuttanad Wetland Ecosystem**

**A Study Report by**

**M. S. SWAMINATHAN RESEARCH FOUNDATION**

**2007**



**M. S. SWAMINATHAN RESEARCH FOUNDATION**

## FOREWORD

Every calamity presents opportunities for progress provided we learn appropriate lessons from the calamity and apply effective remedies to prevent its recurrence. The Alappuzha district along with Kuttanad region has been chosen by the Ministry of Agriculture, Government of India for special consideration in view of the prevailing agrarian distress. In spite of its natural wealth, the district has a high proportion of population living in poverty. The M. S. Swaminathan Research Foundation was invited by the Union Ministry of Agriculture to go into the economic and ecological problems of the Alappuzha district as well as the Kuttanad Wetland Ecosystem as a whole. The present report is the result of the study undertaken in response to the request of the Union Ministry of Agriculture. The study team was headed by Dr. S. Bala Ravi, Advisor of MSSRF with Drs. Sudha Nair, Anil Kumar and Ms. Deepa Varma as members. The Team was supported by a panel of eminent technical advisors.

Recognising that the process of preparation of such reports is as important as the product, the MSSRF team held wide ranging consultations with all concerned with the economy, ecological security and livelihood security of Kuttanad wetlands. Information on the consultations held and visits made are given in the report. The report contains a malady-remedy analysis of the problems and potential solutions. The greatest challenge in dealing with multidimensional problems in our country is our inability to generate the necessary synergy and convergence among the numerous government, non-government, civil society and other agencies involved in the implementation of the programmes such as those outlined in this report. This is why the team has suggested both a high-level policy guidance and monitoring committee as well as a task implementation mechanism.

The Kuttanad Wetland Ecosystem, particularly the Vembanad *Kayal* (lake), is now receiving global attention because nature is at the peak of its beauty in this Ramsar site. This Wetland Ecosystem comprises not only the Vembanad *Kayal* but also a huge network of rivers, canals and drains. The agriculture of Kuttanad wetlands is again unique because in large areas rice cultivation is being done up to 2 m below the sea level. The challenge now is to conserve and enhance the beauty and bounty of this ecosystem by creating an economic stake in its conservation. This will imply that the livelihood security of the farm, fisher and other families

living in this area must be strengthened through better infrastructure and multiple avenues of market driven income earning opportunities. The agricultural crisis in Alappuzha district is deeper in the Onattukara and its northwestern coastal regions known for unique *Pokkali* rice cultivation.

The report suggests an institutional mechanism like the creation of a Special Agricultural Zone (SAZ), which will help to address in a holistic manner all links in the conservation, cultivation, consumption and commerce chain. We must create a *Kuttanad Regeneration Symphony* with all the actors playing their part in harmony with each other. Saving the Kuttanad ecosystem and the regeneration of the agriculture of this area has to be a joint Centre-State responsibility. The Kuttanad Special Agricultural Zone is very worthy of the support the Government of India is planning to extend to State Governments for new initiatives in the field of agriculture, which can help to strengthen national food security and sovereignty.

I wish to express our gratitude to Shri. Sharad Pawar, Union Minister for Agriculture and Food, the Secretary and all the concerned Officers of the Ministry of Agriculture, Shri. T .K. A. Nair, Principal Secretary to the Prime Minister, Hon'ble Chief Minister, Ministers of Kerala Government, Members of Parliaments, Members of Kerala Legislative Assembly, the mass media, and civilian, farmers', farm women, fishermen, farm labourers' non-governmental and Church organizations, and all the others who so generously gave their time to share their views and to suggest solutions. I hope the report will be of help in initiating a new *Kuttanad Renaissance Programme*.



M S Swaminathan

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## **ACKNOWLEDGEMENT**

We owe our greatest gratitude to the people of Kuttanad who with great enthusiasm and hope travelled long distances and partook in the discussions and shared their experiences and views. They were the part and parcel of our consultative study. Our interaction with each one of them, the farmers, fishermen, farm labourers, women, and the youth, was a learning experience. Many of them also provided representations detailing several issues and suggestions to rectify them. Their clarity and concern have shaped our thoughts, findings and some of the final recommendations for alleviating distress situations in the study area. We are deeply impressed and influenced by the indomitable never-say-die spirit and the commitment of the people towards the development of their homeland. Our most grateful acknowledgements are due to each and every one of these participants.

The study would not have been possible at the fast pace that it was conducted had it not been for the continuous support and assistance made available to us by the District Collector of Alappuzha and his body of departmental officials, bureaucrats, the political body of elected representatives from Kuttanad, the scientific academia, media, private institutions and non-governmental institutions. We are deeply grateful for their assistance in conducting public consultations, providing space and logistic support for discussions and field visits, preparing maps pertaining to the study area, providing access to a vast database and scientific information. We are also grateful to many of them for partaking in several of our consultations and offering insights into what may ultimately work for Kuttanad and what may not. The local media, print and visual, deserves special mention for spreading the news of consultations so efficiently so that people from far and near could participate in our consultations. The media also offered their views and helped in compiling the public views published through their columns.

It has not been possible to list out the names individually, since such a large number of people have been involved. However, we would like to list a few of them who have been major catalysts in this study.

To the Hon. Chief Minister of Kerala and the Ministers for Agriculture, Cooperation, Transport, Fisheries, Irrigation and Finance, we are extremely grateful for their patient hearing of the draft report and their invaluable comments. The political body made of the MLAs and MPs of

Alappuzha, and Kuttanad regions falling in Kottayam and Pathanathitta have been involved in the development of the recommendations right from the beginning of the study and have offered their very useful comments. Special mention needs to be made of Dr. K.S. Manoj (MP) and Smt. C.S.Sujatha (MP) and Shri. Thomas Chandy, MLA, Kuttanad who have evinced a very keen interest in helping the study team.

We would like to express our heartfelt thanks to the District Collectors of Alappuzha, Kottayam and Pathanamthitta, and the Departments under them, especially the Departments of Agriculture, Irrigation, Cooperation, Fisheries, Local Self Governance, Labour, Social Welfare, Tourism, and Public Relations. The interest and contribution of Shri.K.R.Vishwambaran, IAS, the previous District Collector of Alappuzha, currently the Vice - Chancellor, Kerala Agricultural University, deserves very special thanks. We also wish to thank Shri. Balakrishnan, present Collector of Alappuzha for his interest and support. Our thanks are due to the Alappuzha Municipal Administration. The contributions of the Kerala State Land Use Board, GoK for making available the land use maps of Alappuzha and Kuttanad and their studies conducted in this region.

We also wish to thank Presidents of Alappuzha and Pathanamthitta district Panchayats and all Block and Village Panchayat Presidents who assisted this study in many ways through suggestions and discussions during field visits.

Thanks are due to many scientists from different Universities, Institutions, and in particular from the Rice Research Station, Mankombu and Regional Agricultural Research Station, Kumarakom for the useful help with expert views, research papers and models on successful livelihoods. Throughout our consultations we had taken care to involve multi-disciplinary specialists and advocates of a better Kuttanad from throughout Kerala. We thank them for their suggestions and advice, which immensely helped us. In this context, we would like to express our sincere thanks to Dr. Geethakutty, Associate Professor, Kerala Agricultural University and Ms. Sudha Soni, Consultant, *Gandhi Smaraka Grama Seva Kendram*, Alappuzha for their competent support for successfully organising and conducting the interactions with women of Kuttanad.

Representatives from the banking sector, notably the NABARD, the State Bank of Travancore (SBT) and the district Cooperatives have offered their valuable suggestions. We specially thank

the help of Shri.S.Sreekumar, General Manager, District Cooperative Bank. We have also held discussions with representatives of private industries, resort and houseboat operators and this has enabled us to gain an unbiased view on several issues; our most sincere thanks to them.

Several agencies and non-governmental institutions that have dedicated their work to the upliftment of the people of Kuttanad, and representing the civil society, have been involved in facilitating our study right from the beginning. Among them the *Kuttanad Vikasana Samiti* (KVS), *Pampa Parirakshana Samiti* (PPS), Gandhi Smaraka Grama Seva Kendram (GSGSK), and the Kerala *Shastra Sahitya Parishad* (KSSP) deserve special mention. The guidance extended by Fr. Thomas Peelianickal and Prof. M.K. Prasad at various stages of this study is gratefully acknowledged. Along with them we would also like to thank several members of the *Kudumbashree*, Women in Agriculture and the *Anganwadi* members who have contributed much to our discussions.

Sincere thanks are also due to the mass media – the Television, Radio and Newspapers, who have captured the essence of the consultations and disseminated it to the wider public. In this context the services extended by Shri. Unnikrishnan, PRO, Alappuzha is acknowledged.

Our team of Expert Committee Members have been carefully selected and have been those who are eminent in their respective spheres of knowledge and who have had considerable experience working on issues of Kuttanad. They have brought with them their enormous expertise and experience which has deepened our knowledge of Kuttanad considerably. They have been with us throughout the study and their contributions will no doubt benefit the people of Kuttanad one more time. We would like to take this opportunity to once again thank them, wholeheartedly for their support, participation and guidance.

Finally, we also wish to thank the Government of India for the study that has brought us very close to the people of Kuttanad and Alappuzha and the natural charms of the region.

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Radha Singh

सचिव, भारत सरकार  
Secretary  
Government of India

16/11/06.  
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D.O. No.12015/41/2004-Credit-I

November 7, 2006

Dear Dr. Swaminathan,

You may be aware that the Government of India has recently approved a special rehabilitation package for the farmers in 31 distressed districts of Andhra Pradesh, Karnataka, Kerala and Maharashtra. Along with this, Government has also approved a special plan of action for improving the farming conditions in Alappuzha and Idukki districts of Kerala. The special plan of action, inter-alia, includes constitution of a multi-disciplinary team to study and suggest programmes for preservation and development of Kuttanad wetlands in Alappuzha district.

In view of the available expertise with the Swaminathan Foundation we have decided to assign the study and report on the Sustainable Development of Kuttanad Wetland Eco-system to the Foundation. Among other things, the study should particularly focus on the ecological security of the Kuttanad Wetland Eco-system and sustainable livelihood for the people of the area and should make specific recommendations on :-

- (i) Measures for strengthening the ecological security of the Kuttanad Wetland Eco-system;
- (ii) Measures for expanding sustainable livelihood opportunities for the people of the area.

This is with the request to kindly work out the design of study, including its financial implications, if possible, within 10 days, to enable us to take a decision on the commissioning of the proposed study.

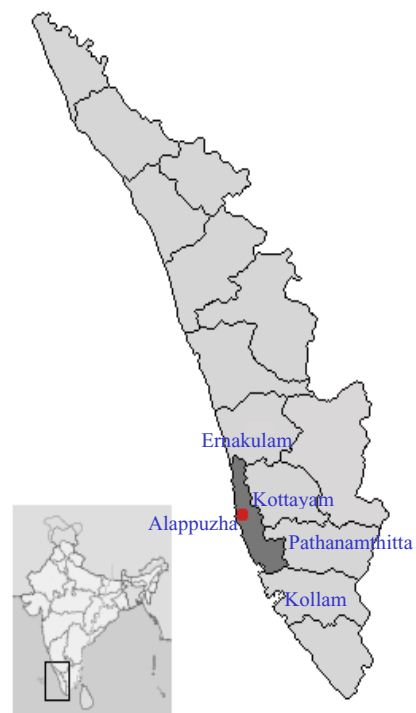
Yours sincerely,

(Radha Singh)

Dr. M.S. Swaminathan,  
M.S. Swaminathan Research Foundation,  
3<sup>rd</sup> Cross Street,  
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Chennai – 600113.

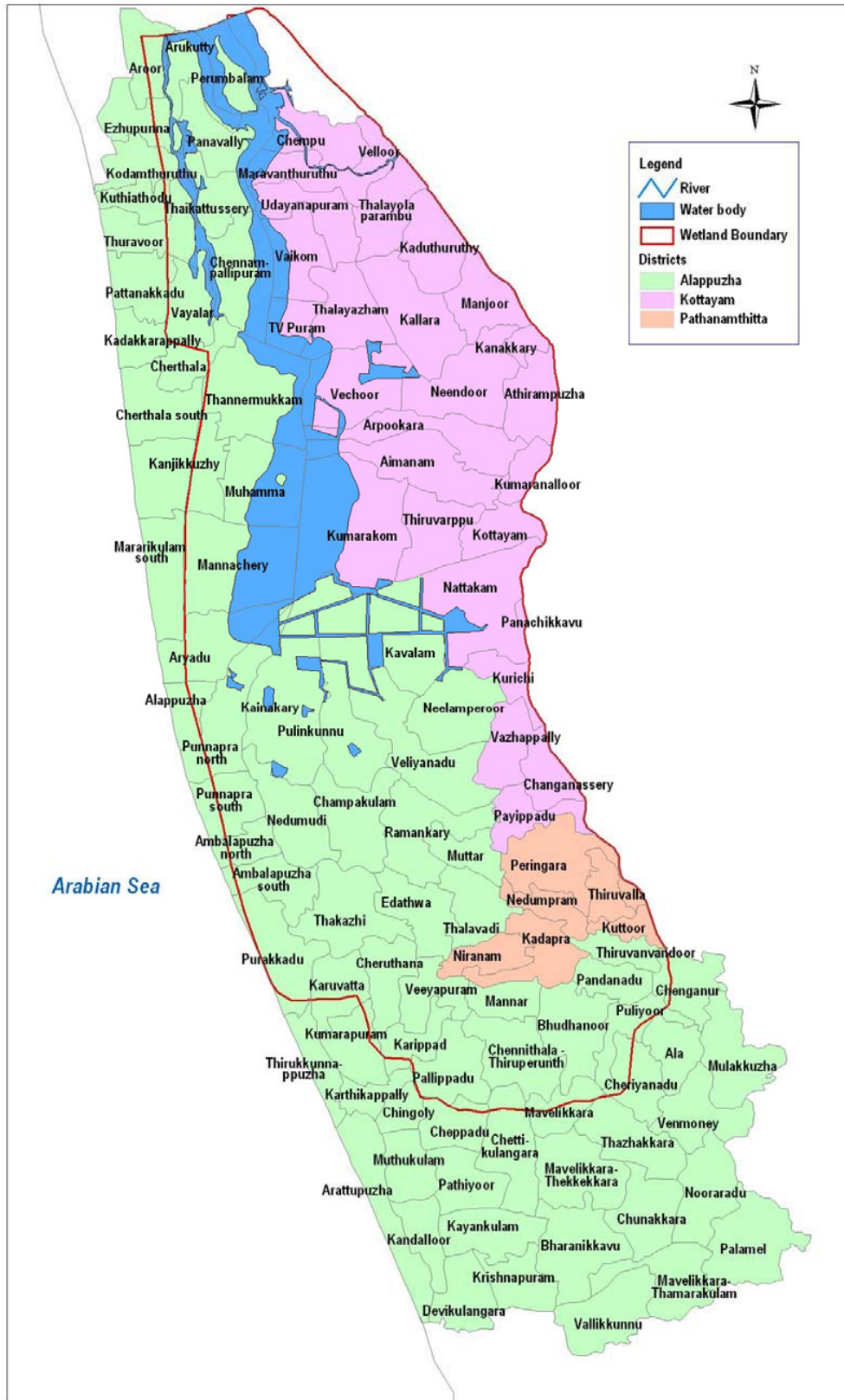
## THE MANDATED STUDY AREA

The geographical location of mandated study region is broadly shown in the Kerala map. The mandated study area includes the whole of Alappuzha, with 73 panchayats, including the panchayats falling under the Kuttanad Wetland System (KWS), and remaining part of the KWS spread over the districts of Kottayam and Pathanamthitta. Nearly 57 % of the KWS is shared by Alappuzha district, 30 % by the Kottayam district and remaining 13 % by the Pathanamthitta district. Administratively Alappuzha district is divided into 6 taluks, namely, Ambalapuzha, Chengannur, Chertala, Karthikapally, Kuttanad and Mavelikkara, comprising a total of 82 villages. Out of the 73 panchayats in Alappuzha, 32 panchayats fall within Kuttanad. Three taluks of Kottayam district, namely, Changanassery, Kottayam and Vaikom comprising 27 panchayats and 16 villages are part of Kuttanad. In Pathanamthitta district, 5 panchayats under Thiruvalla taluk fall within Kuttanad. Thus, the KWS has a total of 64 panchayats. Apart from Kuttanad, two major agricultural regions of uniqueness are Onattukara and *Pokkali* rice belt area. Onattukara is a region spreading to Kollam district, south of Alappuzha. The study is confined to the Onattukara region falling within Alappuzha, constituted by 26 panchayats and 2 municipalities. The *Pokkali* rice area is in Cherthala taluk, northwest part of Alappuzha, with major part falling in Thuravoor and Pattanakkad panchayats.



The boundary of Kuttanad is differently marked in different studies. The demarcation used in this study is in accordance with the definition of area made by an official Committee appointed by Government of Kerala and also in compliance with the map provided by the Kerala State Land Use Board, Thiruvananthapuram (see next page). The map demarcates the Alappuzha district together with Kuttanad, with panchayats falling in each of the three districts in different colours.

## Delimitation map of Alappuzha district and Kuttanad Region



Source: Kerala Land Use Board

## THE STUDY TEAM

The M.S.SWAMINATHAN RESEARCH FOUNDATION (MSSRF) has undertaken this study under the overall guidance of Prof.M.S.Swaminathan, Chairman, MSSRF and Hon. Member of Parliament (*Rajya Sabha*). The study team consisted of the following:

- ❖ Dr. S. Bala Ravi – Team Leader – Former Assistant Director General (IPR), Indian Council for Agricultural Research and currently Advisor, MSSRF
- ❖ Dr. Sudha Nair – Team Member – Programme Director, Eco-Technology, MSSRF
- ❖ Dr. N. Anil Kumar – Team Member – Programme Director, Biodiversity, MSSRF
- ❖ Ms. Deepa Varma – Team Member – Project Associate, MSSRF

The study was assisted by a multi-disciplinary expert team comprising:

- ❖ Shri. R. Hali, Former Director of Agriculture, Kerala
- ❖ Dr. P. Rethinam, Former Chairman of the Coconut Development Board
- ❖ Dr. E.J. James, Executive Director, Centre for Water Resources Development and Management, Kozhikode
- ❖ Dr. Babu Ambat, Executive Director, Centre for Environment and Development, Thiruvananthapuram
- ❖ Dr. K.G. Padmakumar, Associate Professor, Regional Agricultural Research Station, KAU, Kumarakom
- ❖ Dr. K.V. Krishna Das, Former Director & Professor of Medical College, Thiruvananthapuram

## EXECUTIVE SUMMARY

### 1. Introduction

*1.1 The Mandate:* The Ministry of Agriculture, Government of India has recently approved special rehabilitation package for the farmers of 31 districts of Andhra Pradesh, Karnataka, Kerala and Maharashtra. Along with this the Government approved a special plan of action for improving farming conditions in Alappuzha and Idukki districts of Kerala. The Government requested M. S. Swaminathan Research Foundation (MSSRF) to suggest programmes for the strengthening the ecological and livelihoods security of Kuttanad wetlands in Alappuzha district with the help of a multi-disciplinary team. The study was directed to develop specific recommendations on (1) Measures for strengthening the ecological security of the Kuttanad Wetland Ecosystem, and (2) Measures for expanding sustainable livelihood opportunities for the people of the area

*1.2 Mandated study area:* The area approved for special plan of action included Alappuzha district and the Kuttanad Wetland Ecosystem spread across Alappuzha (55% area), Kottayam (35 % area) and Pathanamthitta (10 % area) districts. This covers, the whole of Alappuzha district, 24 panchayats and 3 Municipalities of Kottayam district and five panchayats and one Municipality of Pathanamthitta district. The map classifying Kuttanad area sourced from the Kerala Land Use Board is used to define the boundaries of Kuttanad.

*1.3 The Study Team:* The study team from MSSRF was constituted with Dr. S Bala Ravi (Team Leader), Dr. Sudha Nair, Dr. N. Anil Kumar and Ms. Deepa Varma, under the overall guidance of Prof M.S. Swaminathan. The multi-disciplinary team constituted included Shri. R. Hali, former Director of Agriculture, GoK; Dr. K.V. Krishnadas, former Director and Professor of Medicine, Medical College, Thiruvananthapuram; Dr. P. Rethinam, former Chairman, Coconut Development Board & Plantation Crops Management Specialist; Dr. E.J. James, Executive Director, Centre for Water Resources Development and Management (CWRDM), Kozhikode; Dr. Babu Ambat, Executive Director, Centre for Environment and Development, Thiruvananthapuram; and Dr. K.G. Padmakumar, Associate Professor, Regional Agriculture Research Centre, Kumarakom, Kerala Agricultural University.

*1.4 The Process:* The process adopted included an extensive study of all the earlier reports relating to the KWS, a series of consultations with all the stakeholders including the Hon. Chief Minister and Ministers of Kerala Government, MPs, MLAs and representative of the three-tier Panchayati Raj Institutions, farmers, farm labourers and Farm Women Associations, Fishermen, coir workers associations, government officials from line departments, experts of the study area, academia, civil society and non-governmental organisations, media, and individuals with expertise on the problems of the area, and many visits by Prof. Swaminathan, the MSSRF team and experts to many locations. An Interim Report on Kuttanad was submitted to the Governments of India and Kerala on 13 February 2007. During the course of these meetings and visits, the Committee received many valuable suggestions from all stakeholders, public and private institutions as well as the media. Altogether the Committee received oral suggestions from more than 1,300 persons and about 503 memoranda and proposals. They have all been analyzed and disaggregated with reference to the suggestions for each region for preparation of this report and finalising recommendations and financial outlays. Throughout the formulation of the final draft report, officials of the Government department, particularly the Agriculture and Irrigation Departments, were frequently consulted for information, database and opinions. A draft report with recommendations and tentative budget was presented to the Hon. Chief Minister and his body of government officials and the MLAs and MPs of Alappuzha and Kuttanad on 22 June, 07, for receiving their feedback. Their suggestions were also considered while making this final report.

*1.5 Agrarian distress:* Kuttanad area illustrates the paradox of co-existence of bountiful natural charm and acute agrarian distress. Alappuzha supports the highest density of population in Kerala. According to the data for 2004-05, out of about 4,00,000 families in the Alappuzha district 1,56,151 are below the poverty line. Embracing a typical developmental agenda over the past few decades with criss-crossing roads, reclamation of wetlands and construction activities, ignoring the sensitivity of the KWE and the vulnerability of the area to regular flooding, a serious man-made crisis has been created on ecology, livelihoods, agricultural activities and alternate options, which collaterally and cumulatively contribute to a spiraling agrarian distress in the region. The ecological uniqueness of the area has become a causal factor to the ecological decay, economic entropy, livelihood loss and social sedation being experienced under the developmental paradigms characterized by inappropriate options. A

unique agriculture, managed below the sea level with great vibrancy and confidence is dwindling under high cost of production, indebtedness and increasing risk from natural forces. The irony is that Kuttanad, once considered as the 'rice bowl of Kerala' has become a 'den of distress'. "If farm ecology and economics go wrong, nothing else will go right in agriculture" euphemises Prof. Swaminathan. Kuttanad truly portrays this paradigm. The income from uplands had decimated with sick and low yielding coconut palms, crashing prices, and lack of resources for on-farm or off-farm income generation activities. The Wetland system fishery wealth is also severely declined with poverty as the only alternative for the dependant population. In many other parts of Alappuzha district, agriculture and related economic activities have paralysed with farmers and farm labourers left with no alternative. The agriculture based distress in the study area is so wide and deep as farming is the only source of income to more than 80 % of the population, out of which 95 % are small farmers with less than 0.4 ha land.

The first and foremost challenge in Kuttanad and Alappuzha is restoration of the ecology and natural assets to bring back vibrancy in agriculture, income generation and enhanced livelihood options to the vast number of small farmers, landless labourers and fishermen. Apart from eco-restoration, forward movement in productivity, profitability and sustainability in small farm conditions are issues of high priority to the region for mitigating the distress in medium and long-term perspectives. A section of the farmers, landless labourers and fishing community of the region also needs to be provided with immediate relief, which is essential for re-starting of the agricultural and economic activities by the families affected by the crisis. If this region has not witnessed widespread farmers' suicides, it is largely due to gritty will of the people to defy hardship. Before this will wilts away this report offers an opportunity to urgently intervene to mitigate the distress, restore the ecologic and economic security of the people, strengthen the agricultural and ecological infrastructure and policy framework back up to ensure sustainability to the change. Kuttanad region also eminently deserves to be declared as a Special Agricultural Zone with adequate and regular support from the State and Centre.

## **2 Ecological disaster and remedial action**

Good ecology is the desideratum for successful agriculture and allied livelihood activities. Years of exploitation and neglect have driven the KWS ecology into a state of *extreme*

*fatigue*. This has obvious impact on agriculture, which is the major economic activity of the area. Nursing and nurturing an abused ecosystem back to health is fundamental to revival and expansion of livelihoods. The elements of ecological challenge with short term and long term impact on agriculture and other livelihoods in Kuttanad are (i) declining area of Vembanad Lake and other waterways, (ii) flood management to minimize the risks and loss to the economy and productive assets of small farmers, (iii) better regulation of saline water intrusion all over Kuttanad with least impact to ecology, (iv) choked waterways and consequent problems in water availability and drainage to agriculture, and to human health, sanitation and clean drinking water, (v) pollution of water body due to many factors including alien invasive species, and (vi) declining ecosystem services and goods like water recharge, pollution control, fishery and loss of habitats and biodiversity. Integrated and well calibrated approach to mitigate all these and related problems are essential to achieve ecological revival and restoration of the lost livelihoods of the poorest of this region.

2.1 *Declining water spread area of Vembanad Kayal*: The rapid shrinkage of flood carrying capacity of the Lake by 78 % has come due to reduction in its area and depth. The pace of this decline has prompted prediction on its virtual disappearance in another 50 years. Major causes of this decrease are unchecked encroachments and reclamation of Lake area and raising Lakebed due to silting. While paddy agriculture was responsible for reclamation of Lake until the 1980s, the flourishing tourism is responsible for the current decline in Lake area. The Lake boundary along with that of river and canal networks have to be demarcated using landmarks and detailed satellite imagery to prevent encroachment and reclamation. Removal of all illegal encroachments into the lake is recommended and it is important to segregate a demarcated narrow strip (4-6 m) of ‘ecotone’, planted with mangroves or coconut (WC Tall), between the main land and water body all around the Vembanad Lake as a measure of conservation. Such an ecotone could possibly be owned and managed by the respective private institutions, individuals or panchayat. This is, however, considered essential for preventing further encroachment and erosion of the Lake.

2.2 *Flood management*: Increased frequency and period of flood and consequent losses arise from decreasing flood plane area including the Lake. The Thotappally Spillway (TSW) and the leading channel engineered to reduce the flood intensity in much of the Lower Kuttanad and the Lake area is declining over years in its flood regulation capacity due to poor



maintenance and lack of coordinated action on its operation. Farmers of Purakkad *Kari* in Kuttanad, where paddy is grown in 3,500 ha during monsoon season, are facing brunt of this decreased flood flow capacity and inefficient management of spillway. Measures recommended include modernization of TSW, deepening and side bund protection of leading channel and improved management of spillway operation.

*2.3 Management of salinity intrusion:* Salinity intrusion from sea into Kuttanad happens through few major and many minor inlets. The major inlets, which are regulated by permanent structures are TMB, Thrikkunnappuzha Lock, and Andhakaran-*Azhi*. The many minor inlets are in Vaikom *Kari*, Purakkad *Kari* and Aroor-Pattanakkad areas. The salt intrusion through these minor inlets affects paddy cultivation in more than 12,000 ha. Usually temporary barriers called *orummuttus* are raised every year to prevent salt intrusion, which is costly and ineffective in terms of timely prevention. The operation of major regulators is involved by different government departments, which function without intra- or inter coordination. Also, there are conflicting interests for not closing these barrages and keep them closed for longer time. Closure of TMB disconnecting Vembanad Lake from its northern half, preventing natural water movement for long time had impacted the Lake ecology and ecosystem. Measures recommended include modernization of TMB with efficiently operable shutter, replacement of middle cofferdam with barrage, operation of TMB at scheduled time and exploration of opportunity for reducing the scheduled time. Other measures are erection of permanent regulators in place of *orummuttus* at important salinity entry points including Kariyar in Kaikom *Kari*

*2.4 Blocked waterways:* The functions of major rivers and canals forming part of the KWS and several canals and drains draining the paddy fields in Onnattukara and Thuravoor-Pattanakkad are seriously compromised with encroachments, unscientifically constructed roads, bridges and culverts, silting and aggressive spread of waterweeds. They block free flow of water resulting in flooding to water logging, breaching of bunds, accumulation of wastes, increased growth of waterweeds, promotion of prolific breeding of predators, parasites and deadly pathogens, and degrading water quality, apart from obstructing of navigation. Three major obstructions to be rectified on priority for regulating flood in Lake and Lower Kuttanad area for protection of paddy fields are those between the C and D Blocks in Pulinkunnu panchayat and Rani and Chithira blocks in Kainakari and in the AC

canal flanking the AC road. Farmers in many memoranda and oral suggestions requested for renovation of a network of canals and drains in Upper Kuttanad, Onattukara and Thuravoor-Pattanakkad areas. Many of them essential for strengthening agricultural infrastructure are included in the recommendations. Many roads have changed the quality of communication and life in Kuttanad. However, the manner in which they are laid out are creating major ecological problems and is a cause of serious concern. Many major roads built by the PWD and minor roads laid out by local panchayats have violated the environmental norms essential in Kuttanad. Removal of several of these blocks including encroachments and land fillings, and prevention of creating such blocks in future are recommended.

*2.5 Aggressive waterweeds and water pollution:* The low salinity in Vembanad Lake and increased discharge of organic wastes and fertilizer residues into water bodies are promoting eutrophication. Alien invasive species like water hyacinth is densely spreading in all upper reaches of water body, canals and drains contributing to further pollution to water, preventing water navigation, depletion of dissolved oxygen, interfering in the entry of sunlight into water and thereby the fish reproduction and growth. This weed is a major problem to *padasekharams* causing major increase to the cost of cultivation.

*2.6 Loss of biodiversity:* With the depletion of Lake area, changes in land use pattern and modification of the Lake water by low saline mixing, increased pollution, aggressive growth of water weeds, continuous dredging operations, and other developmental interventions have led to substantial decline in the species diversity and population diversity of flora and fauna. The reclamation has almost decimated the mangrove and associated species diversity, which was once very diverse and luxurious. The cascading effect is on fish particularly prawn population and bird diversity. The changed ecology is believed to have lost about 23 species of fishes, preventing migration of about 13 other species, led to the decline of 33 % of bird population, brought in new predatory birds like *neerkozhi* and increased population of reptiles. There is hope that most of the fish diversity could be restored with restoration of Lake ecology. Focused conservation of important fish species, preservation of Pathiramanal Island in its pristine state, and other integrated measures that promote diversity of the wetland ecosystem is recommended.

2.7 *Health, sanitation and clean drinking water*: The ecological degradation is boomeranging on human health. The man made blocks to natural waterways and spread of waterweeds have created a congenial breeding ground for water-borne vectors like mosquitoes. The continuous fallow of rice fields also has increased rodent population. The rodents and vectors had been causing serious health threat to Kuttanad since some time, which has now assumed epidemic proportion affecting not only Kuttanad, but also the whole State and neighbouring States. This is causing an unfavourable impact on the high health standards of Kerala. Most houses in Kuttanad do not have accessibility to toilets and discharge their household wastes directly to the water. Drinking water problem is also serious with water pollution, salinity and decline in water table. More than 80 % of the people in Kuttanad are reported to be relying on the contaminated canal water for their daily needs. Piped safe drinking water is a luxury in many houses. Equally neglected is healthcare. With the recommended changes in Kuttanad ecology, immediate and long-term follow up measure are needed to strengthen health and sanitation, and augmenting potable water supply. A program for reviving existing ponds, canal systems and paddy cultivation chalked out in this report is expected to partially ease the water availability and its quality.

### 3 **Agricultural rehabilitation and alleviation of agrarian distress**

Agriculture is the major economic activity in Kuttanad and other parts of Alappuzha. Rice and coconut are major crops contributing to about 80 % of agricultural income in this area. Area occupied by paddy and coconut is 38 and 45 % of the cropped area, respectively. Other crops are banana, tubers and vegetables. Alappuzha has nearly 4.66 lakh operational holdings, 95 % of them own holding size less than 0.5 ha and another 3 % less than 1 ha. The *punja* paddy in Kuttanad and its unique collective-management in *padasekharam* framework bear a *Kuttanadan* socio-cultural stamp. The *Pokkali* paddy Thuravoor-Pattanakkad areas area has its own uniqueness. Onattukara, once a region known for high intensification of paddy is severely hit with large part of the paddy area lying fallow. Farmers view that paddy cultivation is not profitable on grounds of high cost of production, low prices and exploitative market. This is emerging as a major threat to paddy cultivation in Kuttanad, while substantial area elsewhere in Alappuzha is already in fallow. In 1967 about 60,921 ha was under paddy in Kuttanad, which in 2003 declined to 37,624 ha. The share of Kuttanad to the State's total paddy production shrunk from 37 % in 1967 to 18 % in 2003. *A linear*

*projection of this decline leads to that by 2020 paddy cultivation may well become a history in Kuttanad.*

The coconut in Alappuzha and Kuttanad is also becoming unprofitable due to declining yield. Several palms are irreversibly affected by root wilt disease and pests like red palm weevil and rhinoceros weevil. The price of coconut is also declining. Other land based livelihood options like dairying is less common due to shortage of fodder, forages, and high price of concentrates. Other livestock such as goat, rabbit, duck, and poultry play marginal role over all in providing livelihoods, despite their potential in the region. Kuttanad has highest number of ducks in the State. Duck farming is also constrained with non-availability of paddy fields for foraging and affliction of serious diseases. While capture fishing from water bodies is a major livelihood, culture fishing is not common, despite availability of water bodies. The fishing community depending on capture fishing is in distress. The culture fishing in paddy fields of wetland and *Pokkali* area under 'one paddy-one fish' system appears to have potential in limited areas for enhancing the farm income. While group or cluster approaches in agriculture is becoming common under the 'Farm Women Group', 'Kudumbasree', 'Ayalkkottom', 'Harithasangom', etc, the spread effect of these initiatives in mitigating farm distress is marginal.

Therefore, revival of agriculture based income generation and livelihood in Alappuzha and Kuttanad cannot be addressed by traditional approaches alone. This revival requires a major investment in infrastructure to promote paddy cultivation with reduced cost of production, improvement in coconut productivity with removal of disease affected palms and care of healthy ones, integration of land based farming with other on-farm and off-farm income generation activities with close connectivity to markets. Each component causing farm distress is examined and specific recommendations are provided in this report.

*3.1 Lack of profitability in paddy:* Increasing cost of production of paddy cultivation and lack of commensurate price for produce is pushing farmers in spiraling debt burden. This is the major reason for many leaving the cultivation leaving the land fallow. Many small farmers who own land less than 0.5 ha find it difficult to cope with the poor economics of paddy production. This is despite the fact that parts of Kuttanad offers fairly higher yield (4.5-5.0

t/ha). In Kuttanad, with the fields away from their house, these farmers are also not able to use their family labour.

An important factor contributing to high cost of production is the high recurring cost on the infrastructure for paddy cultivation, particularly in Kuttanad. This involves strengthening of outer bunds including repair of breaches, construction of motor *thara*, pump house and *vachals*. This, depending on the location, varies between 10-20 % of cultivation cost. Another major cost component is on hiring agricultural labour by small and medium farmers. Different studies show that 60-74 % of the cost of cultivation is accounted to hired manual labour. Farm labour in Kerala is paid two to three times higher than in most other paddy cultivating States. Farm machinery is scarce in Kuttanad and there is resistance against this option from organized labour. However, shortage of labour during peak operations is slowly facilitating entry of machinery. Considering all cultivation costs and current procurement price of Rs.8,500/t (State fixed MSP), the current net profit in areas where high yield is realized is between Rs.6,500-8,150/ha. In low productivity areas like Purakkad *Kari* and *Pokkali* areas, the profit level is much narrower or even loss at times. This has been causing increasing indebtedness and consequent distress among farmers. The decision not to grow paddy is invariably taken to avoid spiraling debt. The frequent crop loss from floods and poor compensation being paid virtually make rice farming a loss in the long run.

Mitigation of problems due to high cost of cultivation on infrastructure including farm machinery is recommended. This involves, strengthening outer bunds of all *padasekharams* across Kuttanad where such work is required, construction of motor *thara*, pump house, *vachals* and threshing ground (*methikkalam*). *Padasekharams* are also to be supported with some essential machinery to facilitate timely operations in the context of decreased labour supply and the importance of taking up sowing and harvest in accordance with the new cropping schedule recommended. These machineries shall be kept under the supervision of concerned panchayats for use primarily in *padasekharams* within its limits.

3.2 *Padasekaram size*: The area of a few *padasekharams* is much higher than the desirable size of 250-280 ha to facilitate low cost transportation of inputs to plots located deep inside and transporting out produce from there. Manageable *padasekaram* size may also help in faster dewatering to conduct sowing on time. This would also reduce the overall loss in situations

of outer bund breach. For these reasons farmers welcomed division of larger *padasekarams* to operational sizes, ranging 150-250 ha or around. On considerations of efficiency of management and cost cutting in recurring operations, this suggestion to divide larger *padasekarams* in Kuttanad is recommended.

3.3 *Regulation of salt water intrusion:* Apart from the three major salt water regulation points, TMB, Thrikkunnapuzha and Andhakaran *Azhi*, saltwater enters paddy fields in Vaikkom *Kari*, Purakkad *Kari* and from the coastal area through the different canals and rivulets. Construction of 33 permanent small and medium saltwater regulators, including one across Kariyar, is recommended to safeguard paddy cultivation in Kuttanad and Purakkad-Thuravoor area. Along with this paddy cultivation has to be undertaken at least one season, where currently fish/prawn culture is practiced round the year.

3.4 *De-silting and Renovation of Irrigation and drainage streams:* Paddy cultivation in many areas, including Upper Kuttanad in Alappuzha and Pathanamthitta districts, Onattukara and Purakkad-Thuravoor is not possible without repair and renovation of all irrigation and drainage canals serving the *padasekarams*. This was an important requirement farmers from these regions were pressing to put the fields back to paddy cultivation. Some of these canal renovation may combine with bunds adequate to allow farm machinery movement. Renovation of about 700 km long canals (*thodu*) and about 55 public ponds in these regions is recommended to revive paddy cultivation and associated livelihoods of farmers and farm labourers.

3.5 *Crop calendar:* Virtual absence of enforcement of a crop calendar for paddy cultivation in various seasons, particularly the *punja* crop, which is grown in largest area in Kuttanad including Lower Kuttanad, *Kayal* Land and North Kuttanad, an erratic cropping schedule is being followed, particularly after the commissioning of TMB. This compels longer period of closing for the TMB with cascading impact on Kuttanad ecology and ecosystem. Late sowing is also reported to increase pest and disease incidences and increased application of pesticides. It is known that prior to the construction of TMB, the crop was sown to harvest in February, although the duration of varieties then used were 10-15 days shorter. With the recommendations being made on TMB, its operation, outer bund strengthening, de-watering process, seed and input supply system, mechanization to compensate shortage of labour, and

common service system for *padasekarams*, it will be feasible to complete the *punja* sowing before first quarter of November and harvest the crop before March. Such *punja* crop calendar, in turn, would facilitate low pesticide use and opening of TMB by late February, both substantially contributing to the improvement of the Kuttanad ecology. Similar crop calendars for other seasons and other regions in Kuttanad are recommended.

*3.6 Supply of seed and other inputs:* Among different inputs, farmers from Kuttanad and Onattukara specifically requested to improve the supply of seeds and its quality. They are enthusiastic in joining certified seed production under the guidance of professionals. After examining different options suggested for this process, the Committee supports Upper Kuttanad as suitable place for production of certified seeds of popular varieties. The recommendation includes the whole chain of seed production, institutional role, infrastructure required for production, grading, storage and quality checking. Supplies of other inputs such as soil ameliorant fertilizers and other agricultural chemicals are also recommended for streamlining to provide quality material and right time.

*3.7 Soil health management:* Kuttanad soils are highly acidic and in some areas soil is affected by salinity. Soil treatment with ameliorants is common practice, which is partly subsidized. In view of the cost of cultivation and requirement to maintain soil health, regular soil analysis based ameliorant and fertilizer application is desirable. The Department of Agriculture is advised to provide this service to all *padasekharams* in Kuttanad, Onattukara and *Pokkali* area once in two years at least two months ahead of the cropping season. The *Padasekhara Samithies* are advised to keep this database as soil health cards and to restrain chemical application within these limits. Enhancing the ameliorant subsidy to *Kari* soil and production bonus to Purakkad *Kari* are recommended

*3.8 Labour bank and labour and other farm service management:* Agricultural labour is a principal component of paddy culture. In Kuttanad the labour had played a very significant role in transforming major part of the Vembanad *Kayal* into golden paddy fields. They have been the strong allies to farmers in their continuous struggle with the recurring natural calamities of the region. However, today, Kuttanad is facing labour shortage during peak labour intensive operations. Timely operations required under new crop calendar require well-managed assessment of labour availability and supply. To facilitate this it is

recommended that labour banks may be established in every panchayat. The new crop calendar for different regions of Kuttanad facilitates increased employment days to farm labour. Apart from labour, other services including skilled labour for operation of common facility machineries, in put advice and supply may be organized through ‘Agri-Clinics’, which will be an integration of technical service, common service facility and *e-krishi* unit or Village Knowledge Center (VKC) or ‘*gyan chaupal*’. Skilled cadre of youths, women and men, may be trained in operation of machinery and its maintenance. An Agri-Clinic for every 2,500 ha area of *padasekharam* is recommended.

*3.9 Promotion of group farming:* The *padasekharam* approach in Kuttanad provides a good example of cooperative management of farming in clusters with collective coordination of major common activities at each *padasekaram* level. De-politicisation of *Padasekhara Samithies* and coordination with panchayat and Agri-Clinics providing the centralized services are important in enhancing the efficiency of *padasekaram* management. The *Padasekhara Samithies* have to coordinate and implement several activities and supplies for enforcing the new crop calendar. The Agri-Clinics may also assist the *Padasekhara Samithies* for leveraging all relevant government schemes for improving farm productivity, profitability and welfare of farmers and farm labourers. The concept of group farming may be successfully adopted in Onattukara to counteract the disadvantages of small-holdings and to effectively canalize the services of community owned farm machinery and common services through Agri-Clinics.

*3.10 Promotion of rice cultivation in Onattukara:* The recommendations on outer bunds, renovation of canals and drains and farm machinery as community assets proposed for panchayats, and seed supply system are designed to promote agriculture in the region. As many paddy areas in this region were fallowing for quite some time and first season cultivation may become too expensive, it is recommended that for resumption of cultivation in fallow areas, an additional cash support may be granted. It also becomes imperative that farmers are required to cultivate paddy in these wetlands, either directly or on lease, after having made substantial investment on infrastructure and other facilities. The Kerala Government may take suitable action to prevent seepage and flooding of paddy fields from the Pamba Irrigation Project and the Kallada Irrigation Project passing through this area.



*3.11 Integrated 'one paddy-one fish' farming for increased income:* Holding size of paddy fields in Kuttanad is very small. According to 1973 figures, 42 % of holdings have less than 1 ha area and 29 % have between 1-4 ha area. Even under *padasekharam* approach, economic viability of smaller holding with current net profitability is a big question. Most of the owners of fields in Q, S and T Blocks have, on an average, only 0.4 ha. These *padasekharams* are lying abandoned for quite some time. Farmers owning similar small areas have opportunity for enhancing income by integrating paddy cultivation during one season fish culture during rest of the year. Experience in certain parts of Kuttanad shows that it is quite profitable. However, fish culture is feasible and recommended in fields, which are adjoining the garden lands and not in main water body areas, where the *padasekharam* has the important role of flood plane. Infrastructure support for free supply of fingerlings for this integrated farming is recommended. The '1P-1F' is expected to lead to organic farming with no agricultural chemicals applied for the paddy rotation. This could be further integrated with livestock, poultry and duckery.

*3.12 Assured price and assured market:* Market is a major constraint for all agricultural options. This is very critical to rice where profitability is very narrow. At present in Kuttanad and Onattukara, government is the major buyer of paddy under PDS of the Civil supplies Department. Procurement is made on the special MSP decided by the State Government. It is suggested that government may announce the price at the beginning of the season and make expedited arrangement for procuring all marketable surpluses. The pace of this procurement is important when the crop at maturity or after harvest is subject to rain and loss. Two options are available to Kuttanad to help farmers from loss of produce due to summer rains. First is storage in a godown constructed away from *padasekharams*. This will require transportation of grain to godown and drying it before storage. This will involve additional cost to farmers on transportation, for containers like gunny bags and for drying. The storage could be free of cost with overhead borne by the government. The second alternative marketing 'as is on bund' state to procurement agencies and millers. More paddy mills in Kuttanad may help farmers in quickly disposing the produce. It is recommended that the price of procured paddy be paid within a month. Recommendation is also made to build two godowns and to establish 12 paddy mills, including existing ones under a specified subsidy and tax holiday scheme.

*3.13 Revival of Coconut farming:* The land holding size of Alappuzha shows 95 % of the farmers own less than 0.3 ha. Within this land, considering this as garden land, coconut is an important crop contributing to the household income. Alappuzha is one of the badly affected districts with coconut root wilt, particularly in the Onattukara region. The current programme of Coconut Development Board for replanting severely disease affected trees and nursing back the rest of the palms to increased productivity is very slow considering the agricultural distress of the district. Hence a massive and major programme for five years to replant all affected palms and tending back the remaining palms is recommended. The productivity improvement of non-diseased palms has to be integrated with other inter cropping and livestock farming activities. Promotional programmes are suggested to follow region-specific intercrops such as vegetables, tubers, floriculture, mushroom cultivation, fodder, apiary, etc with appropriate market linkage. A major livestock integration programme with cows, indigenous like vechoor or cross-bred, buffalo, goat, poultry, ducks, rabbit or fresh water fishery are recommended in linkage with main lending banks with a provision for a subsidy and supply of quality planting material and fish fingerlings. A good integration crop-livestock-fishery may ensure increased employment, higher income and gradual improvement in the coconut productivity.

*3.14 Integration of integrated farming and value addition:* The produce from coconut and other components of integrated farming offers location specific and market linked opportunities for value addition, which in turn would increase employment and income. It would be more viable that such production and value addition is taken up on a cluster approach as is in the case of 'Farm Women Group', 'Kudumbasree', 'Ayalkkottom', 'Harithasangom', etc. Coconut offers opportunity for value added products like *neera*, virgin oil, copra making and oil extraction, coconut water collection and sale for vinegar production, coconut powder and activated charcoal, coir fiber separation and making geo-textiles and other coir products, etc. *Neera*, with technology available for long shelf life offers high economic benefits to farmers. Support is recommended to promote few thousand clusters of small farmers, women and land-less families with technology, training, infrastructure and market back up.

*3.15 Technology back up for farm production:* Research carried out by the Kerala Agricultural University at its Regional Agricultural Research Station, Kumarakom and Regional Research Station at Mankombu has significantly assisted Kuttanad agriculture for increasing rice

productivity and farm profitability with '1P-1F'. The RRS, Mankombu bred rice variety, Uma, occupies 60 % of area in Kuttanad. It is yielding on average about 4.5-5.0 t/ha. However, for a long time Kuttanad farmers are looking for better varieties possessing high yield as well as resistance to major pests and diseases, longer dormancy, and better grain quality. Reduced duration by a week to 10 days would also help the new crop calendar and the need for short period closure of TMB. RARC, Kumarakom is required to take this research agenda and to deliver the results within next 6 years. To support this programme and other programmes described in the text, a substantial special support is recommended to RARC, Kumarakom, RRS, Mankombu and RRS, Onattukara.

*3.16 Establishment of Farm Machinery Research and Training Center:* Mechanisation is important component of the new production management in Kuttanad and Onattukara. There are provisions to provide several numbers of power tillers, tractors and combined harvesters to Kuttanad and Onattukara region. There is also proposal to train youths on operation and maintenance of these machineries. There are needs to develop location specific machinery for more farm operations, like the harvesting of *Pokkali* rice. It is recommended that a Farm Machinery Research and Training Center may be established to serve the current and future farm mechanization needs of Alappuzha and Kuttanad in particular, to train youths on machinery operation and maintenance and to provide specialized service facility to farm machinery in these areas.

*3.17 Policy support and Coordinated governance:* The State government has important role in effectively implementing the recommendations with the financial support to be granted by the Central government. With the departmentalization of development activities, there is much slip between cup and lip. Close integration of these departments for evolving an efficient, accountable and transparent delivery mechanism is very important to take the benefit of these recommendations to farmers and other stakeholders. It also demands appropriate and swift policy modifications to oil the delivery system and to prevent delays. Many of the foregoing paragraphs have indicated interventions from State government with required policy back up. An illustration is the wide demand from Kuttanad farmers to shift the dewatering responsibility from the *Punja* Special Office to *Padasekhara Samithi* under the supervision and control of local 'Krishi Bhawan'. This requires amendment to the

Irrigation Act. Without effecting such changes, the agricultural change recommended for Kuttanad may not evolve in a holistic manner.

*3.18 Declare Kuttanad as a Special Agricultural Zone (SAZ):* Kuttanad and Kuttanad agriculture, particularly the predominantly practiced paddy farming, have several unique features. In addition, the area is part of a fragile but beautiful wetland system, which is declared as Ramsar Site. Paddy cultivation is essential for conserving the services of the wetland system. Paddy cultivation is not only intensely linked with the livelihoods of the people, but also adds profound scenic beauty to the region. However, farmers of this region face several disadvantages, which their counterparts elsewhere are not facing for pursuing similar crop production. Under this unique predicament, for promoting an eco-system friendly farming, generation of additional economic activity, promotion of investment, creation of employment opportunities and development of farming infrastructure, Kuttanad may be declared as a Special Agricultural Zone, ensuring regular economic assistance by the State and Central Governments to address in a holistic manner all links in the conservation, cultivation, consumption and commerce chain.

#### **4 Measures to revive fisheries based livelihoods**

The Vembanad Lake and associated water body measuring about 13,000 ha has several species fishes, crabs and clams. Some of the species like Pearl spot (*karimeen; Etroplus suratensis*) and the giant freshwater prawn (*aattu konju; Macrobrachium rosenbergii*) are endemic species highly valued for their delicacy. The Ramsar List of Wetland on 1st November 2002 has acclaimed Kuttanad as the inland fish basket of the State. The commissioning of the TMB and its prolonged closure has seriously affected the fish species diversity and population. Reported extinction of a number of species is attributed to the TMB. The break in life cycle rhythms and changed ecology of the Lake with high pollution load has affected breeding of many species. The fish population decline and consequent over fishing have been contributing to severe loss of fish and clam wealth. It has been estimated that over the last thirty years fish diversity has come down from 150 to 36 species and fish catch has declined from 1,60,000 t to 7,200 t in 1989 and to as low as 687 t in 2000-2001. Black clam, *Villorita cyprinoids*, and sub-fossils of dead white clam are other rich aquatic resource in Vembanad *Kayal*. Annual landing of black clam is reported to have plummeted

from 27,000 t in 1968 to 11,652 t during the mid-80s. Prolonged closure of TMB, dredging and reclamation of large parts of the Lake, and associated ecological degradation are largely attributed to the decline of clam fisheries. Over exploitation of fisheries using unsustainable practices such as using dynamite and poison for fish catch and low-mesh sized fishnets are some of the other issues related to inland fishery. This summarises the crisis in the inland fishing sector of Kuttanad. This crisis and consequent livelihood loss to fishermen are the cause of distress to the fishing families there. An estimated 12,541 inland fishermen families in Alappuzha and Kottayam are depending on the capture fishery. Revival of fish population and its diversity are the only alternatives to strengthen the livelihoods of this fishing community.

*4.1 Revitalising the fisheries:* The ecological interventions recommended including restricted closure of TMB, reduction in pollutants, removal of water hyacinth, etc are expected to revive the fish habitats in Kuttanad. Fishery resources may be further augmented through ranching of high-value and high-utility fishes and prawns and undertaking targeted conservation of important species. Strengthening the capacity of local communities by providing common and social infrastructure for promotion cage or pen fishery, fish integration in paddy fields, fish culture in water bodies like ponds, and development of models for homestead fishery are proposed to enhance the income from fishery. The RARC, Kumarakom and the Department of Fisheries are required to provide the technology transfer, training and supply of fingerlings of appropriate species of fishes and prawn. Support to different programmes for enhancing fishery production is recommended.

Specific programme for promoting specific fishery habitats, particularly for economically important native species, is to be taken up under the technical guidance of RARC, Kumarakom. A suggestion is also made that in a situation where the *Rani* or *Chithira padasekharam* is not going to be brought back to paddy, one of them or both may be converted to a fishery sanctuary with the participation of local community. In this context it is suggested that the TCL may regulate the dredging in these *padasekharams* and eventually stop the process to facilitate use of these *padasekharams* for ecological strengthening of the area. The fishing community also may follow a code of conduct for responsible fishery exploitation on the basis of guidelines already available. Specific provision for establishing a fishery sanctuary in the Lake area is recommended.

*4.2 Fisher community:* The fishermen, by the nature of their exclusive dependence on capture fishery and due to declining fish stock, have been pushed to the edges of survival. A community with hardly any assets, they constitute a poorest section in this area, with more than 70 % of them below poverty line. They are highly indebted. Women make up 47.1 % of the total fisher work force. They organize marketing of the fish. Some of the pre-processing centres such as the prawns peeling yards and clam meat extraction and fish marketing are carried out largely by women and is mostly an unorganized sector, with the exception of few co-operatives. They work under poor sanitary situations and this ultimately affects their health. It is recommended that basic amenities and hygiene in pre-processing centers be improved and clam collectors are insured for health. In view of the extreme hardship to fishermen families during periods of poor catch, particularly due to the closure of TMB, it is recommended that free ration may be provided to the poorest among those residing south of TMB during its period of closure. Extension of credit facility at 4 % interest and priority extension of schemes for enhancing livelihoods to women groups are also recommended.

## **5 Strengthening research and information transfer**

*5.1 Training and capacity building:* There are many recommendations on programmes for enhancing income generation. Some of them may involve crop husbandry, other livestock husbandry, and yet others fishery. There are also vast opportunities for integrating all these activities at homestead level, preferably on a cluster mode. Opportunities also exist for value addition related income enhancement. All these require, apart from appropriate location specific technologies and infrastructure, training and capacity building in production, processing, quality standards and marketing. Therefore, training and capacity building under different domains is an important need for implementation of many of the recommendations. Training may also be given by involving farmers who are experienced and successful in the application of technologies or enterprises. Field visits to successful programmes and interaction with farm families would be useful learning. Marketing assumes high importance in all new enterprises, new products and new produce. Group approach will be more successful rather than individual efforts. Women farmers require specific priority in the training programmes and they have been found very successful on group activities. Equally important is the timely information dissemination and awareness generation. The radio communication on agriculture in Kerala had been a success. The *Veedum Vayalum*

programme of All India Radio, Farm Bureau deserves special mention. This revival programme in Alappuzha and Kuttanad require considerable information back up. While all forms of media deployment is essential, it is recommended that the All India Radio may be requested to open an Agricultural Information Unit in Alappuzha. Establishment of more *e-krishi* units or '*gyan chaupal*' with relevant core and dynamic information contents is also important for the agricultural revival being envisaged in Alappuzha and Kuttanad.

## **6 Backwater tourism**

Backwater tourism, tourist resorts and houseboat cruise is an economic evolution marketing the scenic and natural charm of Kuttanad. In view of the economic potential of this sector, considerable support and thrust have been given to tourism by government in recent years. With reported existence of about 350 houseboats on the backwaters, there may be a need to determine its carrying capacity with care on the local ecology and water pollution. Creation of a single window for licensing, permits and compliance checking may enhance the efficiency and minimize the hardships to the operators. There is need to enforce all standards to prevent water pollution from solid water, fuel spillage, to build suitable infrastructure along the cruising routes offering opportunities for local people for economic activity, establish navigation aids, assist in cleaning the canal routes from weeds, improving sanitary facilities for local population along the cruising routes, improving tourist safety measures and enforcing the recommended chemical toilets in houseboats and disposal of solid wastes through sewage treatment plants. Expansion of tourism to include farm families and unique farming processes would help in broader integration of water tourism with farm tourism. Sustainable tourism also has to be sensitive to the local ecology, biodiversity, and cultural traditions and sensitivities of local communities. A code of conduct for responsible, safe and ecologically friendly tourism by resort and houseboat operators has to be evolved and put in place.

## **7 Financial assistance**

Financial assistance for implementation of different tasks recommended under this report is arrived on a conservative estimate. It is recommended that this assistance be provided as additional resource over and above the ongoing funding on central-assisted schemes. The total funding required to implement all the recommendations is estimated as Rs.1,840 crores.

## 8 Implementation and Monitoring

Implementation and monitoring of the recommendations and programmes for mitigation of farm distress and revival of agricultural process assumes higher importance to ensure that the financial resources are effectively and efficiently utilized to deliver the programmes and infrastructure recommended for the agricultural and ecological revival, enhancement of livelihoods and mitigation of distress to the farming community. The most important concern here is the compartmentalized functioning of not only departments under the government, but also the divisions within each department with no or rare coordination and cooperation. Hence a well-coordinated orchestration of all implementing agencies for *Kuttanad regeneration symphony* is very essential. It is recommended that the implementation set up may be a two level structure. The ‘Kuttanad and Alappuzha Prosperity Council’ (KAPCO) chaired by the Chief Minister, may provide required policy guidance and monitoring of task implementation. At the second tier is the ‘Task Implementation Committee’ (TIC) chaired by the Chief Secretary, which may leverage all concerned government institutions under single command line for task implementation in right sequence and good coordination. It is desirable to create a special purpose vehicle for task implementation and provide statutory status to the whole set up. The recommendations are classified under tasks with indication of task-wise budget. The ‘Task Implementation Committee’ may include men and women of distinction in public life, representatives of farmers and fishermen’s institutions and main media institutions. Transparency in the business and accountability on the task implemented are most important.

The committee believes that the conclusions and recommendations of this study when effectively implemented would transform Kuttanad from being an agrarian hotspot to a Green Pride of India in the God’s own country. The ecological regeneration would hopefully make the Vembanad *Kayal* one of the most beautiful Ramsar Sites in the world and paradise for those who love the beauty and diversity of Nature. Alappuzha district should rediscover its economic glory of the past with all its agricultural resources put to optimum sustainable use for agrarian prosperity and to emerge as the jewel in God’s own country.



## RECOMMENDATIONS

### A. Strengthening Ecological security

#### Task 1: Protection and ecological restoration of the water spread area:

- 1.1 Halt reclamation of or encroachments on the backwaters, lakefront, and all canals, drains and public ponds. Remove all identified encroachments after conducting public hearing in each panchayats for identifying encroachments. Convert the present Government order on preventing paddy field reclamation and misuse into a law and enforce the same. Demarcate the boundaries of Vembanad Lake and all waterways with appropriate landmarks and database from satellite imageries. Declare a narrow band of 4-6 m wide land area (*karappadam*) on lake outer periphery as ecotone, which shall be the government land with provision to enjoy the land by the non-commercial occupants (including farmers and residents) and for lease right to the commercial occupants on condition that no construction for commercial purpose on this ecotone shall be taken up and it shall be planted with mangoves or/and coconut. The lease periods may not exceed 30 years with provision for extension. The local panchayat/Municipality may oversee the ecotone to check encroachments.
- 1.2 Prohibit road constructions by earth filling across the water flow in Kuttanad causing blockage or throttling of rivers, canals or drains. Ensure all major roads are built on pillars and minor roads with adequate number of culverts, sluices, etc to facilitate free water flow across the road. Similarly, avoid road construction across *padasekharams* and instead use *padasekharam* outer bund for laying down new roads with liberal provision of culverts and other passages for free water flow across. All road constructions are to be taken up only after adequate public hearing, which is well notified in advance.

#### Task 2. Measures for salinity and flood management in Kuttanad

##### 2.1 Modernisation of TMB to manage salinity and minimize ecological decay

- 2.1.1 Undertake and complete the work on Phase 3 of the TMB following modern design compatible with the renovated Phase 1 and Phase 2 portions and with all shutters operable.

Provide a futuristic lock in the Phase 3 section with a width of about 40-50 m suiting to the navigation of bigger vessels and barges. Design this middle lock with the modification of the bridge in a manner to open up the bridge upward for navigation.

- 2.1.2 Dismantle and remove the cofferdam without letting the soil and debris spreading on the lakebed. Dredge the part of Lake south of the cofferdam to suitable depth based on proper bathymetric studies and gradient analysis.
- 2.1.3 Renovate and modernize the Phase 1 and 2 with corrosion-free (cathodised) shutters, smooth closing and opening system so that all the shutters could be totally opened and closed in 15-30 minutes like the shutters to be installed in the Phase 3 section. This is to facilitate quick opening and closing of the barrage to allow low-level salinity mixing and migration of prawn and other fishes.
- 2.1.4 The TMB renovation and operation may be devised with state of the art technology. Also, explore the possibility of computerized operation of the shutters and its lock systems based standardised inputs on post and pre-monsoon water level, salinity level, etc. Include provision to maintain computerized records on the operation of the barrage, its locks, and other details on maintenance, etc.
- 2.1.5 Simplify the administration of operation of TMB using standardized parameters so that it will be placed in auto-management mode with least bureaucratic paraphernalia and subjective decision-making. Establish a TMB management Committee comprising representatives of farmers, fishermen, concerned departments, and elected representatives (MLAs/MPs).
- 2.1.6 Institute a research study by a consortium of competent organizations such as CWRDM and KAU on the operation of TMB with a view to minimize the period of its shut down under the new *punja* crop calendar, to facilitate migration of giant prawn and fishes to certain extent, to allow permissible level of saline water mixing with the fresh water and to create certain flow regime periodically. This research is required to fine-tune the TMB operation with minimal shutdown period with analysis of its impact on fishery and water quality.

2.1.7 After completion of the renovation work and establishing the complete barrage, the State government should provide adequate fund for its regular maintenance. If appropriate, it may consider levying toll from commercial boats (other than public transport) and vessels passing through the locks and similar vehicles using the bridge.

## **2.2 Improving the efficiency of the TSW and leading channel**

2.2.1 Modernise the shutter system of the Thottappally spillway with corrosion free (cathodic protection) shutter gates, redesign the wheel gate by replacing embedded parts and providing guide rails embedded to primary concrete of the pier, undertake modification to provide increased clearance between shutter and hoisting unit, provide new electrical system, make effort to computerize the operation of the spillway based on data accessed on flood water level in the Pamba and upstream leading channel, and other essential works to complete modernization and improved and efficient functioning of the spillway.

2.2.2 Deepening of leading channel to required depth based on proper bathymetric studies and gradient analysis to facilitate increased and smooth flow of floodwater and protecting sidewalls at all essentially required portions with R.R. Masonry. Use the dredged soil to widen and strengthen the *padasekharam* bunds, as required. Widen one side of the channel bund to facilitate farm machinery movement.

2.2.3 Create an efficient institutional system with fair participation of stakeholder farming community for periodic and timely removal of sand bar and efficient operation and regular maintenance of the spillway system. Ensure effective coordination by all concerned departments with least bureaucratic processes.

## **2.3 Regulation of floodwater in Kayal area near C and D and Rani-Chithira blocks**

Construct a channel of required width and depth between C and D block and the Rani and Chithira blocks in the *kayal* area (see Fig. 10) to regulate floodwaters reaching the Tharasu *Kayal* through the Pulinkunnu River and Kavalam River with a view to prevent flood damage to adjoining *padasekharams*. Also provide durable protection to the channel bunds by R.R. Masonry or bio-bunding.

## ***2.4 Complete construction of AC canal with removal of all blocks***

- 2.4.1 Undertake construction of AC Canal to complete the unfinished sections of this canal with removal of all blocks, encroachments, land fillings, etc., all along between Onnamkara to Pallathruthy. Ensure the width of this canal is at least 50 m and depth to the desired level all along. Adequately strengthen the bund south of the canal to provide protection to the poor families living on this bund.
- 2.4.2 Renovate the Alappuzha boat jetty and other jetties in Kuttanad to improve the water transport. Also. undertake cleaning of the canal network system in the municipal areas of Alappuzha, Thiruvalla Ambalappuzha and Cherthala. Removal of waterweeds, silt, and other sediments may be done to facilitate free water flow and easy navigation.
- 2.4.3 The major and minor waterways and canals of Kuttanad have to be demarcated to prevent encroachments and local panchayat be given responsibility to detect encroachments and action for removal.

## ***2.5 Monitoring and assessment***

- 2.5.1 Accurate predictions of flood arrival and intensity are necessary to take precautionary measures for minimizing loss to human life and property. Establishment of a modern and efficient early-warning system for flood forecasting based on rain in catchments of rivers, roughness of the sea, its rise in level, and other factors may be considered by the State. This may require placing adequate rain gauges in the catchments. As the Kuttanad flood plane areas no devices to measure the flood levels, install floodwater height indicating scales at different parts of Kuttanad. These water levels during monsoon and summer with reference ground level at these points may be monitored regularly.

## **Task 3: Measures for pollution control**

- 3.1 Prevent dumping of Municipal solid and sewage waste into Kuttanad river systems and other water bodies and create local waste treatment and disposal facility as per the approved

guidelines in all densely populated areas along the river system and the *Kayal* area.

- 3.2 In view of the major sewage load coming to Kuttanad waters is from Sabarimala area through the Pamba River and Achankovil River, initiate expedited action to prevent pollution of these rivers. The Pamba Action Plan, pending implementation for quite some time should be implemented in a timeframe of two-three years and the river sanitized from human and other solid waste. Develop similar cleansing projects for Achankovil River, Manimala, and Meenachil and implement them during the next five years under an integrated river pollution abatement programme.
- 3.3 Dumping of hospital wastes into river systems and common water bodies is to be viewed very seriously and punitive action taken, including cancellation of license, on offending institutions under environment protection laws. If necessary strengthen the penal provisions of this law to effectively curb such uncivilized and unhealthy practices by the very institutions, which are there to improve the public hygiene and health.
- 3.4 Prevent with the support of strong penal provisions discharge of untreated or partially treated industrial waste into rivers and water bodies. Ensure that discharged industrial waste does not contain harmful constituents like heavy metals. Hotels, tourist resorts, fish landing centres and prawn peeling units may be dealt as industrial units for the purpose of pollution control.
- 3.5 Boats, transport type and houseboat type, are increasingly contributing to the water pollution through fuel spillage and discharge of human waste directly into the water body. Prevent fuel spillage by enforcing inboard motors for all boats including boats used by the public water transport system and bringing all boats under certification requirement to meet specified levels of environmental standards, like in the case of automobile emission standards.
- 3.6 Prevent fuel spillage from boat cleaning centers. Strictly enforce single valve system for the biochemical toilets of houseboats to prevent direct discharge of toilet waste into water. Enforce such biochemical toilets to all houseboats operating in Kuttanad. Expedite completion of the houseboat waste treatment plant at Punnamada, which is a requirement to be completed by the Tourism Department. Introduce heavy penalty on all offending boat operators, including cancellation of license and fines. Promote solar panel to minimize fossil

fuel based energy generation in houseboats. Educate boat operators to check disposal of other solid wastes like polythene material in the water bodies.

3.7 Introduce public health guidelines for Kuttand to prevent use of latrines, which may contaminate water either directly or indirectly from unprotected septic tanks during flooding. There is need to develop a latrine system that is affordable and suitable for this area. The use of domestic toilets linked to ferro-cement septic tanks either individually or a cluster of few houses appears to be the better available option. Encourage such hygienically acceptable toilet options with full subsidy for poor families and half subsidy for others.

3.8 Promote low pesticide use with shift to bio-pesticides or integrated pest management to reduce the pesticide pollution from crops like rubber and cardamom in the catchments of rivers and paddy in Kuttanad. Expedite introduction of new crop calendar, which is expected to minimize the incidences of pests and therefore the application of pesticides. Also encourage the shift to organic farming.

3.9 Ensure that fisheries processing activities in the coastal regions of Alappuzha does not contaminate and pollute the surrounding areas and drains by adopting appropriate waste treatment procedure. Make agri-product processing like prawn peeling an ecologically responsible activity like the concept of 'Eco-village' program in Cherthala taluk, which is part of the Special Export Zone.

3.10 Promote minimization of the water pollution load from coconut husk retting by following either the retting of fibers separated from the husk or the chemical treatment method developed by the Coir Board.

#### **Task 4: Total elimination of aquatic weeds**

4.1 Adopt a systematic programme all over Kuttanad and elsewhere in Alappuzha for elimination of water hyacinth. The proposed desilting and cleaning of many waterways of Kuttanad would concurrently remove huge quantities of this weed. Concerted follow up action for three years are recommended to physically remove this weed and cleanse the waterways free of it. This may be entrusted with each panchayat who in coordination with adjoining

panchayats and public participation may effectively attend to the removal of the weed every year for three years, at least. The weeds removed may be used to making compost along with other organic waste, dung and rock phosphate. After the three years, the removal process may continue, if required, with the support of the State government.

### **Task 5: Measures for augmenting biodiversity in the backwaters**

- 5.1 Pathiramanal Island in the middle of the Vembanad Lake remains the only pristine area with diverse biodiversity in Kuttanad. For this reason this island has to be protected and promoted as a natural habitat for endemic flora and fauna and destination for migratory birds. Restricted nature tourism under the control of Forest Department could be allowed here *without involving any constructional and commercial activities or ecological modification of the island*. The edges of this island could be promoted for mangrove habitation with suitable species, which in turn will promote fishery habitat.
- 5.2 Promote mangrove restoration along the banks of Vembanad *Kayal* and Kayamkulam *Kayal* and the stretches available on the banks of the designated national waterways to strengthen the fisheries resource base and add scenic beauty of backwaters. This would also minimize the flood damage to the adjoining land area.
- 5.3 Initiate a programme for revival of productivity for Pearl spot (*karimeen*) and giant freshwater prawns on a life cycle approach also integrating conservation of these important resources.
- 5.4 Revive conservation of medicinal species and the associated traditional knowledge along with cultural traditions. The health tourism in Kuttanad may provide opportunities for cultivation of medicinal plants and medicinal rice like Njavara, Jeerakashala, Gandhakashala and Oushadhashala. Similarly, conservation of rice varieties being used for ‘Ambalappuzha palpayasam’ as well as Sacred Groves may be encouraged as they are of cultural significance.

5.5 The Gandhi *Smriti Vanam* project for promoting biodiversity proposed in Purakkad *Kari* area may be completed within a timeframe or if not the project may be scrapped to go back to rice cultivation in the area acquired for the project.

## **Task 6: Improving health and sanitation**

6.1 With the cleaning of waterways and removal of waterweeds, major environmental change is expected to happen. This opportunity may be used to initiate land based health and sanitation measures to minimize the risks from vectors and rodents.

6.2 Due to shortage of clean water, rainwater harvest at household level is reported to be useful and economically feasible. Such rainwater harvest facility may be provided to the poor families with 75 % subsidy.

## **B. Expanding sustainable livelihoods opportunities**

### **B. I. Agriculture based livelihoods**

#### **Task 7: Declaring Kuttanad as a Special Agricultural Zone**

7.1 Considering the uniqueness of Kuttanad and Kuttanad agriculture, particularly the predominantly practiced paddy farming, and that this fragile wetland system is declared as Ramsar Site, it needs to be promoted as a Special Agricultural Zone. This move would help to promote eco-system friendly farming, generation of additional economic activity, promotion of investment, creation of employment opportunities and development of farming infrastructure to address in a holistic manner all links in the conservation, cultivation, consumption and commerce chain with regular support from the State and Central governments.

#### **Task 8: Provide infrastructural support to paddy cultivation**

##### ***8.1 Minimising risk to paddy cultivation and recurring cost on infrastructure***

8.1.1 For minimizing the heavy recurring cost to farmers on strengthening of *padasekharam* outer bund (ring bund), it is recommended that outer bunds of all *padasekharams* in the six



agro-ecological zones of Kuttanad, Onattukara and Pokkali area are appropriately strengthened with the participation of *padasekharam* farmers. The height and width of the bund as well as the structural material shall be determined for each location/region with due consideration to the local compulsions including flood water level, flow pressure and other components contributing to the searing action on bunds. In the low-lying area of Kuttanad, it is suggested that the bund should be submersible, its height as a thumb rule should not exceed 30 cm above the average flood level during last 10 years and its width about 3 m at the top, with sideberms. The design and construction of outer bunds of paddy fields in Onattukara and *Pokkali* area have to suit the region.

8.1.2 Outer bunds should be built on standard design suiting the location. While the necessity for R.R. masonry and granite pitching is recognized in areas of bunds where strength is critically important, it is strongly urged that priority be given, wherever feasible, for bunds made of stiff clay with appropriate slope in conjunction with bio-protection on the waterside. However, no bio-protection will be used wherever the outer bund does not have fringing waterway. Eastern and southern sides of the *padasekharams* in *Kayal* area may have bear severe impact of monsoon winds and these sides hence require very stronger bunds. For bio-protection, different species of grasses including fodder grasses and other appropriate grass/shrubs may be chosen and established by using geo-textile as the binding material. Apart from such plant species on the waterside of the bund, one row of coconut could be planted on one side of the bund.

8.1.3 Outer bund of 3 m width at top may provide road space for movement of farm machinery. The road should be gravel topped. The outer bund all around the *padasekharams* in Kuttanad should have sufficient numbers of up and down stream sluices (*madas*) and culverts, depending on its area. These, in the flood prone areas, should be constructed in a manner that the *padasekharams* shall continue to serve their role as flood planes. In addition, along with the bund construction adequate number of motor *tharas* and as many pump houses with skeletal frame (where dewatering is a practice), landing provision for farm machinery are to be built. Pump houses with roof and walls are discouraged as these structures dotting all over the *Kayal* area may affect its scenic beauty. Hence, pump house infrastructure may have pillars, which could be used with temporary roofing material during pumping season.

8.1.4 Within each *padasekharam* in Kuttanad, need based *vachal* and threshing yard (*methikkalam*) are to be provided. *Vachal* construction may be limited to selective *padasekharams* where its recurring construction cost is high. The permanent *vachal* to be built should avoid as much as possible the granite and masonry work. Threshing yard may be built on a thumb rule of one for every 50 ha area of *padasekharam*. The latter facility may be extended to other regions.

8.1.5 The participatory construction and strengthening of outer bunds and other infrastructure should involve the *Padasekhara Samithi*, which shall arrange required land free of cost from *padasekharam* for this work and ensure that the bund strengthening does not reduce the canal width. The *Samithi* shall also be responsible for the ownership of coconut on the bund and other plants raised on the canal side for bio-protection. Hence, regular maintenance of the bunds and other infrastructure after its construction/ strengthening shall be with the *Samithi*.

8.1.6 The lifeline of KWS is the network of rivers, canals, drains and water bodies like ponds. This has close connectivity with the agriculture, particularly the paddy cultivation. Similarly, the cultivation in Onattukara and Thuravoor-Pattanakkadu areas has close relationship with the waterways, drainage channels and ponds of these areas. Their poor upkeep and degradation have strong linkage with the collapse of farming and consequent agrarian distress. Revival of agriculture in these regions hence cannot be done without restoration and renovation of these networks. Need for restoration of several canals and drains in all regions of Kuttanadu, Onattukara and Thuravoor-Pattanakkadu, which together measure to about 650 km and about 55 public ponds is assessed. Their restoration is recommended.

8.1.7 In addition to major projects built to prevent salinity intrusion into paddy fields, several *orumuttus* have to be erected every year to save large areas of paddy in Purakkad *Kari*, Vaikom *Kari* and areas. These structures erected by panchayats usually fail to perform as the work is not done in time or not done due to paucity of funds. In waterways like Kariyar in Vaikom, the higher width of the river causes major recurring annual expenditure and higher risk to cultivation. Creation of 33 permanent salt water regulators are recommended to safeguard paddy cultivation in Purakkad *Kari* (total 21; 4 in Purakkad, 3 in Thakazhy, 7 in Ambalappuzha, 4 in Punnappra-South and 3 in Punnappra-North), Vaikom *Kari* (total 3; across K.V. Canal, across Vadayar and a regulator-cum-bridge at Kottachira across Kariyar),

and Thuravoor-Pattanakkadu (total 8; located at Penadi, Pulively, 16<sup>th</sup> mile thodu, 19<sup>th</sup> mile thodu, Pallithodu, Achuthengumthara, Kandakkappally and Viyathra). Construction of one regulator across Pulikkeezhu River in Pathanamthitta is also recommended.

## **8.2 Division of bigger padasekharams to improve the logistics in farming**

8.2.1 To facilitate rapid dewatering, improve the efficiency and cost in the operation of holdings deep inside these larger *padasekharams* in Kuttanad, it is recommended that all those *padasekharams*, which at present exceed its area beyond 250 ha (600 acres) shall be divided on the consent of concerned *Padasekhara Samithi*. The division shall be made in a manner that the divided pieces of the *padasekharam* shall be equal or near equal in size and have a shape facilitating better logistics of the holding situated in the middle part and optimizing the cost and shall not be less than 150 ha. The *Samithi* shall arrange required land on cost-free basis for creating the division. The dividing bund, on need basis, shall have adequate width to facilitate machinery movement. Larger *padasekharams* identified for division are (i) C and D Block (1,230 ha, to divide into 4 parts), (ii) E Block (960 ha, to divide into 4 parts), (iii) H Block (780 ha, to divide into 2 parts), (iv) K and L and Aappu *Kayal* Block (340 ha, to divide into 2 parts), (v) R Block (620 ha, to divide into 2 parts with house boat navigable channel in between), (vi) Parampady Ponupakke padom (352 ha, to divide into 2 parts), (vii) C Block *Kayal* (256 ha, to divide into 2 parts), (viii) Raja Ramapuram *Kayal* (540 ha, to divide into 2 or 3 parts), (9) Mangalam *Kayal* (402 ha, to divide into 2 parts), and (10) Chalumpadu *padasekharam* (600 ha to divide into 2 parts).

## **8.3 Provision of other infrastructure to promote paddy cultivation**

8.3.1 Farmers in Purakkad *Kari* and few other *padasekharams* in several panchayats wanted common pumping facility under the aegis of local panchayats. In Puakkad, the reason is that such common facility will help in quick pumping to sow the *virippu* crop on time, save it from floods and to use the pump during summer to keep the fields submerged. Farmers from Upper Kuttanad wanted this common facility to overcome water shortage during *punja* crop. It is recommended that about 40 pump sets (*petti and para*) may be provided to 12-14 panchayats (Kurichi, Kallara, Thiruvanvandoor, Ala, Cheriyanad, Puliyoor, Pandalam, Mannar, Budhanoor, Thuravoor, Purakkad, Peringara) for use by local farmers. Timely

planting is important to restore the Kuttanad ecology. This is being hampered by the absence of adequate farm labour and non-availability of farm machinery. The same difficulty is experienced during harvest. Therefore, to supplement the available machinery for field preparation and harvest, 300 tractors, 500 power tillers and 300 combiner harvesters may be provided to *padasekharams* in Kuttanad through the respective panchayats. These machineries are to be operated by the service providing group created for each major *padasekharam* or cluster of small *padasekharams*. Similarly, 50 tractors may be provided to the panchayats in Onattukara to be used by group farming farmers.

8.3.2 As the paddy fields in Onattukara region had been left as fallow for long period and the first paddy cultivation in these fields may be too much expensive, it is recommended that a special one-time cultivation incentive of Rs. 5,000 may be granted to every hectare of fallowed land cultivated.

8.3.3 Efforts may be made to restore the primacy of Onattukara in sesame cultivation by ensuring fair market and profitability. Regular rice cultivation in the area and introduction of machinery for group farming are expected to reduce the cost of cultivation. The agro-processing department may examine the feasibility and economic viability of establishing small oil extraction units. Market linkage with *Ayurvedic* institutions and main trade is essential for growth of area under this crop.

8.3.4 Onattukara also had the reputation of being the major producer of medicinal rice like *Njavara*. Market linked revival of this cultivation should be explored.

#### **8.4 Organising de-watering in Kuttanad padasekharams**

8.4.1 The delay in the current dewatering process and the associated inefficiency had forced farmers to demand an alternative administrative system to facilitate faster dewatering and timely sowing. Timely sowing is most important under the new crop calendar for *punja* being recommended here. However, the present administrative set up on dewatering and making payment on dewatering subsidy by the *Punja* Special Officer (PSO) in Alappuzha and Kottayam districts is supported by a law. The justified demand of the farmers may be met by amending this law by the State to facilitate transfer the dewatering responsibility to the respective *Padasekhara Samithies* under the supervision of concerned Agricultural Officer,

who vested with the authority currently provided to the PSO may oversee the dewatering and disbursement of the due pumping subsidy to the *Padasekhara Samithi*.

## **Task 9: Enforce a Crop Calendar**

### ***9.1 Enforce new paddy crop calendar to promote better ecology of KWS***

9.1.1 With the implementation of all recommendations on the TMB, and TSW, and the outer bunds, the risks on paddy crop will be significantly reduced. Further the recommendations on other farming infrastructure and streamlining dewatering process would facilitate early dewatering and thus early sowing. The recommended *punja* crop calendar requires that sowing is first completed in *Kayal* Lands, Lower Kuttanad and North Kuttanad, then the *punja* area in Vaikom *Kari* and lastly in Upper Kuttanad. Sowing in *Kayal* Area, Lower Kuttanad and North Kuttanad has to be completed latest by the first week of November. *Punja* sowing in Upper Kuttanad could extend up to third week of December. This would facilitate harvesting the crop in *Kayal* Area, Lower Kuttanad and North Kuttanad by end of February and in Upper Kuttanad before first week of April. It is important to adopt this crop calendar and enforce it strictly on completion of tasks on TMB and outer bunds in these areas.

### ***9.2 Services on seed, soil health and pest management***

9.2.1 It is recommended that all seeds required for Kuttanad and Onattukara may be produced in Upper Kuttanad during *punja* season. The process should involve one or two state seed farms in the region for Foundation seed production, depending on the number of varieties involved and the area required. The Regional Research Station, Mankombu may be entrusted with breeder seed production. The certified seed may be produced with farmer participation in Upper Kuttanad under the supervision of experts. The overall activities may be brought under the responsibility of either the Department of Agriculture or the Kerala State Seed Development Authority. Support to be provided may include provision for land facility and initial assistance for breeder seed production at RRS, Mankombu, infrastructure facility to two state seed farms, additional infrastructure facility to the *padasekharam(s)* identified for the certified seed production, seed processing, grading and storage facility and seed testing laboratory with facility to monitor seed quality and a revolving fund for recurring expenditure. With this

infrastructure the production and sales of seed should be made competitive on self-supporting mode.

9.2.2 The agency responsible for the seed production shall ensure that quality seeds are made available to farmers in time on competitive price.

9.2.3 Soil test based fertilizer application is important to regulate cost of cultivation and to some extent to minimize the fertilizer pollution in water bodies. The Agriculture Department has adequate facility for providing this service. It is recommended that the Department may ensure that soil analysis of every *padasekharam* is conducted free of cost once in two years. The *Padasekhara Samithi*, with the help of Agri-Clinics may take and supply soil samples after *punja* harvest and the Department may provide analysis-based advice on fertilizer and soil ameliorant use in these *padasekharams* two–three months before the *punja/virippu* crop season. The *Padasekhara Samithi* may ensure these recommendations are followed. The analysis and advice may be computerized in the Village Knowledge Centres (VKCs), wherever it exists or as part of existing *e- krishi* services.

9.2.4 The existing facility in Kuttanad for Pest Forecasting and Early Warning Service under the Department of Agriculture is an important facility. However, it is facing manpower shortage. The Department of Agriculture may address this problem and provide effective service to farmers, or else transfer the center to the KAU, if the University is willing to deploy sufficient qualified staff to man this important service. Support is recommended to strengthen and modernize this facility

## **Task 10: Strengthening Research and Extension**

### ***10.1 Promoting location-specific research, training and capacity building***

10.1.1 The Regional Research Stations under KAU at Kumarakom, Mankombu and Onattukara have to be provided with additional support for strengthening their infrastructure and research capacity to successfully address the regional problems on paddy, coconut, vegetables and fish. The contributions of these centers have immensely assisted in enhancing the economic returns to farmers. However, these institutions due to paucity of funds from the

regular institutional support are constrained to effectively address the arising technological gaps. Hence, this additional one-time support is recommended. Assistance to RRS, Mankombu is recommended for building a laboratory for modern rice research, facility for evaluation of varieties for pests and disease resistance, grain quality and milling, building an embankment, and renovation of seed store. Support to RARC, Kumarakom is recommended for establishing a new research facility on farming system research for Kuttanad, strengthening research on Kuttanad biodiversity conservation and management, and creating facility for monitoring water pollution in Kuttanad. RRS, Onattukara is recommended support for strengthening of laboratory facility and seed processing and storage facility.

10.1.2 A Centre for Farm Machinery Research and Development may be established in Kuttanad area of Alappuzha to develop machineries and implements most suited to the Kuttanad and *Pokkali* rice area, for providing major repair service to the community owned machineries and for training youth on the use and maintenance of machineries.

10.1.3 Need for alternatives to professional coconut climbers is increasing in view of decreasing availability of these persons. This need may be met with the development of practical and easy to use coconut climbing device. The existing models of this device are to be vastly improved in this respect. Hence, it is recommended that a competent institution may be identified and supported to develop practical, easy to use and economically viable coconut climbing device within three years.

10.1.4 The capacity of Duck Hatchery in Niranam has to be increased to provide increased supply of ducklings of locally adapted breeds in consonance with the enhanced livelihood opportunities with duck farming. Expansion of this hatchery with 15 additional hatchery sheds, facility for transportation of chicks to different parts of Kuttanad and establishment of chick sale facility at 8 panchayats are recommended. It, however, requires deployment of adequate staff to the hatchery commensurate with this expansion.

## **Task 11: Strengthening Economic Viability**

### **11.1 Price and Marketing**

11.1.1 As rice production in Kerala may not be profitable at the Minimum Support Price (MSP)

being adopted by the Centre, the State has to jack up the MSP and ensure procurement. For this reason it is recommended that the State government announces the State MSP applicable to the year prior to the crop season and it enters in paddy procurement on substantial scale to sustain the MSP. While there is procurement facilitated by the State, the process is very slow, particularly in Kuttanad, due to administrative and coordination deficiencies. This may be rectified and procurement completed expeditiously without causing loss to farmers from rains during harvest. With the promotions of establishment of additional rice mills in the area, the procurement process may be speeded up. This will substantially reduce the need for storage of marketable surplus paddy at the additional cost of farmers or the government.

11.1.2 Farmers in Onattukara require procurement from field as is being done in Kuttanad. The State government may make arrangement to help the farmers here in this respect.

11.1.3 A common and perennial problem put forth by farmers in Kuttanad and rest of Alappuzha is that payment of procured paddy takes unduly long time and this itself constitutes a cause of distress. Many lessee farmers, who constitute the majority in Kuttanad, do not have bank accounts, which contribute to delay in payment, despite the good services being extended by the banks. A suitable remedy for paying within a month from date of procurement may be arranged.

11.1.4 Establishment of as many rice mills, including the existing mills, with total capacity to process about 60,000-80,000 t paddy/year is recommended. A subsidy of Rs. 20 lakhs is recommended for each mill which are either new or re-starting after shut down since last one or more years. The State government may grant tax exemption for all rice mills (including existing ones) for seven years considering the proposed Special Agricultural Zone status of Kuttanad and ensure that labour union activities shall not hamper or threaten their functioning.

11.1.5 Establishment of two paddy go-downs, each with storage capacity of 25,000 t is recommended to be established, one at Kainakary or Pulinkunnu and the other at Ramankary or Edathua or Muttar.

## ***11.2 Farm labour employment security and welfare***



- 11.2.1 Recognising the reality that distribution of farm labour is very unevenly distributed across panchayats *vis-à-vis* the paddy cultivated area, it is important to establish labour banks in each panchayat to ensure increased employment days to the labour and timely labour supply to *padasekharams*. This will facilitate drawing labour across panchayats and regions depending on the intensity of farm operations. This is important in the context of new crop calendar and mechanization. The ‘one paddy-one fish’ also offers more employment days in a year.
- 11.2.2 In view of the fact that youth, women and men, are not keen to take up employment in agriculture, they may be encouraged to take up skilled job like machinery operation and maintenance. With the recommendations to introduce community owned machinery in *padasekharams* and farming groups, requirement for skilled labour would increase for providing common service to *padasekharams*. The trained youths could occupy this space, which would offer more value to their time.
- 11.2.3 The current scheme of operating ‘Agri-Clinics’ under the Department of Agriculture may be expanded to include Common Service Centers (CSC) and VKCs to provide integrated information, technology and service package to *padasekharams*. Each such integrated Agri-Clinics may be established for every unit area of about 2,000 ha of paddy cultivated area, comprising as many as *padasekharams* to constitute this area. These Agri-Clinics may facilitate the panchayat and the *Padasekhara Samithi* in operating the community owned machineries at the rates jointly determined by the panchayat, *Padasekhara Samithi* and Agri-Clinics.
- 11.2.4 For all purposes of extending assistance and services, the lessee cultivators shall be treated on par with owner cultivators in every *padasekharams* and they shall not be discriminated in any manner.
- 11.2.5 In view of the current anonymous leasing of paddy lands, the State government may bring in suitable legislation to legalise the leasing without any kind of threat on the ownership of land owners. This would promote leased cultivation in more areas, which are being fallowed, prolonged period of leasing to the same party and make the lessees eligible for facilities like procurement, etc. Prolonged leasing may improve soil and crop productivity.

11.2.6 Women farm workers, particularly those who are taking their young kids to the work place, desired to have crèche facility near the work area. Considering the hardship these women and their children are facing, it is recommended that 10 creches may be established in different parts of Kuttanad, preferably closer to the major field areas.

### **11.3 Farmer welfare measures**

11.3.1 Farmers in Kuttanad, particularly those from Purakkad *Kari*, requested a modest enhancement of production bonus from the present Rs 140/acre to Rs.200/acre in view of the increased cost of cultivation and the lowest productivity in this *Kari* area. Assuming that 2,500 ha out of the 3,500 ha in Purakkad *Kari* will be cultivated, the annual enhanced financial commitment is Rs.3.75 lakhs. This enhanced productivity bonus to Purakkad *Kari* paddy farmers who may cultivate a crop up to harvest is recommended. The grant of the additional financial requirement for the first three years is also recommended.

11.3.2 The crop losses or very low profitability from rice farming, low coconut yield and price, extremely low fish catch over last several years, and low employment availability have made farmers, fishermen, fisher women marketing the fish, and farm labourers indebted from loans taken over last few years from formal and informal lending agencies. Immediate relief to these groups of people is recommended on the norms approved by the Government of India for agriculturally distressed regions. Such immediate relief is essential for re-starting the agricultural and economic activities by the families affected by the crisis.

## **Task 12: Coconut-based enterprises and integrated farming**

### ***12.1 Improving income from coconut and coconut based garden lands***

12.1.1 The ongoing programme on re-planting diseased and low yielding palms with quality seedlings from disease-free mother palms may be put on a crash programme mode to complete replanting in the Alappuzha district and rest of Kuttanad in five years. This may be implemented jointly by the State Agricultural Department, Central Coconut Development

Board, and local panchayats with full transparency and adequate technical back up in mother palm selection, quality seedling production and identifying diseased palms for replanting.

12.1.2 There is a need to launch a massive coconut revival programme for improving health and productivity of palms in the Alappuzha district and rest of Kuttanad during the next five years. Recognising that almost all holdings are very small, and that these small lands are the only base for enhancing on-farm income, there is a need to integrate the coconut revival programme with other income and employment generating activities, such as livestock rearing, homestead fishery, intercrop with vegetables, floricultural crops, tuber crops, etc.

12.1.3 Enhancement of on-farm income generation from garden lands (uplands) with integration of one or more location-specific components such as livestock (cow, buffalo, goat, fowls, ducks, rabbit and pigs), organic recycling, and intercropping of coconut with vegetables, floriculture, tubers, fodder, etc, and farmstead fish culture is recommended. This has better prospects in Onattukara, Upper Kuttanad and west of Vembanadu *Kayal*. Cluster approach by involving farm families choosing similar components to achieve economy of scale and appropriate market linkage are suggested. The concerned State Departments shall provide adequate support with appropriate technology and services like livestock healthcare and insurance, quality planting material and market information. NABARD may enhance the funds being made available to the lead banks to support this programme at 4 % interest rate with six year and three year repayment period for livestock and annual crops, respectively. A one-time subsidy of 25 % on initial loan for livestock and 20 % on productivity-based cultivation cost of intercrops and culture cost of fish is recommended to clusters on successful completion of the activity in first year.

12.1.4 Duck farmers are a poorest section among farmers in Kuttanad. They frequently suffer sudden loss due to duck epidemic and mortality and these huge risks severely affect their livelihoods. It is, therefore, recommended that extension of insurance cover to the birds when it is farmed in flocks numbering 50 or above may be addressed. Duck farmers with less than 3,000 birds may be treated on par with small and marginal farmers and made eligible for 50 % subsidy on premium.

12.1.5 Promotion of cluster based and market linked value addition of livestock and agricultural produces is recommended in view of its potential to multiply income and employment. For instance, opportunities such as production of ghee and curd from milk, rice-based *puttu podi*, *appam podi*, beaten rice, etc., coconut based value added products, such as virgin oil, *neera*, coconut milk, coconut powder, copra and oil production, production of husk fiber and geo-textile or other coir products, activated charcoal from shells, etc, production of quality planting material of tubers, vermin-compost, etc. should be explored. One time support to clusters towards the cost of value addition infrastructure not exceeding Rs. 30,000/unit is recommended.

12.1.6 The clusters sponsored by panchayats, non-governmental organizations and other developmental institutions may be equally treated, using performance as the major criterion, for the purpose of providing economic support.

## **12.2. Promotion of organic farming**

12.2.1 Encourage organic farming, which sustains economically viable productivity and better income generation. Organic farming may emerge as an economically attractive option in ‘one paddy-one fish’ programme. Similarly, the *Pokkali* rice cultivation could also be easily transformed into organic under rice prawn culture. Opportunities also exist in garden lands for organic farming when this is organized on a cluster basis with contiguous area. Organic certification and internal or external market offering a premium price to organic products are required economic incentives to sustain this farming.

## **12.3. Paddy fish integration for economic and ecological security**

12.3.1 With larger part of wetland areas in Kuttanad and *Pokkali* rice area stabilizing to one season paddy cultivation and a small part of these areas being fallowed, it is suggested that effort should be to consolidate the current cropping stability and to bring fallow lands under one crop. Under such cropping intensity, movement towards zero agro-chemical may be achieved with ‘one paddy-one fish’ system, which would promote economic and ecological security in these regions. Hence, this rice-fish integrated farming system is recommended in areas without interfering with the ecological services of the wetland system. It is important to

ensure that fish culture done in these wetlands only after a rice crop in *punja* or *virippu* season and the 6-7 month duration of this culture does not interfere with the recommended crop calendar.

12.3.2 The ‘one paddy-one fish’ system in Kuttanad shall be done only as polyculture of fresh water fishes comprising a scientific mix of species, which are surface feeders, column feeders and bottom feeders and macro vegetation feeders along with high value species. Thus, a suitable mix, which may vary in proportions in area to area, of Indian major carps, common carps, the Chinese carps such as Silver carps and grass carps together with a high value species such as giant freshwater prawns (*attu konju*) or Pearl spot (*karimeen*) could be used. Inclusion of high value stocking component enhances the economic viability. In *Pokkali* area rice-prawn rotation may be practiced.

12.3.3 The economic viability of *pokkali* rice culture in Pattanakkad and Thuravoor area could be strengthened by combining paddy during monsoon season and fish/prawn during high saline months. As a precaution against round the year prawn culture, the Department of Fisheries must ensure that adequate fingerlings are supplied only to those who had grown paddy during the preceding paddy season. Use of fields for exclusive prawn culture may be banned on ecological considerations and also in line with the Supreme Court directives on the matter.

12.3.4 In Kuttanad, fish culture after *punja* crop should not interfere with the important role of *padasekharams* in low-lying area serving as flood planes. The Departments of Irrigation and Agriculture should jointly identify *padasekharams* falling under flood plane and notify this list. It would be safer to restrict the practice of ‘one paddy-one fish’ to *padasekharams* adjoining the *karappadom*, without raising the outer bund above the recommended height. These *padasekharams* would also allow multi-level integration of fish culture with animals, poultry or duckery.

12.3.5 Rice-fish integration may be extended to include animal husbandry such as poultry, duckery, dairy, piggery, etc. in homesteads with pond or channels. Channels and drains in coconut gardens may be used for fresh water prawn farming.

12.3.6 The Departments of Agriculture and Fisheries, and the KAU should jointly train and build the capacity of farmers on ‘one paddy-one fish’ system and other fishery opportunity in

integration with wet and garden land farming with a view to prevent misuse of the ‘one paddy-one fish’ system, to promote polyculture of recommended species mix, healthy fish culture with required sanitation, to access fingerlings only from approved nurseries, dos and don’ts of homestead fish culture, marketing prospects and dangers of over production from larger area. These training may also use experienced farmers as resource persons with visits to well managed farmers’ fields. Training for three year period is recommended with fund made available to DoA.

## **B. II. Inland Fisheries based livelihoods**

### **Task 13: Actions to promote fishery wealth of Vembanadu *Kayal***

13.1 It is well established that the duration and the time of closure of TMB have significant impact on fishery wealth in Vembanadu *Kayal* south of the TMB and the livelihoods of people depending on this natural wealth. While strict adherence to the currently followed period of closure of the TMB (15 December to 15 March) is recommended, it needs to be further examined to reduce the duration and for the possibility of occasional openings for short time during the closure period with the introduction of new *punja* crop calendar and further research on this subject.

13.2 The cage or pen culture technology could be used, depending on the water body to enhance fish production in open or enclosed water bodies like *Kayal*, ponds, etc controlled by panchayats or private individuals. Public water bodies may be leased by the concerned panchayats on nominal lease amount to groups of landless families, the poorest among fishermen and farmers. Such water bodies may be identified close to the habitation of lessees, without hindrance to existing public uses of these water bodies and clearly marked to prevent unauthorized fishing. It is recommended that the technology with the supervision of RRS, Kumarakom and regulation of Department of Fisheries (DoF) may be tried in 50 units, each unit having 50 cages. A subsidy not exceeding Rs. 1,00,000 per unit is recommended to support the group, which may have at least 15 members. The DoF may provide fingerlings of approved species for the culture. The initial infrastructure expenses may be met from local bank loan with the help of Panchayat and DoF, and the subsidy released only after satisfactory conduct of the culture as certified by the DoF. Similarly, fish culture in

homestead would also harness fish production and income generation. The DoF may arrange timely supply of fingerlings of species, including *karimeen* and giant fresh water prawn, recommended for this fish culture under fishery intensification programme.

13.3 Ranching, involving large-scale hatchery-reared production of post-larvae and their release, is being practiced by the DoF in the Vembanad Kayal for enhancing the fishery production and livelihood enhancement of dependant people. It appears the programme started in 1992 under Social Fishery Scheme is not being implemented now. Hence, it is recommended that the DoF may revive this programme for next three years with the support provided here under fishery intensification and make internalize this important social fishery component in its regular operational programme.

13.4 Fish hatcheries for raising adequate and quality fingerlings of important species required for ranching, supply to farmers for cage culture, paddy field culture under 'one paddy-one fish' system, and homestead culture is very important. This demand may be met, possibly, by using the model on fish farms developed by the Fish Farmers' Development Agency (FFDA).

13.5 Renewal and accelerated reproduction of black clam is important to safeguard the livelihood of several poor families depending on black clam harvest. It is also linked to augmenting the shell demand of local industry. The renovation and new management of the TMB is expected to improve black clam resource. Further enhancement is possible with scientific methods of clam collection, culture and better pricing of the shell. The Tranvancore Cements Ltd is requested to provide Rs. 15 lakhs every year to the DoF to support a project on black clam culture to be undertaken by affected poor families living south of TMB under their Corporate Social Responsibility programme. It is recommended that the impact of dredging for white shell in Vembanadu *Kayal* has to be critically examined by a committee of fishery and environment experts with public participation for developing a *Kayal* environment management plan in the context of its declaration as a Ramsar site.

13.6 It is important that the *Rani* (T block) and *Chithira* (Q block) *padasekharams* (402 ha), now being left abandoned and abused by dredging are immediately restored for paddy cultivation. The investment being made on their infrastructure will not be justified if this return does not happen. In case the land is not to be used for regular paddy cultivation, these *padasekharams*

may be converted into a major fishery sanctuary for conservation and enriching of endemic fish species and black clam. To facilitate this, planned planting of mangroves may be taken up jointly here by the DoF and RARC, Kumarakom after three years on a project with support from Ministry of Environment and Forests.

13.7 Populations of the two most economically important endemic species of KWS, the giant fresh water prawn and *karimeen*, have been steadily declining over years. The ecological and livelihood securities of the region demand urgent conservation measures to conserve these species with specific action and promote its breeding. Participatory conservation of these and other important species is recommended under the lead role of RARC, Kumarakom. This activity may be shifted to T and Q blocks.

13.8 It is important to promote conservation and to practice conservative fishing in Kuttanad. This requires to be put in place a code of conduct on fishing and fishery management. This must involve regulation and enforcement of appropriate fishing gears to check over-fishing, optimizing fishing pressure, particularly during breeding and migration season, fishing with explosives and poisons and harvesting of young and undersized black clams.

#### **Task 14: Promoting fishing infrastructure, capacity and fishermen welfare**

14.1 Ornamental fish culture is becoming an increasingly lucrative business and this offers new income generation opportunities in Kuttanad region with group based enterprise building. The RARS, Kumarakom and DoF may give necessary technical and infrastructure assistance to the group managed units across Kuttanad on experimental basis with care to nurture and to take these units as model enterprises. Required support for the same is recommended to DoF.

14.2 Fishing communities in Kuttanad requested a few units of cold storage facility to prevent distress sale of fish on 'good catch days'. On appreciation of the importance of this demand, the Committee recommends establishment of five small cold storage units on the condition that its maintenance cost, except major repairs, will be met by the fishermen groups using and controlling this facility. The local panchayat, Matsyafed and fishermen associations could identify the fishermen group for such control. Matsyafed may assist in getting the major repairs done on time.



- 14.3 Fish landing centers as well as cleaning and processing centers are inadequate with essential facility like clean water supply, waste disposal systems and steady power supply. This is causing serious environmental problems around fish processing centers. There are several small units of prawn cleaning centers outsourced by major exporters and these units located on public land like sides of railway track are with no hygienic facility and waste disposal norms. The State Government has to regulate functioning of these units to ensure fair wages to workers, sanitary conditions consistent with guidelines of Sanitary and Phytosanitary Standards, environmental safety and public health.
- 14.4 The Government of Kerala is providing free ration to coastal fish workers deprived of employment during ban period of mechanized boats. It is recommended that similar free ration may be provided to the poorest among the fishing community residing south of TMB during its period of closure, as the closure is affecting their daily livelihoods.
- 14.5 Training and capacity building of fishermen in KWS area on conservative fishing, using right fishing gadgets, cage fish culture, fish seed and fingerlings production, processing and storage, sanitation and hygiene should be taken up jointly by the DoF and the KAU. Women play important role in fish marketing. Their capacity has to be strengthened in other areas like raising of ornamental fishes and fingerlings production. Special programs for women in culture fisheries need to be promoted. 'Women in Fisheries Groups' have to be initiated by the DoF on similar lines of 'Women in Agriculture' being effectively organized by the DoA. Support is recommended for such training for three years to the DoF. This may be eventually linked with VKCs serving information on various aspects such as technology, good fishing practices, quality awareness, finance, processing, marketing, etc.
- 14.6 This study encountered several inconsistencies in the fishery wealth of the Vembanadu *Kayal* south of the TMB. Studies purported to have conducted during same year have recorded widely different results on fishery wealth. There is need for conducting systematic studies on the fish diversity and quantity (based on catch) continuously for a period of at least three years. Department of S & T of the State may encourage competent institutions and Universities may take up this task with project-based support from suitable sources.

## **B. III. Water Tourism in Kuttanad and Local ecology**

### **Task 15: Infrastructure support to facilitate responsible tourism**

- 15.1 Although tourism is virtually promoted by private industry, it is not developing any infrastructure in the cruising route or taking adequate care of the local ecology. The Government has to come forward to build suitable infrastructure along the cruising routes offering opportunities for local people for economic activity, maintain canal bunds affected by frequent boat movement, establish navigation aids, clean the canal routes from weeds, improving sanitary facilities for local population along the cruising routes, improving tourist safety measures and sanitation in the houseboats, enforcing the recommended chemical toilets in houseboats and disposal of solid wastes through sewage treatment plants, etc.
- 15.2 The Pollution Control Board, which has the responsibility of the task it is meant for, sits like a distant onlooker with entry only after a crisis. It should take proactive role for preventing tampered biochemical toilets in houseboats, fixing green emission standard for fuel pollution with strict enforcement, and setting up waste treatment plants in partnership with private parties. It has unused strength to provide regular trainings to houseboat and other boat operators and unwary resort owners on pollution standards and on a code of conduct for eco-friendly tourism management. Maintaining good ecology is everybody's business, the government, the private sector and the public at large.
- 15.3 A 'code of conduct', self or externally imposed, is essential for the responsible water tourism in Kuttanad area. This Committee prefers that the houseboat owners voluntarily impose a 'code of conduct' to promote water tourism for health and happiness. A 'Green and Health Audit' procedure was also suggested. The Tourism Department shall ensure finalisation of such 'code of conduct' and Green and Health audit procedure and its enforcement. Similarly, routes and period of operation should be clearly defined and enforced without boats straying outside such routes and cruising after the time limit. Tourists must be advised using multi-language information folder against throwing packets and plastics material into the open waters.

15.4 Farm tourism involving farm families and demonstration of unique farming practices is important to canalize the benefit of tourism to the local farmers. Hence, necessary development and methodology may be worked out to integrate farm tourism with the present pattern of tourism. Such exploration may consider use of smaller boats for cruising to interior areas for interaction and overnight stay with farm families or farmhouses.

15.5 Tourism also has to be integrated with understanding and enjoying the art and culture of the local inhabitants in village setting rather than in star rated resort setting. The *vallom kali* or boat races of Alappuzha is one such culture. It occurs after the monsoon when the waters are running full. One suggestion is for periodic conduct of such races round the year or in months the tourist flow is higher, although the counter point is that events of cultural uniqueness is not commercialised. Monsoon tourism being initiated to synchronise tourist visit and local boat race events may hopefully find response. Kerala Government may examine the relevance of establishing a museum for the conservation of culturally significant monuments such as the Amablappuzha Temple, *Thakazhy Smarakam*, and Karumadikuttan, etc. A study centre and a light and sound display to depict the rich history of Kuttanad should also be explored.

15.6 The Island *Pathiramanal* is the only piece of habitat with least disturbance now left in Kuttanad. For this reason and for it being a locale of several endemic flora and fauna, the island should be preserved for its rare ecological value and pristineness. The proposal of Tourism department to make it as a tourism spot is viewed with concern. No construction of any sort or earth filling may be undertaken on this island or its immediate environment. No roads should be built within the island. If desired, mangroves may be planted all around as a belt and this may promote fish conservation and proliferation.

### **C. Implementation Mechanism**

In view of the highest importance to be given for the efficiency, coordination and transparency of the implementation of the recommendations, a high-powered 'Kuttanad Prosperity Council' chaired by the Chief Minister is suggested for policy guidance and monitoring. The recommendations grouped under 'tasks' are to be implemented by a 'Task Implementation Committee' chaired by the Chief Secretary. An inter-departmental team constituted under a 'Special Purpose Vehicle' shall do the work at field level on

implementation. Desirability of providing statutory standing to this set up is recommended. The Task Implementation Committee shall have participation from farmers, fishermen, civil society and media.

## COMPOSITE FINANCIAL SUMMARY

Task No	Details of Tasks	Budget, Rs in Crore
<b>A</b>	<b><i>Strengthening Ecological security</i></b>	
<b>Task 1</b>	<b>Protection and ecological restoration of the water spread area</b>	
<b>Task 2</b>	<b>Measures for salinity and flood management in Kuttanad</b>	
2.1	Modernisation of TMB to manage salinity and minimize ecological decay	160.00
2.2	Improving the efficiency of the TSW and leading channel	18.90
2.3	Regulation of floodwater in <i>Kayal</i> area near C & D and Rani-Chithira Blocks	40.00
2.4	Complete construction of AC canal with removal of all blocks	80.00
2.5	Monitoring and assessment	
2.1.6	Supporting research study by a consortium of competent organizations on TMB operation and <i>Kayal</i> ecology	0.60
<b>Task 3</b>	<b>Measures for pollution control</b>	
3.7	The use of domestic toilets linked to ferro-cement septic tanks either individually or a cluster of few houses	2.50
<b>Task 4</b>	<b>Total elimination of aquatic weeds</b>	
4.1	Systematic programme all over Kuttanad and rest of Alappuzha for elimination of water hyacinth	30.00
<b>Task 5</b>	<b>Measures for augmenting biodiversity in the backwaters</b>	
5.2	Promote mangrove restoration along the banks of Vembanad <i>Kayal</i> and Kayamkulam <i>Kayal</i>	0.50
5.3	Programme for revival of productivity for Pearl spot ( <i>karimeen</i> ) and giant prawns on a life cycle approach	0.50
<b>Task 6</b>	<b>Improving health and sanitation</b>	
6.2	Install roof top rainwater harvesting for all houses using ferro-cement tanks	2.50
	<b>Sub Total</b>	<b>335.5</b>
<b>B</b>	<b><i>Strengthening livelihood security</i></b>	
<b>B - I</b>	<b><i>Agriculture based livelihoods</i></b>	
<b>Task 7</b>	<b>Declaring Kuttanad as a Special Agricultural Zone</b>	15.00
<b>Task 8</b>	<b>Provide infrastructure support to paddy cultivation</b>	836.00
8.1	Need for restoration of KWS, Onattukara and Thuravoor-Pattanakkadu rivers, canals, drains and water bodies like ponds	361.00
8.1.7	<i>Orumuttus</i> Creation of 33 permanent Kottachira across Kariyar	22..00
8.3	Provision of other infrastructure to promote paddy cultivation	
8.3.1	Supply of pumps and Agricultural machinery for common use at padasekharam level	85.00
8.3.2	2.3.2. Onattukara first paddy cultivation charges	12.00
8.3.3	Promotion of rice-sesame rotation in Onattukara	0.60
<b>Task 9</b>	<b>Enforce a Crop Calendar</b>	

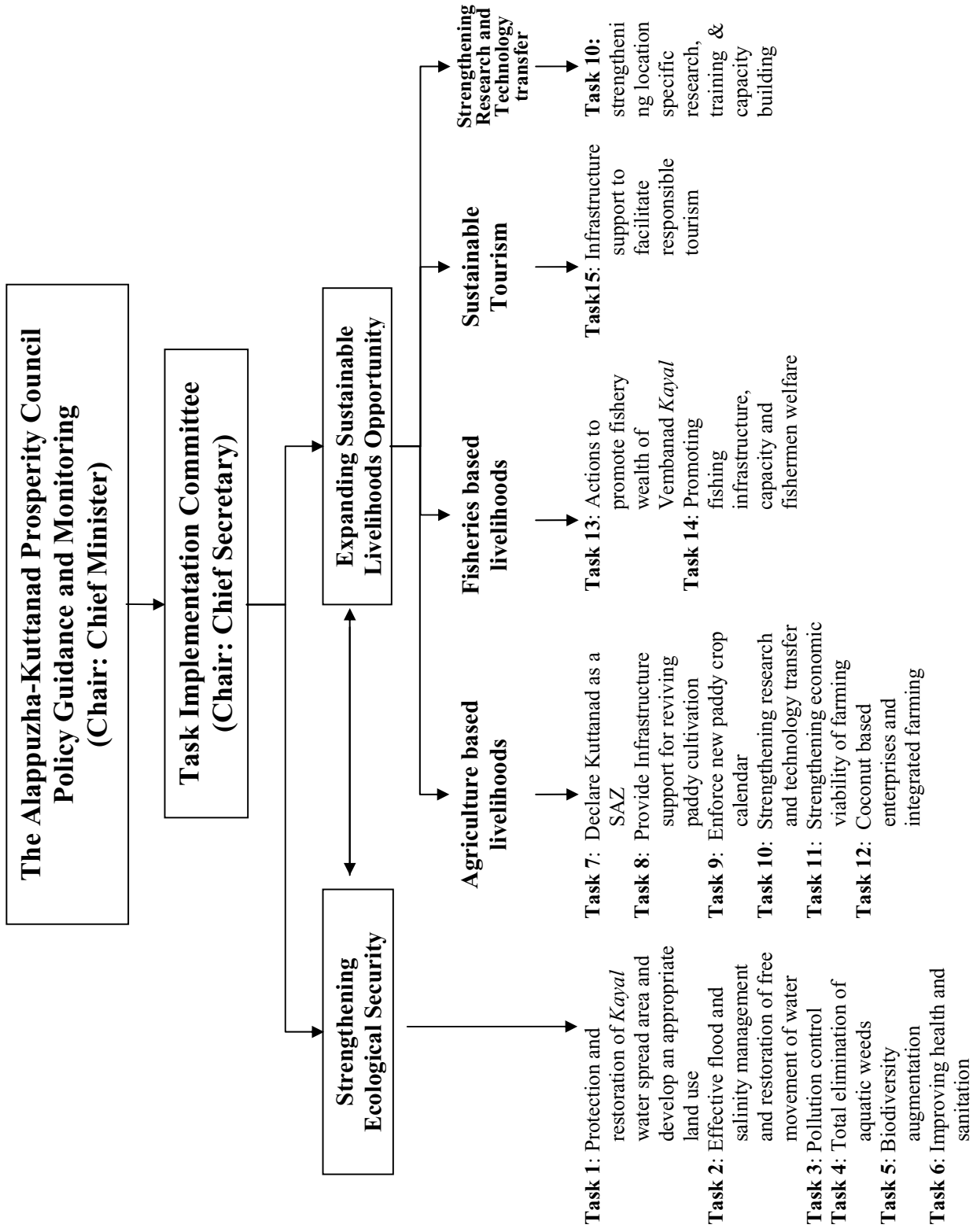
9.2.1	Certified seed production for Kuttanad and Onattukara	7.50
9.2.3	Support for soil test based fertilizer application	0.20
9.2.4.	Pest forecasting and early warning service	0.20
<b>Task 10</b>	<b>Strengthening research and extension</b>	
10.1	Promoting location-specific research, training and capacity building	8.50
10.1.2	Establishing Centre for Farm Machinery Research, Development and Training	4.50
10.1.3	R & D on coconut climbing machine	0.20
10.1.4	The capacity of Duck Hatchery at Niranam	0.18
<b>Task 11</b>	<b>Strengthening economic viability of farming</b>	
11.1	Price and Marketing	
11.1.5	Establishment of paddy go-downs in Kuttanad	4.00
11.2	Farm labour employment security and welfare	
11.2.2	Training youths in skilled agricultural jobs like farm machinery operation	0.50
11.2.3	Establishing and supporting 'Agri-Clinics' in study area	0.80
11.3	Farmer and Farm labourer welfare measures	
11.3.1	Production bonus enhancement in Purakkad <i>Kari</i>	0.20
11.3.2.	Immediate relief to farmers for restarting agricultural and economic activities	50.00
11.2.6	Establishing crushes for the use of women labourers	0.35
<b>Task 12</b>	<b>Coconut-based enterprises and integrated farming</b>	
12.1.1	Supporting a crash programme on re-planting diseased and low yielding palms	62.00
12.1.2.	Massive coconut revival programme for improving health and productivity	15.00
12.1.3	One-time support for establishing integrated livestock and crop production in garden land	4.5
12.1.4	Providing insurance cover to ducks - subsidy on premium.	0.05
12.1.5	Promotion of cluster based and market linked value addition- one time support to clusters for infrastructure	10.00
12.3	Paddy fish integration for economic and ecological security and farmers' training	2.00
12.3.6	The DoA-DoF- KAU jointly train and build the capacity of farmers	0.20
<b>B - II</b>	<b><i>Inland Fisheries based livelihoods</i></b>	
<b>Task 13</b>	<b>Actions to promote fishery wealth of Vembanadu <i>Kayal</i></b>	
13.1	Cluster based Cage –subsidy support	0.60
13.3	Ranching, involving large-scale hatchery-reared production of post-larvae	0.20
13.4	Fish hatcheries for raising adequate quality fingerlings	0.60
13.7	Fresh water prawn and <i>karimeen</i> urgent conservation measures	0.25
<b>Task 14</b>	<b>Promoting fishing infrastructure, capacity and fishermen welfare</b>	

14.1	Group based enterprise on ornamental fish culture	0.12
14.2	Cold storage facility for the fishing communities	0.30
14.5	Training and capacity building of fishermen and fingerlings production, improving sanitation and hygiene in processing units in Kuttanad	0.20
	<b>Sub Total</b>	<b>1503.75</b>
<b>B - III</b>	<b><i>Water tourism in Kuttanad and local ecology</i></b>	
<b>Task 15</b>	<b>Infrastructure support to facilitate responsible tourism</b>	
15.4	Introduction and promotion of farm tourism involving farm families	0.50
	<b>Sub Total</b>	<b>0.50</b>
	<b>Grand Total</b>	<b>1839.75</b>

## FRAMEWORK FOR IMPLEMENTATION

Implementation and monitoring of the recommendations and programmes for mitigation of farm distress and revival of agricultural process assumes higher importance to ensure that the financial resources are effectively and efficiently utilized to deliver the programmes and infrastructure recommended for the agricultural and ecological revival, enhancement of livelihoods and mitigation of distress to the farming community. The most important concern here is the compartmentalized functioning of not only departments under the government, but also the divisions within each department with no or rare coordination and cooperation. Hence a well-coordinated orchestration of all implementing agencies for *Kuttanad regeneration symphony* is very essential. It is recommended that the implementation set up with statutory back up may have a two level structure (see the flow chart on page 58). The ‘Kuttanad and Alappuzha Prosperity Council’ (KAPCO) chaired by the Chief Minister, may provide required policy guidance and monitoring of task implementation. The second tier set up is ‘Task Implementation Committee’ (TIC) chaired by the Chief Secretary, which may leverage all concerned government institutions under single command line for task implementation in right sequence and good coordination. It is desirable to provide statutory status to the special purpose vehicle created for task implementation, KAPCO and TIC. The recommendations are classified under tasks with indication of task-wise budget. The ‘Task Implementation Committee’ may include men and women of distinction in public life, representatives of farmers and fishermen’s institutions and main media institutions. Transparency in the business, accountability and work delivery on time frame to prevent cost over run are most important for task implementation.





# CHAPTER 1

## STRENGTHENING ECOLOGICAL SECURITY

This section is divided into two: the first part identifies the major factors of ecological decay that has caused considerable agrarian distress in Kuttanad and provides specific remedial measures for ecological redress. The health security of Kuttanad, which is closely linked to the ecological security, is described finally in this section.

### 1.1 Ecology

#### 1.1.1 The unique ecological character of Kuttanad

The Kuttanad floodplains comprise marshy low lying areas lying below mean sea level, coastal alluvial belt, uplands of higher elevation, river networks and backwaters, contributes to a unique ecology. The ecological character of the wetland is the capacity to provide a wide range of naturally occurring ‘ecosystem services’<sup>1</sup>. Its uniqueness is described below.

##### 1.1.1.1 Hydrology

Kuttanad Wetland System (KWS) is a part of the Vembanad Wetland System (VWS), which is a large estuary<sup>2</sup> stretching from the Kayamkulam *Kayal* in south to Cochin in the north, where it meets the sea. KWS is placed in the southern part of the VWS. It is a floodplain of 4 rivers, Pampa, Achenkovil, Manimala, and Meenachil. The Achenkovil-Pampa-Manimala River system feeds south and south-western parts of Kuttanad and the Meenachil feeds the eastern parts of Kuttanad. The Muvattupuzha River and the smaller Kariyar River feeds the Vaikkom area, which are in the north-eastern parts of KWS. These rivers confluence into the Vembanad *Kayal* or backwaters through a maze of water ways and canals, and flow in a south to north direction, and then travel further north towards Cochin gut or *thuramukhom*, to empty into the Arabian sea. There are several openings in the sandbars along the coast, through which the rivers drain into the sea. Permanent sandbars are called ‘*pozhi*’; temporary ones are called ‘*azhi*’ in local parlance.

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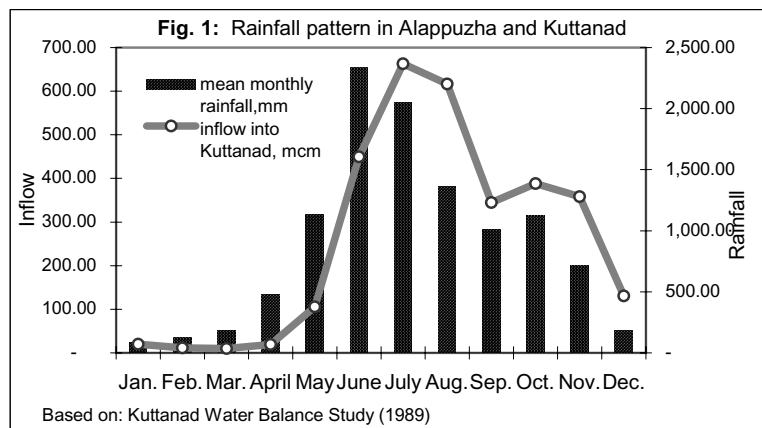
<sup>1</sup> Ecosystem Services are the processes by which the environment produces goods and resources that are necessary for human survival such as clean water, pure air, moderate weather conditions, wood for fuel, habitat for fisheries, pollination of native and agricultural plants, etc (Millennium Ecosystem Assessment, 2005. Ecosystems and Human Well-Being, Island Press: Washington)

<sup>2</sup> Partly enclosed coastal body of water in which river water is mixed with seawater. An estuary is thus defined by salinity rather than geography.

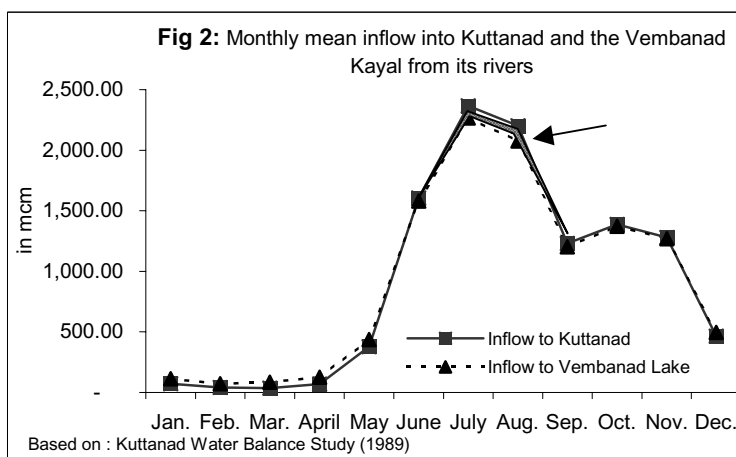
The floodplain<sup>3</sup> and the Vembanad Lake together make this the largest wetland ecosystem in the Indian west coast. This has been declared as a Ramsar site in November 2002<sup>4</sup>.

The rivers and the topography divide Kuttanad into three major ecological zones – highlands, lowlands and backwaters. Sandy beach ridges close to the sea have an elevation of 1.5 to 5 m above MSL. Upper Kuttanad has elevations of -0.5 m to +6.0 m MSL and elevations in lower Kuttanad areas range from -1.5 m to +1.0 m MSL. The backwaters or the *Kayal* lands are at elevations -1.0 m to -2.2 m MSL.

The northward flow of water is guided by the topography and is rapid at about 60m/km, in highlands and slow and placid, at about 1m/km, in low-lying areas. The average 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). The rainfall



data records the mean of values recorded at Alappuzha, Vaikom, Chertala and Kottayam for 34 years from 1955 (Fig 1).



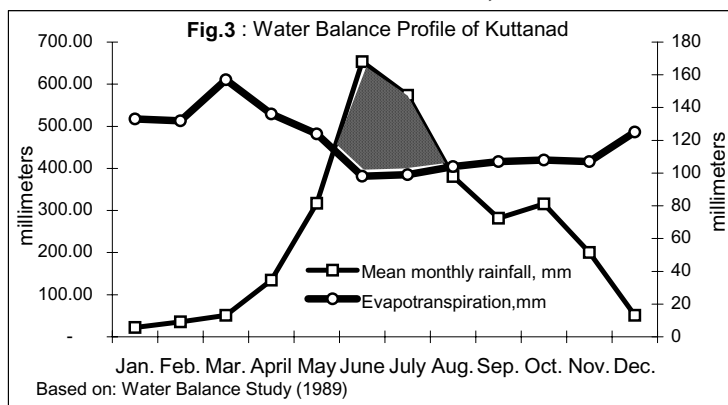
The six rivers together are estimated to bring in a total of 10,074 Mm<sup>3</sup> water into the Vembanad *Kayal*, 67 % of which is during the southwest monsoon and 12 % during the northeast monsoon. Pampa contributes the most to the total inflow. The

<sup>3</sup> A low plain adjacent to a river that is formed chiefly of river sediment and subject to flooding

<sup>4</sup> The Convention on Wetlands, signed in Ramsar, Iran, in 1971, is an intergovernmental treaty, which provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.

monthly mean of the inflow into Kuttanad during the period 1970 to 1988 is presented in Fig. 2. This Figure also shows that most of the inflow into Kuttanad finds its way to the Vembanad Lake, which makes the Vambanad *Kayal* a massive freshwater body. During the months of June to November, the inflow into Kuttanad exceeds the inflow into the Vembanad Lake (*shaded portion* in the Fig. 2). The mean value of this excess water is about 302 mcm. This excess water reaches maxima during July (100 mcm) and August (125 mcm). The flow of this excess water is possibly southwards to Kayamkulam *Kayal* and westwards through the Thottappally Spillway (TSW) to the sea. This information is relevant as a prelude to the analysis of the flood-flow capacity of the TSW, where water is engineered to flow westwards.

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. This inflow is about 264 mcm during the 6 months, with the peak 21 % and 22 % of the inflow during April and May, respectively. A study of rainfall and evapo-transpiration<sup>5</sup>

shows that the actual wet season in Kuttanad is only about 3-4 months, from mid-May to mid-August (indicated by shading in Fig 3). The rest of the months are water deficit periods. During this period, tidal influx raises and lowers water levels in Kuttanad by 1.22 m within 6 hrs and this brings saline water influx into the Lake. There is considerable seasonal intermixing of saline and freshwater in Kuttanad and this dynamics vary from year to year, depending on the rainfall, its distribution and the inflow from rivers. From January to April-May, Kuttanad turns into a large brackish water expanse.

Three important ecological characteristics can be drawn from its hydrological regime. They are,

- i. **The water spread area** of the KWS includes backwaters, canal networks and paddy polders. This defines the hydrological carrying capacity of the wetland. The ecosystem

<sup>5</sup> Process where moisture is returned to the air by evaporation from the soil and transpiration by plants

services emanating from this are flood mitigation, drought control, soil fertility renewal through silt deposition and ground water recharge. The Central Water Commission has identified 20 springs in the Meenachil River basin and 7 in the Manimala River basin.

- ii. **The cyclic and seasonal tidal mixing of saline and fresh water** permitted by the low-lying terrain of the KWS is the third ecological character. This gives rise to widely fluctuating salinity conditions, which serves important ecological functions as a natural cleanser of accumulated wastes in the water body by detoxification and decomposition. This also helps in expunging waterweeds. The bactericidal property of saline water is known to purge pathogenic bacteria and to protect human and animal health. Several agricultural pests find it difficult to adjust to the fluctuating salinity conditions and their life cycle gets disrupted.
- iii. **Unobstructed and free flowing water to the sea** facilitates the washing out of accumulated wastes, minimises excessive silting and clogging of water canals, maintains the depth of the *Kayal* and canals, and permits easy navigation through them. Furthermore, the Vembanad *Kayal* is a part of a larger inter-connected network of estuaries starting with Kayamkulam in the south and extending to the *Kol* lands in the north. The network also is connected to sea at multiple points. This connectivity is vital and is maintained by a free exchange of water among them. This wetland continuum provides important economic connectivity between the south and north parts of Kerala and this is vital for the economic development Alappuzha.

#### **1.1.1.2 Origin of Kuttanad**

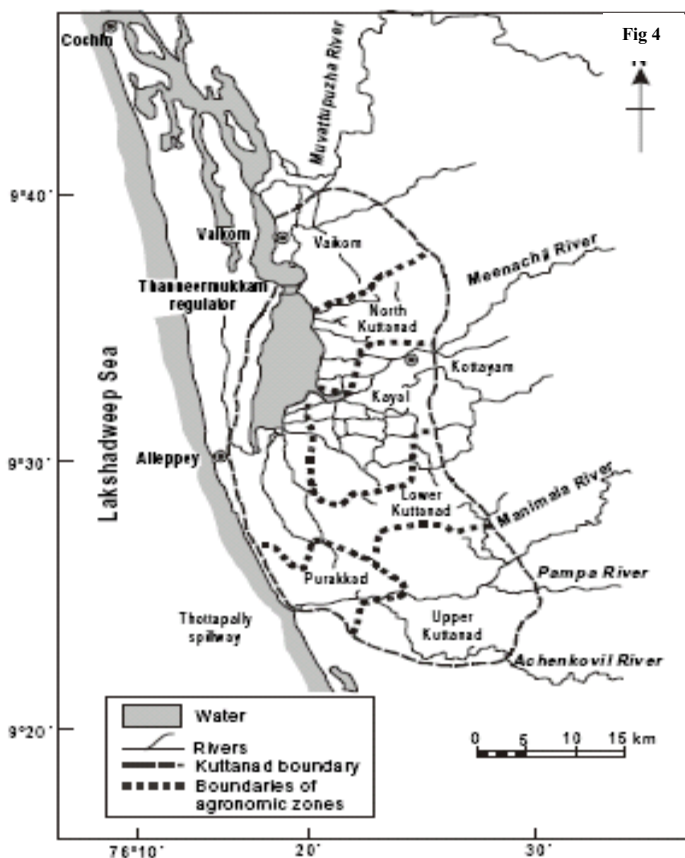
The name 'Kuttanad' denotes the low-lying lands. The enchanting backwaters of Kuttanad hold immense economic importance. There are two major hypotheses on the origin of Kuttanad. According to the widely agreed hypothesis, millions of years ago these lands were forest and during a geological event, the Arabian Sea advanced up to the foot of Western Ghats in many places, submerging these areas. Years later there were upheavals and recession of sea, during which the trees of the entire forest that was under submergence got uprooted and buried 'in situ' under varying levels of silt to give rise to the low-lying marshy saline lands of Kuttanad. Soils of these areas have vast organic deposits, fossils of timber and shellfish in varying depths.

### 1.1.1.3 Land use in Kuttanad

A unique land use becomes the fourth ecological character. Kuttanad is a flood plain. Kuttanad is divided into four zones on ecological basis and six zones on agro-ecological basis. The land use is a distinguishing feature of a wetland from which diverse livelihoods have emerged. Paddy is the most suited land use for livelihoods in the floodplains, although its predominance as a major land use component is declining. Cultivated paddy lands represent 26 % of the current land use pattern. Similarly fishery is the most logical water based livelihoods in the water body. The most suited form of transport is water based. Houseboats and water tourism have evolved based on the use of water for navigation and recreation.

Kuttanad has an area of 1,10,000 ha, which is divided into four ecological zones. These with approximate area are the Garden or dry land (31,000 ha), Wetland (11,000 ha), Reclaimed land situated below sea level (55,000 ha), and Water bodies including lake, canals, etc (13,000 ha). It is divided into six agro-ecological zones as shown in Fig 4.

Fig 4: Agro-ecological zones of Kuttanad



The garden land is elevated region situated at 0.5 to 2.5 m above MSL, where predominant crops are coconut, cocoa, tapioca, banana, pepper and vegetables. The dry lands do not suffer from floods or from saline water intrusion. Wetlands areas are waterlogged low formations measuring 66,000 ha and located either above MSL or 0.60 to 2.20 m below MSL, reclaimed from the surrounding backwaters for paddy cultivation. Of this, 55,000 ha area below MSL is known as *punja* lands. These polders reclaimed from *Kayal* area with an outer or ring bund are made into cluster of fields called '*Padasekharams*'. Remaining 11,000 ha of

wetland is relatively elevated and forms part of Upper Kuttanad. These lands suffer less frequently from floods and not affected by salinity intrusion. The *punja* land located in Kuttanad is further classified as *Karappadam land* (33,000 ha), *Kayal land* (13,000 ha), and *Kari land* (9,000 ha). *Karappadam* lands are areas of alluvial soils situated along waterways and constitute the lower reaches of the eastern and southern periphery. *Kayal* lands constitute *padashekharams* recently reclaimed from the Vembanad Lake with elevations between 1.5 to 2.2 m below MSL. *Kari* lands areas have black peaty acidic soils located at or below MSL to the north (Vaikom) west (Cherthala) and south-west (Purakkad) of Kuttanad. The soil in Kuttanad is a mixture of silt and clay in varying proportions and that in most of the low lying areas is generally highly acidic and contains toxic salts.

#### 1.1.1.4. Biological diversity

The endemic flora and fauna of the region is the fifth ecological character of the wetland. The large water expanse and the unique intermixing of saline and freshwater make the Vembanad estuary an ecotone, in other words, an interface between land and sea and between fresh and saline water. The ecotone is a large repository of migratory fishes and birds. The brackish water environments promote a rich diversity of mangroves, which used to abound in the area and provide ideal habitats for a diverse flora and fauna. The 11 km long stretch of mangrove vegetation still found close to Kumarakom supports a diverse array of mangrove and mangrove associates (Box 1). Some of the rare mangrove species such as *Excoecaria agallocha*, *Bruguiera sexangula* are reported to be found here. The fish species have been reported to change with the widely fluctuating salinity conditions of the KWS. During summer months there are more species adapted to increased salinity conditions and freshwater species tend to dominate during the monsoons.

**Box 1: Mangrove and associated species reported in the bird sanctuary in Kumarakom**

*Acanthus ilicifolius*, *Acrostichum aureum*, *Ardisia littoralis*, *Avicennia officinalis*, *Barringtonia racemosa*, *Bruguiera gymnorhiza*, *Cerbera odollam*, *Iroderodendrum inerme*, *Derris trifoliata*, *Dolichandrone spathacea*, *Excoecaria agallocha*, *E. indica*, *Flagellaria indica*, *Heritiera littoralis*, *Hibiscus tiliaceus*, *Kandelia candel*, *Viscum orientale*, *Morinda citrifolia*,

*Pandanus fascicularis*, *Pongamia pinnata*, *Premna serratifolia*, *Rhizophora apiculata*, *Sonneratia caseolaris*, *Stenochlaena palustris*, *Terminalia catappa* and *Thespesia populnea*. The epiphytic *Dendrophthoe falcata*, *Viscum orientale*, *Stenochlaena palustris*, *Terminalia catappa*, *Thespesia populnea*, and *Dendrophthoe falcate*

The lake also serves as home to several migratory and predatory birds that feed upon the aquatic species. Pathiramanal island is reported to be a sanctuary for several species of

mangroves, birds and fish species (Box 2). The KWS is known to be a part of the 'Central Asian-

Indian Flyway' for migratory birds. The Ramsar Information Sheet provides an expansive list of mangroves, mangrove associates, fish fauna, avifauna of Vembanad wetland<sup>6</sup> and their ecological importance. KWS is an ideal habitat for variety of finfish, shellfish, and several varieties of prawns and shrimps. Many fish species depend on the wetland for food, spawning and nursery. *Horabagrus brachysoma*, popularly known as yellow catfish, is an endangered and cultivable species. The species has recorded a sharp decline in its catch and is now restricted to the riverine environs of the Vembanad wetland. Barracuda or Giant sea pike (*Sphyraena jello*), Pearl spot popularly known as *Karimeen* (*Etroplus suratensis*), the grey mullet (*Mugil cephalus*), Dusky-finned bulleye (*Priacanthus hamrur*), milk fish (*Chanos chanos*), fresh water catfishes, etc. are some of a few species found in the KWS.

The Vembanad *Kayal* is well known for its clam resources, live and as sub-fossil deposits. The black clam (*Villorita cyprinoids*) is the main resource, which contributes to about 67 % of the clam fishery. The other species of clams found here are *Meretrix casta*, *Paphia malabarica* and *Sunetta scripta*.

The estuarine zone plays an important role in the life cycle of many shrimp species and the entire Vembanad wetland acts as nursery for important shrimps like *Panaeus indicus*, *P. monodon*, *Metapanaeus dobsoni*, *M. monoceros*, *M. affinis*, *Macrobrachium rosenbergii*.

The lake also supports a variety of birds, many of them are endangered, such as the IUCN red-listed birds *Pelecanus philippensis* and *Anhinga melanogaster*. Both resident and migratory waterfowl abound in the wetlands. The *Kayal* is home to the third largest population of more

#### Box 2: Biodiversity in Pathiramanal Island

Pathiramanal Island is located in the Vembanad Lake and forms part of Muhamma Panchayat in Cherthala taluk in Allappuzha district. It is about 1.5 km away from Muhamma boat jetty. The island has an area of 28.5 ha.

It has a soil profile of medium size sands with shell at the surface, clayey sand below up to 10 m depth and hard rock at below 35 m depth. The soil is acidic with high organic matter. The boundary of the island is tidal marsh with an area of 4.0 ha. Between these two zones lies the inter-tidal flat zone with a total area of 1.99 ha. Out of the 86 small canals or ditches identified; a main canal runs along the length of the island opening to the *Kayal* in both ends. A fresh water pond is also said to be present.

There is no inhabitation in the island. Tourists are permitted on the island as part of the Vembanad *Kayal* cruise. About 2 ha of land area is believed to have been under paddy cultivation in the past. The major vegetation is swampy groves making up 9.24 ha. Reports from plant diversity study indicate existence of 166 species including small mangrove species and mangrove associates close to the tidal marsh zone, climbers and a mix of commonplace plant species. A few rare species of plants including some medicinal plants are also reported. Animal species reported include 88 species of birds, 58 species of fishes, apart from several species of insects and others.

<sup>6</sup> Ramsar Information Sheet, <http://www.wetlands.org/RSDB/Default.htm> accessed 28/06/07



than 20,000 waterfowls that visit India during winter. Endangered species of waterfowl that have been identified are spot billed pelican, oriental darter, water cock and black billed tern.

#### **1.1.1.5. Cultural diversity**

The ecological character is tightly linked to the local socio-culture and local livelihoods. The unique ecology of KWS has supported a multiplicity of enterprises based on inland fisheries, paddy, coconut, and several other allied enterprises. Kuttanad had created and nurtured several cultures while evolving different economic activities. Thus, the *punja* paddy has not just been a crop of economic importance; rather the '*punja vayal* (paddy land), the *punja krishi* (cultivation) and the *punja vayal koyithu* (harvest)' and its unique style of collective-management has been a socio-cultural stamp of Kuttanad. Similarly, the *aattu konju* and *karimeen* have not just been a part of Kuttanad's biodiversity but also a part of Kuttanad traditions. It is quite evident that the traditional social fabric and institutions have emerged from the ecological character of Kuttanad, which in turn had been safeguarding it well. These institutions have overseen the proper utilisation of resources. Art and music of Kuttanad woven with its scenic beauty have touched many a hearts. The canal network and vibrant water transportation had served to build a flourishing economy since historic period. Little wonder that Alappuzha was known as the *Venice of the East*.

However, changing social and cultural traditions, demographic pressures and the challenges of economic development have resulted in multifaceted change in the ecological character of Kuttanad, making it a serious source of concern. This has in turn upset traditional beliefs, institutions and means of livelihoods. For example, human health, locally and all across the region, has become severely endangered with the ecological degradation of Kuttanad. The mindless exploitation of KWS has turned the table wherein an abused ecology is on its onslaught to endanger human and animal health and to wither away human livelihoods.

It is in this context that Vembanad *Kayal* has been identified as a wetland of Ramsar to strengthen the critical nature of the wetland and to protect its ecological character for conserving the natural biodiversity and safeguarding the livelihoods of the people (Box 3). To save Kuttanad out of its present ecological, economic and social crisis is a very important national responsibility, which cannot brook any delay without inviting far more human misery, distress and natural calamity.

### 1.1.2. Ecological decay

Any disruption to one or more of the five basic properties of the wetland can alter the ecological character of KWS. A close examination of these basic features *vis-à-vis* the development pathway followed by Kuttanad gives a defining vision on the major drivers of change. A conclusion easily reachable is that Kuttanad's

#### Box 3: Guidelines of the Ramsar Convention on Wetlands

The guidelines of the Ramsar Convention on Wetlands have spelt out for conservation and wise management of wetlands. The first step under the Ramsar guidelines is to undertake ecological restoration programmes. Here efforts must focus on restoration of the natural ability of wetland to detoxify wastes, control floods, restore soil fertility, expunge weeds and purge pollutants and destroy disease causing organisms and support a diversity of aquatic and bird lives. Since the wetland and the floodplain is inter-connected with the rivers, aquifers and the sea, the management of the wetland goes hand in hand with river basin management, groundwater management and coastal zone management.

The Convention recognizes the multi-sectoral nature of water resources development involving different socio-economic groups and the multi-interest utilization of water resources such as water supply and sanitation, agriculture, industry, urban development, hydropower generation, inland fisheries, transportation, and recreation. The Ramsar guidelines state that people are an important part of the ecology and their livelihoods are an important contributor to the economy of the region. The guidelines specify close participation, monitoring and decision-making, and effective mechanisms for conflict resolution, involving all those who hold a stake in the development of the wetland

developmental agenda heavily conflicts with its ecology and the latter is pushed to a state of *ecological fatigue*. The different factors responsible for this state are explained in this subsection.

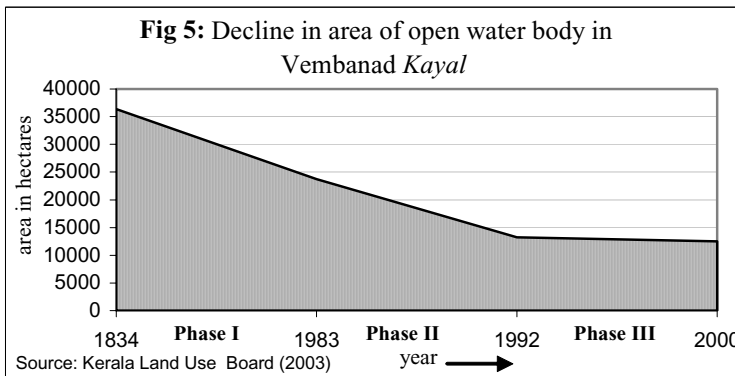
#### 1.1.2.1 Anthropogenic pressure on natural resources

Alappuzha district, which spreads out to 57 % of the KWS has the highest population density in Kerala. The district, according to the census, 2001 has population density of 1,492 persons/km<sup>2</sup>, while the same for Kerala is 819 persons/km<sup>2</sup>. The region experiences enormous pressure on the natural resources to meet daily requirements such as drinking water and other infrastructure such as land for housing, roads and commercial establishments. The dense habitation also aggravates the ecological and health problems. They also pose greater challenges in providing remedial solutions and urban planning may require the immediate attention from policy makers.

#### 1.1.2.2 Reduction in the water spread area of Kuttanad

There is a rapid decrease to the water spread area of the Vembanad *Kayal* and its backwaters, lagoons and canal networks, due to large scale and cumulative reclamation of water bodies and paddy lands for developmental purposes. The Vembanad *Kayal* is shrinking from its land boundaries and from its lakebed.

The water spread area of Vembanad both in terms of square area and cubic area has substantially decreased over the last 100 years. It is now a mere 1/3<sup>rd</sup> of its original size (Fig.5). In 1834, before agriculture started in Kuttanad, the original expanse of *Kayal* was 36,329 ha; this reduced to about 23,750 ha in the year 1983. Observations in 1992 revealed only 13,224 ha and this further declined to 12,504 ha in the year 2000. The annual rate of decline during the first phase

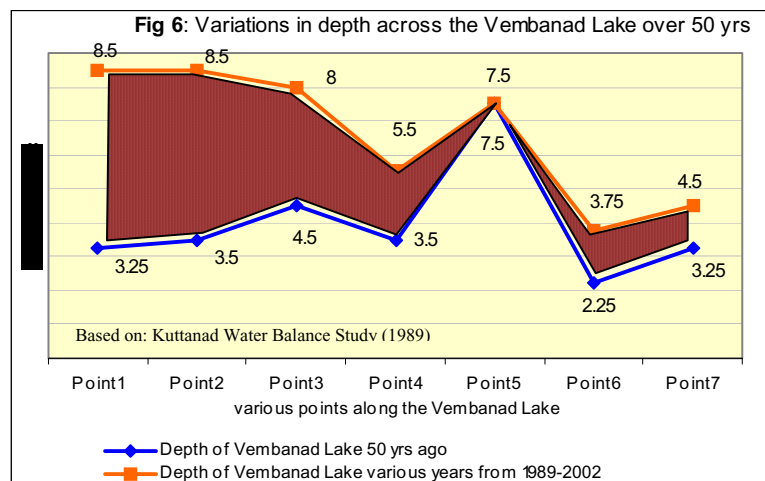


(1834-1983) was 0.23 %, which during the second phase (1983-1992) increased to 4.93 % and to 0.68 % during the third phase (1992-2000). Similarly, the depth of the *Kayal* is also decreasing. Survey across selected points in the

*Kayal* over 50 years showed that the *Kayal* bed is getting filled up and becoming shallower.

This process appears to have hastened after the erection of the Thanneermukkom Barrage (TMB) particularly its cofferdam. The depth of the Vembanad *Kayal*, measured at several points showed considerable decline (Fig. 6). The water carrying capacity of the system is reported to have reduced from 2.4 km<sup>3</sup> to a mere 0.6 km<sup>3</sup>, a decline of 78 %.

Reclamation for agricultural intensification and encroachment of Vembanad *Kayal* for constructing houses, tourist resorts and other commercial buildings is believed to be a major factor for unregulated reclamation. With a declining interest in paddy cultivation several alternative developmental



agenda have sprung up, chiefly tourism and the construction industry. Silting and dredging for lime shell mining and sand mining have changed the cross section of *Kayal*, paddy lands, waterways and riverbeds considerably. Silting, together with encroachment, reclamation and

clogged waterways, has been shrinking the carrying capacity of water in Vembanad *Kayal* and waterways. This is reflected in the increasing frequency of floods.

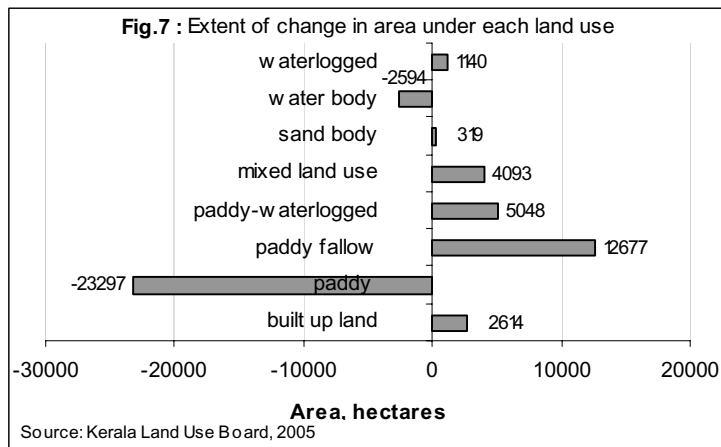
The Vembanad *Kayal* has been subject to severe and continuous dredging, mainly for white clam and silt. Rani and Chithira *Kayals* alone are believed to have white *kakka* deposits worth Rs 30 crores. Continuous mining of lime shell (white *kakka*) causes considerable harm to the aquatic biota and their support systems in the lakebed, especially fishes and clams, and is often treacherous to navigation. Dredging also has impacted the livelihoods of fishing community, particularly the black clam collectors as several fishermen are involved in collecting black *kakka* from *Kayal* bed as a means of livelihoods.

Sand mining is flourishing in the area in the wake of a booming construction industry. Rivers, paddy lands, and *Kayals* have been subject to sand mining and clay mining for brick making. It is said that sand is lifted from 23 sand mining locations (*kadavus*) from Pamba River bed. An example from two locations Edathikavu *Kadavu* and Pandanad reveal that a total of 2,044 m<sup>3</sup> of sand is lifted daily from the river. This amounts to an average of 4,08,800 m<sup>3</sup> of sand mined away annually as against an annual replenishment of 17,734 m<sup>3</sup>. Sand mining in rivers affects the quantum of water brought down to the Vembanad *Kayal*. In the Upper Kuttanad and Onattukara regions spread around Niranam, Kadapra, Mannar and Budhanur and in many other parts of Alappuzha district, fertile paddy lands have been contracted out by the brick industry. Annual extraction of clay from these four panchayats is more than 65,000t. Clay mining could also have adverse impact on water flow and this connection needs to be explored further.

It may be noted that the boundary of the Vembanad *Kayal* and many of the major canals and waterways is not physically demarcated. In the absence of this, measures to prevent reclamation activities cannot be taken. Such demarcation along with satellite mapping of boundary is important to save the *Kayal* and waterways. Along with this, creation of an ecotone of 4-6 m width around the *Kayal* periphery may help in checking encroachment and reclamation. This band of land may be clearly demarcated with landmarks. As this land is already in private possession, care should be taken not to dispossess the land from its present owners. In the case of non-commercial ownership like farmers and residents, the land may be allowed to be enjoyed by them as before. In the case of commercial users, the land may be given to them on a 30-yr lease with provision for renewal. No construction for commercial purposes may be allowed in the

ecotone area. The ecotone may be planted with local vegetations, particularly coconut, preferably avoiding dwarf varieties, and mangrove. An evaluation on the carrying capacity of the *Kayal* so as to estimate the quantity of dredging it can support appears to be essential.

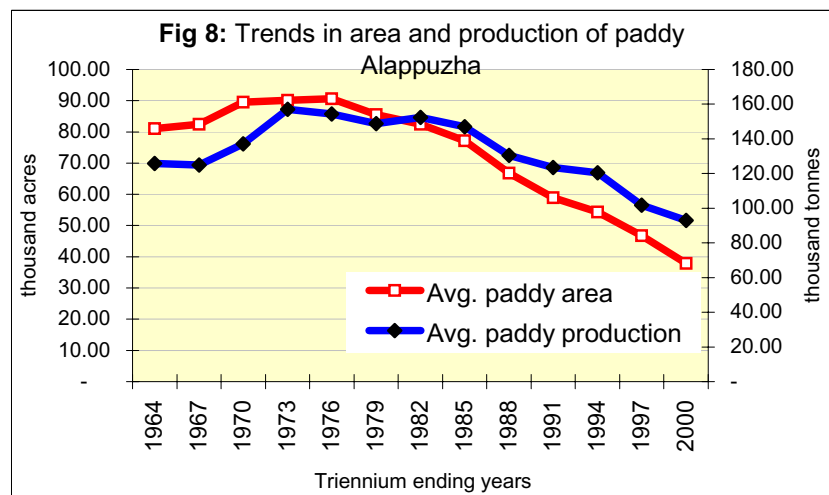
### 1.1.2.3 Changes in Land use and declining paddy area



A comparison of the land use pattern of Kuttanad region in 1967, seven years before the erection of the TMB, and in 2003, and 30 years later, using remote sensing with ground-truthing, shows considerable change (Fig 7). The net area under water bodies of the Vembanad *Kayal* and its associate river

systems and channels has declined by 11.4 %.

This comparison brings out that predominance of paddy in the land use is weakening. During this period, 20 % of paddy lands have become fallow lands, another 8.3 % had become permanently water logged. Many of these neglected paddy lands have naturally evolved into a dense scrubland; some of them have lost their depth as they get filled with gravel, silt, and plant debris. Weeds have also overgrown in adjacent water canals, promoting silting so that the land mass and the canal adjacent to each other look alike. The net built up land has increased by 185 %. It is not clear how much of built up land have been recovered from paddy and the water bodies. The public memoranda received are replete with examples of resorts, homes and roads that



have taken up paddy lands. Visits made to Onattukara and Kuttanad regions gave ample proof to the above facts.

The land use change is reflected in paddy production. An analysis of data from 1960-61 to 1999-2000 for trends in paddy area and production shows that paddy area in Alappuzha has indeed increased from 1968-69 till 1975-76 upon which it started declining slowly initially till about 1985, and more steeply afterwards (Fig 8). By the year 2000, the area appeared to have reduced to one-third of the peak area in 1975-76. Production of paddy had peaked at about 1.4 lakh tonnes/year during the decade 1971-72 to 1981-82, and the production decline started afterwards. This phase coincides with the spread of high-yielding paddy varieties which appear to have been the chief factor for the observed increase in paddy production. The increase was facilitated, no doubt, by the confidence that saline intrusion would be reduced by the TMB. To this extent, it appears that the barrage did accomplish what it set out to do – agricultural intensification.

It appears the major decline paddy area and production started from 1983, almost 10 years after commissioning the TMB. This decline, in the case of Kuttanad, cannot be attributed solely to the TMB. Other important factors contributed to the decline could be the land reforms, acute labour shortage, rising conflicts between fishermen and farmers, increased availability of rice for import from neighboring states and its supply through the universal PDS. Changes in the policy focus of the various governments also appear to have influenced decline in paddy production. Land reforms and redistribution substantially declined the size of many holdings making them economically unsustainable for cultivation under Kuttanad situation. These changes happening gradually until the 1990 appeared to have accelerated during the post- economic reforms period. One wonders, whether, under a business-as-usual scenario, it would be economically viable to continue with paddy as a major land use, say, by the year 2020.

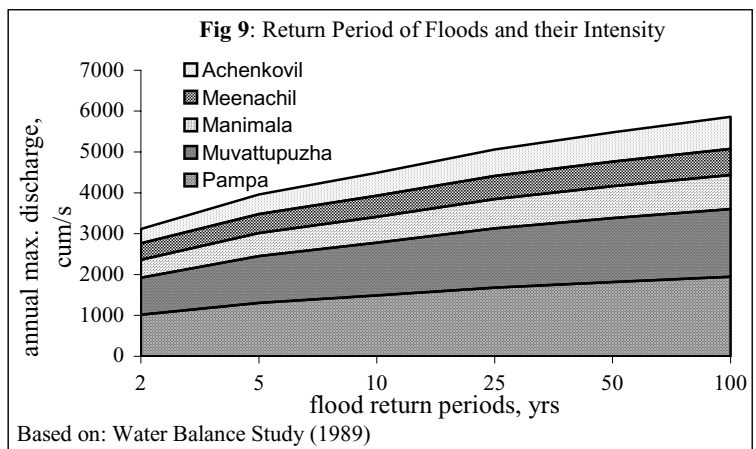
The change in land use is alarming and poses serious questions on the ability of the floodplain to contain the floodwater carried down by the rivers twice a year. The danger in allowing further decline in paddy to the food security of the Kerala State has already been discussed in the section on agriculture. Misguided policies and misplaced priorities have also contributed to the change. What is needed is a mid-course correction and re-orientation to set in place a more ecology friendly policies and promotion of a land use pattern that is in harmony with the true nature of Kuttanad, while keeping pace with developmental objectives.

### 1.1.2.4 Recurring Floods

Floods occur regularly in Kuttanad during the southwest monsoon and rarely during northeast monsoon. Reduced water spread has resulted in more frequent and intense flood and drought

regimes that need specific attention for the ecological revitalisation.

Historic data suggest floods in Kuttanad have a return period of 2, 5, 10, 25, and 50 years (Fig. 9). Floods with a return period of 10-year and above are severe, whereas the regular floods with return period of 5-yrs and less are less severe. Floods that occurred in 1986 had a return period of 10 years and flooded the entire wetland. However, it appears that during recent years, floods occur every year and they are major destructive force and a terrifying experience.



The first devastating flood that affected the entire State was in

1924. Afterwards the year 1961 witnessed heavy floods. Since then floods were recorded in the years of 1968, 1975, 1981, 1985, 1986, 1989, 1992, and 1994. Limited flood affecting Kuttanad

**Box 4: Alappuzha district reels under floods**

Alappuzha is reeling under one of the worst floods in the district in the last 16 years, with 1,34,000 people being evacuated to 664 relief camps in Kuttanad, Mavelikara and Chengannur taluks. The number of people living in these camps and depending on gruel centres for food stood at 1,75,640, out of which 1,22,958 were in Kuttanad. Till Friday, 212 houses have been completely damaged and 9,494 houses partially damaged. Most of the damage was reported from Chengannur where 92 houses were partially damaged. In Cherthala, 34 houses were damaged partially and the number was 20 in Mavelikara. The toll was 17 at Ambalapuzha and nine at Karthikapally.

Strong currents aided by increased water flow from the high ranges along with non-stop rain shattered bunds at several areas in Kuttanad, damaging paddy worth crores of rupees and sweeping off an entire house in Kainakary.

In Kainakary, Aarupanku and Cheru *Kayal* paddy fields and houses alongside the canals in the area were among the worst affected, with water rising to more than six feet in some areas. Meanwhile, residents of Kainakary and other areas in Kuttanad are slogging round the clock to repair the breached bunds and to prevent further breaches. Near Aarupankukara, where a breach swept away a house, two more houses on either side of the breached bund are facing the threat of being washed away.

*(Reported in 'The Hindu' on Jul 21 and 22, 2007)*

area also occurred in the years of 1964, 1971, 1978, 1996 and 1998. Kuttanad floods are devastating on paddy, fisheries, human lives and property. The most recent flood in 2005 caused several casualties in Kuttanad (Box 4). The importance of protecting Kuttanad flood plain, regularly maintaining and

protecting the floodwater carrying capacity of all waterways and interfering in the flood flow with developmental projects discussed above are stressed here.

### ***The Thottappally Spillway and flood control***

The Thottappally spillway cum regulator (TSW) was envisaged to divert excess floodwaters brought by Pampa and Achenkovil directly to Arabian Sea (Box 5). It was expected to engineer flow of 1/3<sup>rd</sup> of floodwater from the Pampa to westwards. The floodwater diversion capacity of the TSW, however, is far lower

than the proposed plan, largely due to structural and maintenance reasons. Inappropriate implementation of this project, like in the case of TMB, had resulted in near failure of this scheme. The main issues that were brought during the stakeholder consultations are the poor state of the spillway which was built 56 years before, inefficient operation of its shutters and the decreasing water carrying

#### **Box 5: The Thottappally spillway cum regulator:**

The Pampa-Achenkovil-Manimala system discharges about 189,000 cu.ft/s during the peak monsoon season from July to August. Veeyapuram is the confluence point of these rivers. In 1949, the then agriculture minister, E. John Phillipose and the Executive Engineer, Irrigation Department, P.H. Vaidyanathan envisaged a spillway cum regulator to divert floodwaters from Veeyapuram to the sea at Thottappally. The TSW is 60 m wide and 1290 m long with 40 gates, each 7.62 m wide giving a total clear width of 305 m. The sill is 2.15m below MSL. The TSW has been designed to discharge 64,000 cu.ft/s of floodwaters, which is one-third of the floodwater at Veeyapuram. A leading channel, 9 km long and 1200 m wide was originally planned from Veeyapuram to Thotappally to divert the floodwater. However, it was constructed to the desired specification only for about 1 km, the remaining continued to be not more than ½ the desired width. A sand bar blocks the outlet to the sea at Thotappally at the beginning of the flood season which helps in checking saline intrusion during dry months. Sandbar with a height of 2m above MSL keeps forming, blocking spillway opening to the sea. This is manually cut when the water level reaches an elevation of 0.70 m MSL. This opening, under the force of floodwater, gets scoured up to 8m deep and 90m wide within a period of 24 hours. The spillway is left open during June to December.

capacity of the leading channel due a variety of reasons. The spillway gate system is based on very old technology and this prevents its quick opening. A few shutters were damaged during the Tsunami that struck Kerala coast in 2004. The leading channel to the TSW remains a permanent bottleneck.

The net effect is that floodwater carrying capacity of the channel and the spillway is now less than 30 % of its proposed capacity. The annual removal of sand bar is quite expensive.

There is a need to modernize the gate system and its operation to make it efficient under the given circumstances. Deepening of the leading channel, all along and strengthening its side bunds from frequent collapse are some of the requirements of local farmers for minimizing



breaching into their paddy fields and advancing the interest of agriculture and their livelihoods. Farmers of Purakkad also requested to build an over-bridge across the 60 m wide over the National Waterway canal at Kannittakadavu for providing connectivity to many isolated *padasekharams*.

The operational problems put forth by farmers of Purakkad *Kari* area and local community are (i) delay in cutting open the sand bar due to complex bureaucratic exercises being followed every year so that sand bar removal does not always happen before the monsoon floodwaters cause damage, (ii) farmers wanted their due representation in the official committee which decides on sand bar removal and management of the TSW, (iii) the opening and closing of spillway shutters being managed by the Mechanical division of Irrigation Department are not done in synchrony with the needs of the farmers causing serious damages to the crop and farming infrastructure, (iv) the office controlling the governance of TSW is located in Kollam district and this contributes to the administrative delays in timely action on the operation of the spillway, and (v) there is a need for proper redesign of the spillway with consideration to alternate location for effective discharge of floodwater to the sea, when the sea level is higher due to monsoon activity.

#### **1.1.2.5 Blocked connectivity to the sea and mismanagement of salinity intrusion**

Saline water enters Kuttanad from (i) the Cochin gut through Vembanad *Kayal*, (ii) Kayamkulam through Thrikkunnappuzha, and few other canals, and (iii) the seaside through the Andhakaran *Azhi*, a temporary sand barrier between backwater and sea at Pattanakkadu, and a few canals.

The entry of salinity from Cochin gut is checked at Thanneermukkom (Box 6). About 32,000 ha *punja* area in the *Kayal lands*, Lower Kuttanad and North Kuttanad, as well as about 8,100 ha second crop area in *Kayal lands*, Lower Kuttanad stands to benefit from the TMB. *Kari lands* northeast to barrage (near Vaikkom), about 7,750 ha, are still affected by saline intrusion, as the barrage does not address these areas. *Kari lands* in Purakkad area (south), another 3,500 ha, are not affected by saline intrusions from Vembanad Lake.


The existing saltwater entry regulators from Kayamkulam *Kayal* at Thrikkunnappuzha from the sea at Pattanakkad is at Andhakaran *Azhi*. Barrages at Thrikkunnappuzha are provided with locks to facilitate navigation. They fall in the proposed National Waterways No.3. The salinity

intrusion through Thrikkunnappuzha and few small canals linking Kayamkulam backwaters affects the Purakkad *Kari* area. Some of these inlets from the Kayamkulam *Kayal* are Kannukali Palam *Thodu*, Danapadi *Thodu* and Kottaravalavu *Thodu*.

The major issue at Thrikkunnappuzha lock is that the existing functional lock is 30 ft wide and the second non-functional lock is only 20 ft wide. It had been remaining non-functional for long

**Box 6: The salinity barrier in the North: the Thanneermukkom Barrage**

The TMB, located at Thanneermukkom, 25 km north of Alappuzha is built at a narrow region of Vembanad Lake, between Vechoor in east and Muhamma in west. The TMB was planned to be of 1402 m long, with 93 shutters, all of them electricity operated. The TMB was commissioned to prevent saline intrusion from Cochin gut into a part of Vembanad Lake, where paddy cultivation is practiced to protect the crop from damage



due to saltwater intrusion.

The plan was to build the TMB in three phases. The first phase at Muhamma comprising 31 shutters and two locks for navigation was completed in 1968. The second phase at Vechoor-end with 31 shutters and one lock was completed in 1974. When the work on the third phase with 31 shutters was delayed, a cofferdam was erected in 1975 to stop the saltwater flow. The expected benefit from TMB was safe *punja* paddy and intensification to a second crop (*virippu* crop) in about 18,500 ha of *Kayal* and Lower Kuttanad. The barrage does not address saline intrusion problem of Vaikom *Kari lands*, about 7,748 ha, northeast to barrage. Purakkad *Kari lands* having an area of 3,500 ha are not affected by saline intrusions from Vembanad Lake.

time. Both these locks are old and obsolete. Its management is also unsatisfactory and this allows saltwater intrusion into Purakkad *kari* area. Another related issue is that, due to the formation of Valiyazhekkal harbour, salt water entry through Kayamkulam *Azhi* has increased, and neither the Thrikkunnappuzha lock in its present state nor the various *orumuttus* are effective in checking salt

water intrusion.

Salinity intrusion also takes place through several inlet points in Aroor and Thuravoor, such as at Penadi, Pulively, 16<sup>th</sup> mile *thodu*, 19<sup>th</sup> mile *thodu*, Pallithodu, Kandakkappally, Achuthengumthara and at Viyathra. The regulators at Andhakaran *Azhi* do protect a considerable area from salinity intrusion. Furthermore, all these points are provided with temporary salinity barriers, called *pulimuttu* or *orumuttu*. The temporary *orumuttus* are periodically constructed by the minor irrigation department with the help of concerned panchayats and this involves recurring expenditure and usually this work does not happen on time. An example is the 110 m long *orumuttu* constructed every year across the Kariyaar River in Kottachira in Vaikom *Kari* area. These demand renovation and widening of Thrikkunnappuzha lock as well as the regulators

and installing of modernized permanent spillways/regulators in the place of all major *orumuttus*. Today, when the threats of climate change and sea level rise loom large, the importance of retaining and strengthening the salinity barriers for the safety of Kuttanad and its farming system cannot be overemphasized. Yet, the relevance of minimum closure also needs to be stressed to facilitate fishing.

### ***Issues related to the opening and closing of the TMB***

The unscientific operation of the TMB and other salinity barriers to safeguard rice cultivation appears to have blocked the connectivity of the *Kayal* to the sea for a good part of the year. This has severely affected the ecological characteristics of KWS and restrained the seasonal intermixing of fresh and saline water and thereby interfering with the natural cleansing mechanisms of wetland and threatening accelerated loss of habitats and biodiversity.

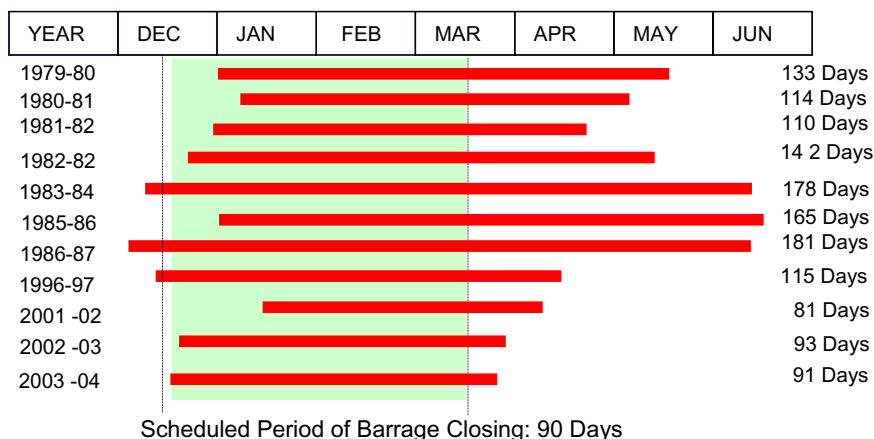
There are several management issues surrounding the opening and closing of shutters of the TMB. From interactions with people and site visits, it is gathered that most of the shutters remain corroded and mal-aligned by several years of exposure to salinity and wave action so that considerable force is necessary to open them. Mechanical opening of the shutters takes a week to 10 days, which creates considerable delay in either flushing out floodwater or preventing saline water intrusion.

Another important issue associated with TMB is the deviation in the construction from its original design with the erection of the cofferdam at central section. This has changed the cross section of the Vembanad Lake at its deepest central part.

Yet another important issue is the period of closure of TMB. Due to protracted *punja* sowing and harvest, the TMB is required to be kept shut for varying period extending up to 6 months (Fig. 10). Delay in effective flood control and other factors, which in turn delay *punja* season agricultural operations causes cascading delay on opening of shutters. The long closure severely affects the fishery as well as the livelihood of fishermen. This creates constant conflict between the fishermen and farmers over opening and closing of the shutters. The Committee, headed by Dr E.J. James, appointed by the Government of Kerala, had recommended in 2002 closure of TMB only for 3 months, from 15 December to 15 March every year (Fig. 10). A good many

memoranda received from the general public and farmers have suggested strict adherence to the closure eriod of Dec 15 to March 15 and completion of the third phase of the TMB. Fishermen

**Fig. 10:** TMB Operation schedule across Years



Based on: Kerala Land Use Board, 2003

groups have also largely supported these views excepting a few who wanted the TMB shutters completely open all the time. Those that have held their views on minimum closure of the TMB have also proposed that fishermen during this time be paid some sort of a compensation for loss of catch due to the closure of the TMB shutters.

People have also mentioned that there is need for coordination among the several government departments who are involved in the maintenance and operation of the shutters, canals and waterways, pumping water from paddy fields, promotion of agriculture and fishery. These are the Mechanical Division of the Irrigation Dept., the Major Irrigation Division, Minor Irrigation Division, the PWD, the Electricity Department, the Agricultural Department, the Revenue Department, the Meteorological Department, and the Collectors of concerned districts. Considerable coordination is necessary amidst conflicting interests of fishermen and farmers for

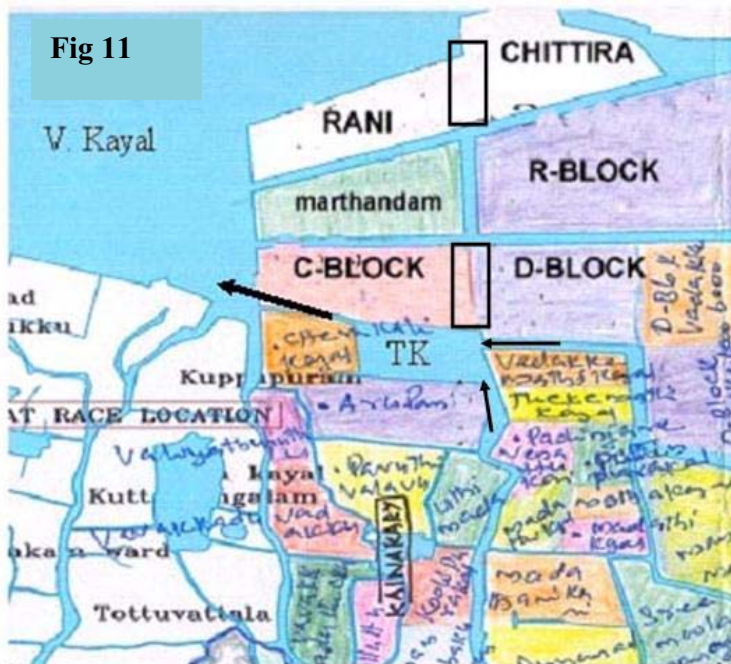
timely decision and quick action on opening and closing of the shutters of the barrage. This does not happen, causing more delay in execution.

This Committee received many memoranda from farmers, public and elected representatives for (i) removal of the cofferdam and building the third phase of the barrage, (ii) providing a 50 m wide lock and sliding passage in the middle section for futuristic navigational needs, (iii) repair or replacement of all shutters of the barrage using state of the art technology for rapid operation of all shutters in shortest possible time, (iv) deployment of electronic technology to monitor the water levels on both sides of the *Kayal* and computerized operation of the barrage shutters and its locks, v) regulated dredging in the central part of the *Kayal*, south of the barrage, to remove the silt which had accumulated due to the existence of cofferdam during last 30 and odd years.

### 1.1.2.6 Stagnant water caused and blocked waterways

Numerous encroachments, unscientifically constructed roads, bridges and culverts and aggressive spread of water hyacinth have blocked free flow of water along the natural waterways resulting in accumulation of wastes, promoting prolific breeding of predators, parasites and deadly pathogens, apart from obstructing navigation. Almost all the 500 and odd memoranda received by the Committee and many oral representations made by the public and institutions underscored the urgency for renovation and repair of the blockage and complete clogging of

most of the waterways throughout Kuttanad, Onatuukara and Pattanakkad area.



Water flow during monsoon towards the Vembanad *Kayal* also has been disrupted completely in several parts. Major contributions to this come from the obstructions created by few *padasekharams* in the *Kayal*. Two major obstructions for the rapid flow of water in the *Kayal* area brought to the notice of

this Committee and examined by it are in between the C and D Blocks in Pulimkunnu panchayat and the Rani-Chithira Blocks (Fig. 11). In the case of the C and D Blocks, floodwater reaching to Tharasu *Kayal* (marked TK in Fig. 11) from Pulinkunnu River (branch of Pampa-Achenkovil river system) and Kavalam River (Maniamala River) into the southern side of C and D block *Padasekharams* (marked with small thin arrow in Fig. 11) has flow into the Vembanadu *Kayal* through very narrow channel on the southern side of C Block (marked with the bold arrow in Fig. 11). The inflow to Tharasu *Kayal* is from two rivers having 1,000 m width and out flow from the Tharasu *Kayal* by canal of 80 m width. This causes flooding in the upstream of the canal and rivers causing regular breaching of the outer bunds of near-by *padasekharams* to the extent of about 4,000 ha. Most of the surrounding *padasekharams* are large in size, some of them measuring up to 970 ha.

The only possible solution to regulate this flooding and minimize continuous damage to adjoining *padasekharams* is cutting a wide canal in between C and D Block (marked with a square box in Fig.11). Similarly, creating a wide canal between Rani and Chithira *padasekharams* (marked with a second square box in Fig.11) and strengthening the canal side bunds would minimize the flooding at the R Block and the nearby Marthandam *padasekharam*.

All blocks to floodwater flow, major and minor, in all parts of Kuttanad and elsewhere in Alappuzha are man made with unscientific building of roads, bridges, culverts, townships and even railway tracks. While road construction in Kuttanad have enormously benefited the quality of life and helps in mounting more developmental works, the utter neglect given to the local ecology by these constructions is badly boomeranging on the livelihood and public welfare of local community. It is estimated that the current density of roads in Kuttanad and Ambalappuzha Taluks is about 0.82 km/km<sup>2</sup>, which is about 60 % of the district average of 1.34 km/km<sup>2</sup>. Construction of many more roads continues to be an important developmental program.

A classical example widely known in Kuttanad is the Alappuzha - Changanassery (AC) road and the AC Canal on its sides. The AC road was created in an east-west direction right across the direction of floodwater movement. Along its 42 km length is the AC canal was envisaged to remove the block caused to the water flow by the AC road, and cuts across all the three north flowing rivers and some of their branches. This canal was envisaged along as a 50 m wide canal. The canal was to serve three main roles. First, it may serve as a shunt inter-connecting rivers

being crossed by the road for re-distribution of flood water from one to another. Second, it may serve as water transport facility between Alappuzha and Changanachery. Third, it may provide the necessary mud for raising the AC road. The road construction had seriously compromised the natural width of rivers and rivulets it had crossed. In addition, the construction work had left the AC Canal incomplete in several stretches, so that the canal as it exist now is not serving any of the two important functions.

A number of roads branching off from AC road were also recklessly built either with a very narrow culvert over the canal or by completely filling the canal. Consequent lack of flow in the canal has made it a haven of water hyacinth and breeding ground for parasites and predators. Thus, while the AC Road is a boon for the communication in Kuttanad, it has become a major curse to the floodwater management with its impact seriously affecting the Lower and Upper Kuttanad. The canal is left partially constructed only for 13 km between Onnamkara and Changanasseri with several blocks to this created subsequently. In rest of its length, between Onnamkara junction and Pallathuruthi River, the canal is broken into bits, with many encroachments, old and new numbering about 97. Local people say some of these encroachers are 'powerful persons'. The continuous neglect had made the constructed part of the canal also in very poor state and liable for encroachments. Construction of AC Canal with at least 50 m width without any interruptions along its length is very important for the flood control in the region and to serve as a water transport and tourism route.

Railway tracks built across waterways have severely constricted the width of river channels causing problems to the fast flow of floodwater to the sea and at the same time creating severe drainage problems to the rice fields; several memoranda have brought out this as a major problem for draining water from paddy fields in Onattukara region. Furthermore, the narrow culverts remain clogged with silt and weeds.

When one considers the transport requirements, which, of course, is very important, of a huge wetland ecosystem like Kuttanad, some questions remain. What is the carrying capacity of this wetland to support increasing number criss-crossing roads? Would it not make more ecological sense from the point of sustainability and well being of the people to give equal importance to the water transport and provide better quality and more frequent public transport services in eco-friendly water transport system? The roads will continue to have the limitation of connectivity

with many of the *padasekarams*, where farmers need affordable transport facility. While communication is critical to further the livelihoods and to improve the quality of life, developmental processes conflicting with the local ecology may in the long run become counterproductive, diminish livelihoods, debase the quality of life, and disintegrate the traditional social institutions. Yet, the repeated concern conveyed to the Committee by the people in memoranda and public discussions on the blind view the developmental agenda continues to take on ecology. The intensifying ecological backlash on health and livelihood deserves full and integrated solution with deserving urgency.

#### **1.1.2.7 Pollution of backwaters:**

Prolonged stagnation of water body has promoted accumulation of sewage and agricultural wastes in the fresh water part of the *Kayal* causing new threats to fisheries, human health and tourism. Obstruction to the natural and free flow of the river-backwater system and the consequent disruption to the seasonal mixing of saline and fresh water has meant that the natural cleansing services that the backwaters provide are now impaired.

Several geo-chemical studies have consistently indicated heavy loads of nitrite, Total Dissolved Solids (TDS), suspended matter, low Dissolved Oxygen (DO), coliform count far higher than permissible limits, high levels of various pesticide compounds, etc. The sources of these pollutants are also traced to domestic sewage, sewage from Sabarimala area, untreated sewage from houseboats, municipal wastes, hospital wastes, industrial and agricultural wastes, and coir retting activities. Hotels and resorts that line the Vembanad Lake also discharge their wastes in to the backwaters with minimum or no treatment. Fossil fuel from motorboats and their cleaning centres adds to the pollution load. Much of the upstream pollution load is contributed by industries, hospitals, pilgrimage places and homes. Thrikkunnapuzha, Arattupuzha, Vaikom, Vechoor, etc. are the major areas where coconut husk retting is very predominant. Pesticide residues detected in water include lindane, carbofuran, DDT, BHC, monocrotophos, dithane and thimet among other compounds, in concentrations fairly higher. This is reported to be fairly within prescribed limits for fisheries to exist safely.

Short term increases in the level of suspended sediments due to pollution and dredging activities, can give rise to changes in water quality. The water quality undergoes major change in salinity,



heat content, light influx, dissolved oxygen, etc with significant impact on the *Kayal* biota. Dredging invariably leaves a trailing turbidity 'plumes' behind the dredger or disposal sites. Turbidity decreases the penetration of light to the water column, thereby affecting growth and productivity of submerged plants and affects filter-feeding organisms, such as shellfish, through clogging and damaging feeding and breathing equipment causing high morbidity among them.

It may be possible to minimize the harms from pollutants, if the ecological rhythm governed by water flow is brought back in KWS. This in no way minimizes the importance and urgency of interventions required to stop dumping of human, hospital, industrial, hotel and municipal wastes into the Vembanad *Kayal* and its river system. A more proactive and a more vigilant role may be expected from the Kerala Pollution Board in regularly monitoring, checking pollution and acting on offenders. It may also provide the necessary guidance to them on matters related to pollution and its control.

#### **1.1.2.8 Alien invasive species and noxious weeds:**

Kuttanad waters are afflicted by few alien invasive species. Among these the floating water-hyacinth (*Eichornnia crassipes*) and African payal (*Salvinia molesta*) are most common and most aggressive. Four other floating weeds are species of *Nymphaea* and *Nymphoides*. There are five other submerged and three emergent shoreline species. Currently, the water hyacinth is the principal weed causing very serious threat to the KWS. Algal growth is also serious. High levels of organic load in the backwater have led to a condition called 'eutrophication' causing dense growth of plant life. This affects water quality, deprives the waters of oxygen, prevents entry of light into water column affecting fish reproduction and survival and posing increased risks to human health. Aquatic weeds do not get expunged because of absence of saline intrusion. Studies have shown that salinity during summer before the construction of TMB was 18.47 ppt<sup>7</sup>, and this fell to 2.8 ppt in summer during the post-barrage period. Monstrous growth of weeds has clogged waterways affecting navigation considerably.

#### **1.1.2.9 Loss of biodiversity:**

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<sup>7</sup> Parts per million

Loss of biodiversity encompasses natural habitat loss, species loss and loss of genetic diversity<sup>8</sup>. Natural habitats loss in Kuttanad is caused by anthropogenic pressures such as regular dredging of *Kayal* area for lime shells, sand extraction, creation of physical obstructions to river and canal flow, proliferation of invasive species, use of fish poisons, dynamite, electro-fishing and a wide array of prohibited fishing gears and practices, and physical elimination of mangroves and other endemic vegetations. Other species adapted to brackish water lose their habitat when the water becomes predominantly fresh. For instance, the giant fresh water prawns require saline and fresh waters to complete its life cycle and denial of salinity with the shut down of TMB has seriously dwindled its population. Studies show that the TMB also has prevented migration of several other migratory fishes and about 13 species of them are no longer present in the Vembanad Lake. Pollutants are another contributor to habitat loss. Mangroves, which are uniquely adapted to salinity fluctuations, are no longer visible largely due to the lack of a brackish water habitat. This leads to loss of nursing grounds of several prawn and shrimp species, which in turn leads to their numerical decline. The RARS, Kumarakom, Department of Environmental Studies in MG University, the Ashoka Trust for Research in the Ecology and the Environment, Nature Club and the Aloysian Centre for Kuttanad Studies, have conducted some of these studies.

Multiple reports have recorded that 23 species of fishes have become extinct as water body got shrunk, the fish population and diversity got reduced. There has been a corresponding reduction in the migratory birds also. Studies have reported that bird population had declined by 33 % and the water stork by 85 %. However, care needs to be taken in interpreting these reports. There is also change in the species spectrum and its predominance. A typical example is *Neerkozhi*, a predatory bird, which was hitherto little known in Kuttanad backwaters but has since increased in number and become a new menace as it eats up small aquatic animals in large quantities<sup>9</sup>. Stone walls and land refilling have increased snake population. Risk to lives from snakebite has been on the rise as was brought to the notice of the Committee during public discussions. The poor connectivity between *padasekarams* and hospitals makes snakebites fatal.

As a footnote, it must be mentioned that the lack of a verifiable benchmark of species that existed before and after the commissioning of the TMB prevents a definitive conclusion about the possibility of extinction or endangering of any fish or bird species due to the barrage. This also brings a ray of hope that the status of these species may not be so bleak after all. Given

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<sup>8</sup> Genetic diversity is the morphological difference arising out of differences in the composition of genetic make up of individuals or groups within the taxonomically similar organisms

<sup>9</sup> Discussion with local resident during one of the boat trips to the Vembanad Lake undertaken by the study team

adequate prioritisation of policies and focus in the implementation of suggested recommendations, especially with regard to the TMB and water movement along Kuttanad, the possibility of reviving many of these species and reintroducing them to Kuttanad and revitalizing the KWS does indeed exist.

### **1.1.3 Impact of ecological decay on the livelihoods**

Ecological decay is closely linked to loss of livelihoods. All ecological maladies discussed above generate a rippling effect on livelihoods based on paddy and fisheries; they have increased the intensity and duration of epidemics affecting human health; and threatening growth of sustainable and viable backwater tourism. With the change in the ecology of KWS, the livelihoods, which it once supported, are being threatened.

#### **1.1.3.1 Impact on paddy**

Dredging activities in Kayamkulam backwaters has increased the threat of salinity intrusion through the Thrikkunnappuzha Lock, and other temporary barriers to adjoining paddy lands, demanding the need for tighter measures of salinity control. The salinity problem in Vaikkom *kari* area also have reduced paddy cultivation. This underlines the need for making these saltwater intrusion pints with permanent regulators. Sand and clay mining in good paddy lands cause serious losses to agricultural production, often irreversibly. There is a one-to-one relationship between the ecological decay and local livelihood options. The decline in paddy area has resulted in loss of income to farmers and farm labourers and this has diverted the youth away from farming. Loss of paddy lands also has serious consequences to the food security of the State.

#### **1.1.3.2 Impact on fisheries**

The ecological changes in KWS, particularly to the backwaters, has significantly affected the fisheries based livelihoods and representations from fishermen during the stakeholder discussions reflected the loss of fisheries due to dredging, pollution, pesticide application, weed infestation, etc. The most important has been the impact on the migratory fishes due to the TMB, which got reflected in their catch in the major landing centers, both north and south of the barrage. Decline in the catch of the highly priced giant fresh water prawn and *karimeen* have

been reported. Black clam harvest also is reported to have declined. The traditional livelihoods of fishermen are severely threatened and they are looking for alternate income sources. Water pollution also had affected their health and preparedness to continue in fishing. Youth are no longer attracted to fishing. These aspects are dealt with in greater detail in the section on fisheries.

#### **1.1.3.2.Impact on Navigation and cargo movement:**

Waterweeds, silting and other blocks in waterways have affected navigation. Reports suggest that both the banks of several waterways are severely eroded. In many small canals even the traditional small *vanchis (kothumbu vallom)* are not navigable due to dense waterweeds. The foundation that held Kuttanad's thriving economy for long has been its network of waterways. A few examples have been elaborated in the memoranda such as the Thakazhy Arattukadavu, a water way from the point of the modern rice mill to the Pamba River and the Thakazhy Padaharamthodu from Modern rice mill to Pookkaitha River, both at Thakazhy Panchayat. These networks facilitate in transporting rice from the Kuttanad Padasekharams to the Modern Rice Mill at Takazhy. With blockages all along the canal water way and silting, it is proving difficult to continue with cargo movement along these waterways. Strengthening of navigation is important for movement of cargo of harvested produce from *Kayal padasekharams* to the godowns or rice mills. Facilitation of cargo movement close to municipalities also demands renovation of several canal systems including those in Alappuzha town, namely, Commercial canal, Vadai canal, West junction canal, East junction canal, and Murinjapuzha canal. Many memoranda were received from farmers to renovate many waterways and canals being left neglected over years, with some of them turning nonfunctional. These waterways have close connectivity with the livelihoods of people.

#### **1.1.3.3.Impact from poor hygiene and sanitation in fish processing**

The coastal part of Cherthala taluk has concentration of fish processing units with focus on export. The Ministry of Commerce, Government of India has designated Cherthala as 'Towns of Export Excellence' under the Special Export Zone. However, these units are not only functioning under poor conditions but also causing serious environmental problems with the discharge of processing waste and washing water into the nearest canals. For instance, the *kappithodu* in

Ambalappuzha is notorious for the emanating foul stench caused by the discharge from prawn processing units. Most of these units are subcontracted from exporting units and they operate under these conditions to make more profits. The operational conditions are incompatible with standards under the *Codex Alimentarius*<sup>10</sup>. These are the minimal standards applicable to the export, although some countries have higher standards. These standards are applied very stringently by importing countries and failure in complying with may lead to rejection of shipment, heavy penalty and loss of export market. Hence clean environment and good practices are important, not only from exporting point of view, but also from the environmental considerations of the processing area. Export of fish being the last link in a chain of livelihoods starting from fish capture, these practices will have impact on hundreds of fishermen and employees processing the fish. Interventions from the State Government are required for these units to comply with treatment plants to maintain hygiene and sanitation in pre-processing and processing centres.

#### **1.1.3.4 Impact on drinking water and health**

Shortage of potable water is a major environmental problem in Kuttanad. Harnessing water from elsewhere and supplying it in all parts of Kuttanad is also not easy because of poor logistics and problems and safety in laying water supply pipe lines through water bodies. It also involves huge initial and recurring cost. Currently, many panchayats in Kuttanad do not have potable water supply facility. This constitutes a major risk, with the poor people exposed to highest risk. This water supply situation places very high pressure and stress on women. Many ecology recovery measures recommended are expected to improve the water quality and ground water recharge to improve local availability of quality water. Water quality has direct relationship with standard of health and well being of people. As the most affected section are the poor, who are daily wage earners, poor healthy conditions are to severely affect their livelihoods. This issue is discussed in a subsequent section on health, sanitation and drinking water.

#### **1.1.4 Strategies for ecological restoration and management**

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<sup>10</sup> *Codex Alimentarius* is a set of internationally recognized standards, codes of practice, guidelines and other recommendations relating to foods, food production and food safety under the Agreement on Sanitary and Phytosanitary Standards (SPS).

Ecological restoration of KWS cannot be done without concurrently attending to all factors those have contributed to its deterioration and fatigue. Several of these factors were identified and recommended by earlier studies. However, apart from implementable and affordable recommendations, availability of adequate resource, development and enforcement of appropriate policies and effective implementation of all recommendations are important for revival of ecological health of KWS. In the context of Kuttanad falling under Ramsar site, it is important that all recommendations are in compliance with the Ramsar guidelines.

Serious measures for remedial action to restore ecological security shall include specific attention to (i) Restoration of the water spread area, (ii) development of an appropriate land use based on hydrology and evolving livelihoods, (iii) effective flood and salinity management, (iv) restoration of free movement of water by removing all blocks in waterways and canal systems, (v) pollution control, (vi) total elimination of aquatic weeds, and (vii) restoration of estuarine habitats ideal for breeding of fish such as mangroves and initiation of programs to augment fish diversity and density in the backwaters.

Such revival would naturally have its positive impact on the traditional and non-traditional livelihood opportunities for the people, their health and well-being. Needless to say, that the revival of Kuttanad ecology will offer the greatest benefits to the poorest of the people who are the most dependent on its ecosystem services. Ecological revival would also help in consolidating, preserving and enhancing the natural resource base, which is the desideratum for secure livelihood opportunities for all, leading to *ecological welfare*.

## **1.2 Health and sanitation**

Public health is a very precarious and serious issue in Kuttanad. It appears the anthropogenic onslaught on local ecology is being boomeranged. Kuttanad had for last several years been the nursery of several water-borne pathogens and parasites causing gastroenteritis, enteric fever, leptospirosis, Japanese encephalitis, dengue and cholera. The latest in the list of these serious diseases is chikungunya, which during this year has assumed epidemic proportion through out Kerala and neighbouring States. Chikungunya took the largest toll of human life during this year. The disposal of solid human waste into upstream areas of the river systems and into the Kuttanad waters, the lack of flow in waterways due to multiple ecological interventions and fallowing of

paddy fields have contributed to the present state of high risk public health in this area. As the environmental health of the region has virtually collapsed, the consequences it is radiating around, to be controlled with marginal actions like use of insecticides for vector control, etc. The local ecology has to be re-visited and brought back to health to safeguard human health and a weak management to deal with crises need to be strengthened.

Despite the region supporting high population density, replete with polluted waterways and flooding a common and regular phenomenon, there is no adequate and spread out infrastructure for healthcare. More over, many of the existing hospitals are inadequate to deal with an epidemic or an emergency such as snakebite, which has become very common. It is reported that more than 80 % of the people in Kuttanad rely on contaminated canal water for their daily requirements. Major investment on public health is badly needed in the area including a hospital with specialized snakebite treating facility in the *Kayal* and lower Kuttanad area. It is a common scene that people living beside the canal or *Kayal* side push away the water hyacinth from their banks and use this water for cleaning utensils, cloth and taking bath. The latrines of these houses along these banks are also emptied into the same water. All of them are adequate reasons for the ill-health.

Wetlands are noted for their ability to detoxify and purify water with the presence of macrophytes. Nevertheless, drinking water is in serious shortage throughout Kuttanad. Kuttanad is now in a typical state of ‘water, water every where, but not a drop to drink’. But many who cannot afford costly potable water or receive panchayat-arranged water supply, often drink what is available. The upper Kuttanad due to fallowing and conversion of paddy fields is facing water shortage during summer. During summer, the low-lying areas of Kuttanad face additional problem to drinking water due to salinity. While there are a few drinking water projects, the acuteness of potable water shortage in Kuttanad is still keenly felt. Piped water facility reaches only 25 % population, and that too, at the rate of 40 ltrs/day/person. According to a news item, Kainakari situated in the *Kayal* area, “with over 6,000 households and 30,000 people, does not have even one public tap to supply safe water”. For water drawn from Pampa, which is highly polluted, chlorination is the only water treatment being followed.

### **1.2.1 Ecological health to benefit human health**

Much of the ecological restoration mentioned in the previous sections is expected to reduce the predator and vector build up with positive impact on human health. However, other matching integrated public health measures and actions, including supply of quality potable water, better awareness among people on the maladies and remedies related to health problems, deploying a cadre of health workers or volunteers trained in field epidemiology, incidence report system, availability of rapid diagnostic kits at village level, etc are important to bring the health and happiness of the people. The ongoing epidemics have exploded the myth that Kerala has best healthcare infrastructure and capacity to effectively confront and contain such disasters. With regard to the environmental sanitation, it is hoped that the implementation and completion of Total Sanitation Programme will end the prolonged suffering of people and serve to quench their thirst. Similarly, the ongoing/proposed water supply scheme by the Kerala Water Authority and the Neerettupuram and Pallikkunnu drinking water scheme is hoped to address the potable water problem. It is important that water supply scheme has to reach north Kuttanad as well, where salinity during summer causes major problems. In certain panchayats water for local distribution could be tapped from ponds, some of them requiring a revival.

This Committee strongly considers that Kuttanad urgently needs focused health care capacity building, and the government and private medical health centres need to pull their socks up and act immediately. There is also a need for greater public awareness. It, however, is constrained that its mandate does not allow recommending support for health and drinking water related problems of the area. Under this circumstance, the best it can do on the matter is recommending rainwater harvest at household level using ferro-cement tanks.



## CHAPTER 2

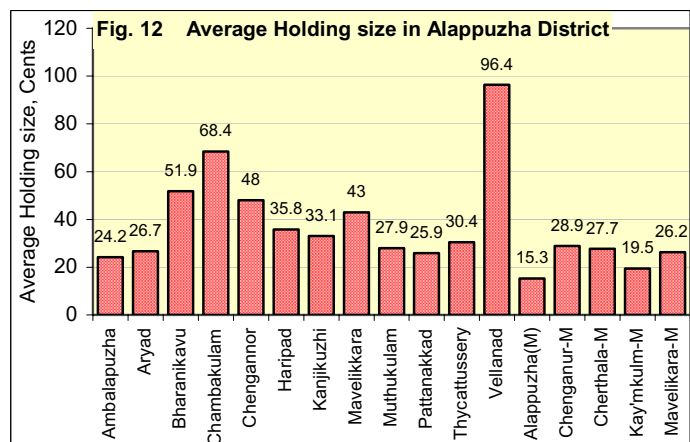
### STRENGTHENING LIVELIHOOD SECURITY

Livelihood security in Alappuzha district and rest of the Kuttanad is largely based on agriculture and allied activities. Among different economic activities, agriculture is the major contributor of the economy in Alappuzha and Kuttanad. Out of the 4.0 lakh families in the district, 88 % are associated with agriculture for income generation and for majority among them this is the only source of livelihoods. Agriculture includes crop and livestock husbandry and fishery. This report deals only with inland fishery.

#### 2.1 Crop based agriculture

Total cropped area in Alappuzha is 1,25,032 ha, which is 89 % of the geographic area of the district. Among the major crops, coconut occupies 46 % area, followed by rice (38 %), banana ( %), tuber crops (3.7 %) and vegetables (1.7 %). More than 75 % of the rice area in the district falls in Kuttanad. In the 1970s, Kuttanad shared about 25 % of the State’s total rice area and contributed 37 % of the rice production. For its primacy in rice area and production, Kuttanad is termed as “The Granary” or “The Rice Bowl” of Kerala. However, the remote sensing imageries spaced across three decades analysed by the Kerala Landuse Board, reveal a huge change that had taken place in the land utilization pattern in the area (Fig. 12). This change brought down the share of Kuttanad to the state’s rice area and production to 15 % and 18 %, respectively. Although the marshy and poorly drained wetlands of Kuttanad make it virtually unsuitable for crops other than paddy, increasing cost of cultivation is forcing farmers either to fallow the land leading to its reversion to water logging state, or conversion to garden lands. Two other major agro-ecological regions in the Alappuzha district are the Onattukara region and the *Pokkali* rice area in Puravoor-Pattanakkad region.

Farm holding in Alappuzha district is notable for its very small size. The



district has very high proportion of small and marginal farmers. The average holding size (in

cents) in different Block Panchayats and Municipal areas is presented in Table 1. The highest average farm holding size is 96 cents in Vellnad, while the lowest average holding size among Block Panchayats is 24 cents in Ambalappuzha and among Municipal areas 15 cents in Alappuzha. In the case of Kuttanad, the holding size data available to this study dates to 1973. According to this, the average holding size in Kuttanad is also very small. About 60 % of farmers cultivate in less than 2 ha area. It is important that all approaches examined to enhance profitability and income generation from farming have to factor in the very small size of the holdings.

Table 1: Pattern of land holdings in Kuttanad area (as in June 1973)

Holding size	Alappuzha district		Kottayam district		Total		
	No.of holdings	Extent of holding, ha	No.of holdings	Extent of holding,ha	No.of holding	Extent of holding,ha	As Per cent
< 0.42 ha (<1 Acre)	10,112	4,166	6,464	2,556	16,576	6,722	<b>11.7</b>
Between 0.42 - 1 ha	7,723	6,667	4,460	3,981	12,183	10,648	<b>18.5</b>
Between 1 and 2 ha	6,203	9,841	4,957	7,182	11,160	17,023	<b>29.5</b>
Between 2 and 4 ha	3,816	8,696	1,215	3,503	5,031	12,199	<b>21.1</b>
Between 4 and 6 ha	1,013	4,312	238	1,072	1,251	5,384	<b>9.3</b>
Above 6 ha (>15 Acre)	201	4,333	141	1,323	342	5,656	<b>9.8</b>
Total	<b>29,068</b>	<b>38,015</b>	<b>17,475</b>	<b>19,617</b>	<b>46,543</b>	<b>57,632</b>	

Source: Report on Kuttanad Development Project, Kerala

### 2.1.1 Rice cultivation in Alappuzha and Kuttanad

In Kerala Kuttanad is a main rice-producing region, the other two being Palghat and Trichur. The rice area in Kerala has been steadily declining over the last 45 years. Out of a gross cropped area of 29.76 lakh ha in 2003-04, food crops including tapioca occupy only 13.7%. In 2005-06, the total area under paddy stood at 2.76 lakh ha as against around 7.53 lakh ha in 1961-62. This means the State witnessed a decrease of 63 % in paddy area in over four decades. Even

#### Box 7: Trends in Rice Production

Rice production in Kerala touched the pinnacle at around 1.4 m t from 8.8 lakh ha during the mid-Seventies, when the state achieved 50% self-sufficiency in rice production. However, down the years, rice production has been steadily declining, with 0.73 m t in 1998-99 and 0.57 m t from 2.88 lakh ha in 2003-04. The area under rice in 2005-06 was 21 % of the total food crop area in the State. Rice productivity of Kerala, which consistently remained above the all India average slipped down in 2003. Palakkad district ranked first in terms of the cultivated area, followed by Alappuzha district. During 2004-05, Alappuzha had 11.1 % of the state's area under paddy and contributed 11.8 % of the production. These figures for Kottayam are 4.5 % and 4.9 %. In 2003-04, contribution of rice area to Kuttanad from Alappuzha, Kottayam and Pathanamthitta were 66%, 23 % and 11 %, respectively. Share of these districts, in that order, to the Kuttanad rice production were 62 %, 26 % and 12 %. On the other hand, there has been a rise in the area under coconut in the State, from 5.05 lakh ha in 1961-62 to 8.98 lakh ha in 2005-06

retention of remaining rice area is becoming a serious challenge (Box 7). This is largely on

account of low profitability from rice cultivation and better income from paddy fields converted to grow cash crops. With threat of further shrinkage of rice area looming large, there is a dire need to safeguard rice cultivation and livelihood of rice farmers in principal rice growing area like Kuttanad. With the loss of rice area the important ecological functions of wetland is also lost. The only way and the sustainable way to do this is increasing the profitability from rice cultivation without losing competitiveness. Rice in Kuttanad is grown during two seasons. These are the *punja* (November-March) and *virippu* (May-September). The *punja* season of Kuttanad is different from rest of the Kerala. Largest area, close to 40,000 ha used to be under *puncha* crop, which now has come down to less than 30,000 ha. Similarly, about 10,000 ha which were under *viruppu* has now shrunk to less than half. The rice cultivation in the six agronomic zones of Kuttanad, namely, Upper Kuttanad, Lower Kuttanad, *Kayal* lands, North Kuttanad, Purakkadu Kari, and Vaikom Kari is not similar. Productivity and profitability are different in these regions. Features of these regions are described in Annexure I.

The paddy fields reclaimed from the *Kayal* exist in clusters called polder or *padasekharams* or *padam* or *padavu*. Each of them is bound by an outer bund, which protects the cluster from surrounding water body. There are about 1231 *padasekharams* occupying a total area of 59375 ha. These *padasekharams* vary in size from 1 ha to 985 ha. A few of them, such as C, D, E, J, H, and R, Blocks, etc far exceed 240 ha (600 acre) size. Strengthening of outer bund during every crop season is very crucial to safeguard the crop from frequent flooding and intrusion of saline water common in the area. These bunds, depending on their location undergoes erosion in different intensity caused by wind, floodwater and tidal currents and speedboat induced wave action. Strengthening of the bund is an important recurring event adding heavily to the cost of cultivation. Even then bund breach and crop loss during flooding is not totally excluded. The regular maintenance of outer bund is managed by the respective '*Padasekhara Samithi*' with cost proportionately shared by owners of the fields. While most bunds grow a row of coconut, habitation and additional homestead crops like banana, mango, etc are common on few wider bunds between canals and *padasekharams*. The relatively elevated areas of Upper Kuttanad used to grow *puncha* (80 % of area) and *viruppu* (40 % of area). Although Pamba Irrigation Project (PIP) and Kallada Irrigation Project (KIP) were built to increase the cropping intensity of this region, the impact had been negative with decline rice area. On the contrary, the heavy seepage from PIP had created drainage problems changing rice fields into swamps.

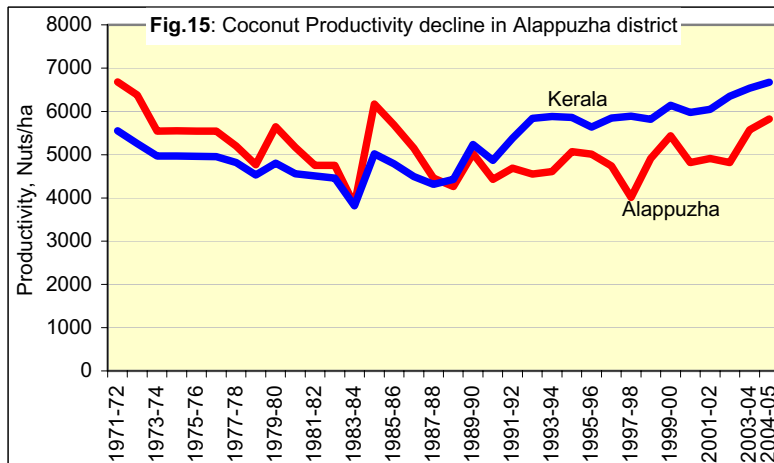
**Onattukara** is the second major agricultural region after Kuttanad in Alappuzha district covering an area of about 48,540 ha. This region situated south and southwest of the Upper Kuttanad with Thottappally in North, Krishnapuram in the South, Arabian Sea in west and Pandalam in east. The region spreads across 26 panchayats and two Municipalities in the two taluks, Mavelikkara and Karthikappally. A portion of Onattukara stretching in to the adjoining Kollam district is outside the mandate area. The soil is low in organic content and predominantly loamy. Rainfed farming is the rule in this region with limited area under tank irrigation. The important crops grown are rice, coconut, sesame, banana, pulses, tubers and vegetables. The region is traditionally known for high cropping intensity, with two paddy and one sesame or pulses. The paddy crop seasons are *virippu* (April-August) and *punja* (December - March) or *mundakan* (September - November). Sesame or legume is grown during December - March, wherever water for *punja* paddy is not available. *Punja* paddy is more common in region adjoining the Upper Kuttanad, where the *padasekharams* are protected with outer bunds against flooding during monsoon and to facilitate irrigation during summer. The region is also a major coconut growing area of the district, although the palms are severely affected by disease and pests. A Research Station established in 1937 work on the regional crops under the control of the Kerala Agriculture University (KAU).

**The Pokkali** rice areas of Thoravoor-Purakkad *Kari* lands are situated in the north-western part of Cherthala taluk. The area in 43 *padasekharams* is spread over an estimated 2000 ha in 8 panchayats under Pattanakkad block, on both sides of National Highway. From the northern coastal edge of Alappuzha, the *Pokkali* rice area spreads to the southern part of the adjacent northerly Ernakulam district. The peculiar eco-geographical features of this region are characterized by salinity, poor drainage, low fertility, proneness to flooding during monsoon season and saline water intrusion during summer and low productivity. Fields are organized as *padasekharams* with outer bunds to safeguard the crop from unregulated flood and saline water inflow. The traditional varieties such as *Chettiviruppu* and *Pokkali*, which can withstand the adverse effect of salinity to considerable extent, offer a modest productivity. *Pokkali* cultivation is known for its integration with organic farming and fish culture, particularly the prawn.

### **2.1.2 Coconut**

In terms of commodity value, coconut is the second important crop in Kuttanad and Alappuzha district. Apart from the immense economic importance of this crop to the small and marginal

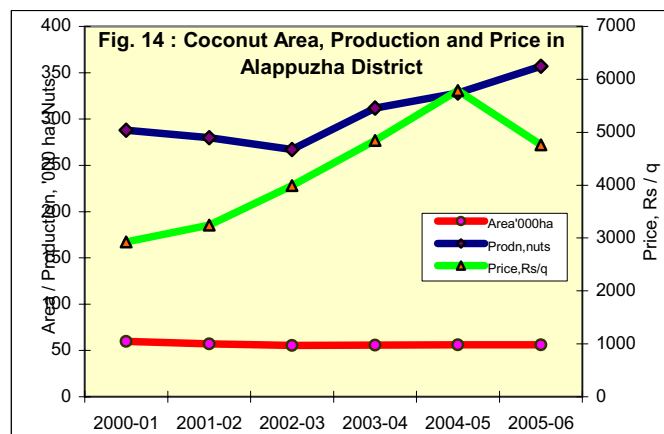
farm holdings, the palms grown in the outer bunds of *Kayal Land padasekharams* and *Karappadam* parts of Kuttanad add profound scenic beauty to the backwater region. Over the years, the area and productivity of coconut in Kerala have been rising, albeit at very slow rate in the case of area and rather irregularly in production. Nevertheless, the share of the state to the total area under coconut in India declined from 56 % in 1991-92 to 44.6 % in 2004-05 with a



corresponding decline in share of production. A comparison of coconut productivity of Kerala and Alappuzha over the last 35 years presented in Fig.13 generates serious concern on the state of the coconut economy in the district. This trend has had ominous impact on the

economy and livelihood of more than 95 % of the farmers of Alappuzha, who own less than 0.3 ha of land, in which coconut invariably is an important crop contributing to the household income. Along with the decline in coconut productivity in Alappuzha, the productivity of the garden lands, where the coconut is a major crop, has also been declining for want of soil care and management. This is also a matter of utmost concern for the reason that these lands alone offer a production resource to eke out an agriculture-based livelihood for a huge percentage of the farm holdings.

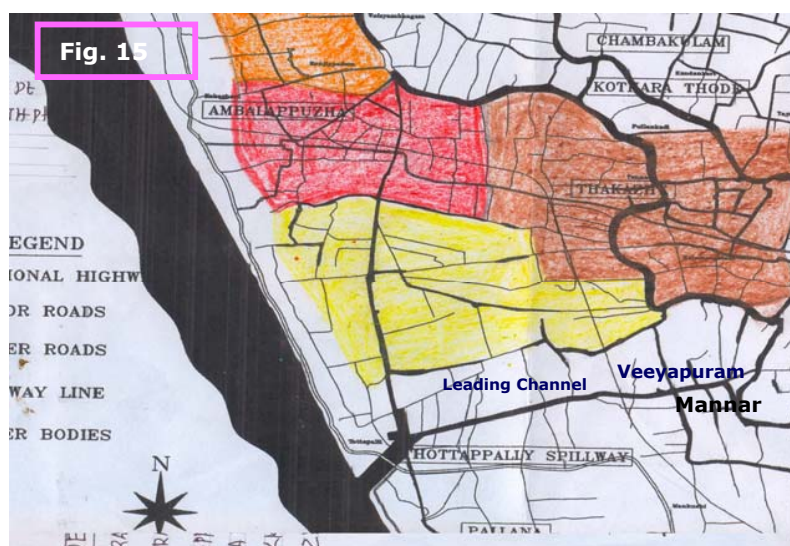
Major set back to coconut productivity is the widespread damage from root-wilt disease. The problems of coconut farming have been compounded by the recent epidemic-like attack from coconut mite and an increasing incidences of damage from red-palm and rhinoceros weevils. Unlike in the case of rice, there is neither a decline in the area or production of coconut in Alappuzha district (Fig. 14). The declining price of coconut together with fall in productivity is severely hurting the income of all households. In the case of root wilt



disease, although several years of intensive research yielded no tangible results, management technologies are now available for economic revival of coconut, provided the price stability is also maintained.

## 2.2 Causes of agrarian distress to Kuttanad farmers

Kuttanad farmers carry the proud legacy of indomitable adventure, innovation and achievements in taming the nature, unmindful of the challenging conditions, for creating resources and livelihoods. The Governments of the time have been rendering helping hand to the Kuttanad farmers in their heroic struggle on rice farming. Rice cultivation, the mainstay of Kuttanad economy had traditionally been confined to the *punja* season, once in three or two years during the early period. During these days, sowing was done soon after southwest monsoon and harvesting before the tidal intrusion of seawater in the Vembanad *Kayal* during summer. Traditional varieties maturing in 100 days and yielding less than 1,200 kg/ha were used. Cultivation in these fields below sea level was a huge gamble with the floodwaters brought by the northeast monsoon during October-November and tidal intrusion of saline water during summer. The outer bund plays critical role in minimizing the risks from natural causes.



Two major initiatives taken by the Government to minimize these risks and to promote annual cultivation of *punja* rice in Kuttanad was the flood control and regulation of saltwater entry. TSW was commissioned in 1954 to directly divert about one-third of floodwater from Pamba-Achankovil in Lower Kuttanad

at Veeyapuram to the Arabian Sea at Thottappally (Fig 15, also see Box 5).

The TMB was built to prevent saltwater entry in the *Kayal* land area of Vembanad *Kayal* with a view to safeguard *punja* crop and to enlarge *virippu* crop grown area (Boxes 6 and 8). The TMB

which was to be shut for a shorter period of time during summer to safeguard the *punja* crop, continued to be kept for longer periods, largely due to an erratic crop calendar followed with sowing extending up to January.

During the post-TMB period Kuttanad agriculture underwent many changes in land ownership, cultivation practices and governmental policies. The implementation of Kerala Land Reforms (Amendment) Act, 1969 from 1970 abolished the intermediary rights on land between the State

**Box 8: TMB and rice culture**

A century prior to 1940s, cultivation of *punja* rice in Kuttanad was once in two or three years and the crop used to extend only up to January-February, when the sowing in the whole *Kayal* area used complete before November, under a season imposed crop calendar and varieties used were 100 or less in duration. Since the 1940s, annual cultivation of paddy was encouraged by the Governments of the time for augmenting rice production in the State. However, paddy cultivation in Kuttanad continued to be risky with the *virippu* crop facing unpredictable submergence during monsoon flooding and the *punja* crop threatened by salinity intrusion. During December to May, when water flow in the four rivers flowing in the southern side of Vembanad *Kayal* decreases, tidal influx of salt water from Arabian into the *Kayal* increases. The tidal activity reaches high in December during '*Vrichika veliyettam*'. It continues till next Monsoon. Out of the 55,000 ha *punja* area in Kuttanad, 35,000 ha covering the Lower Kuttanad, *Kayal* Lands and North Kuttanad, which produce about 1.5 lakh tonnes of *punja* paddy is highly vulnerable to crop loss due to salinity.

and the tenant-cultivator and enforced ceilings on land holdings. This made 71 % of the landholding in Kuttanad below 4 ha with 42 % among them below 1 ha (refer Table 1, Page 91). The surplus land was distributed to landless families. For Example, the Q, S, and T *padasekharams* measuring 196, 240 and 204 ha respectively, in

Kainakari Panchayat were redistributed to 490, 600 and 510 families, each on an average having 0.4 ha (1 acre) of field. It is gathered that many of these families, who own the redistributed land are residing far away from Kuttanad and not keen in cultivation.

This period also witnessed the arrival of high yielding rice varieties, such as IR 8, Annapoorna, Aswathi, Rohini, Triveni and Jaya. While traditional Kuttanadan *punja* crop was 100-105 day duration, the new high yielding varieties, which totally replaced the traditional varieties, were 15-20 days longer. Current ruling varieties, Jyothi and Uma, mature in 115 or 120 days. The increased maturity duration of varieties and the insurance against saltwater intrusion during summer offered by the TMB, encouraged a non-rhythmic *punja* season stretching from November to May, replacing the earlier stringent *punja* crop calendar between November and March. This loose or relaxed *punja* crop calendar introduced two major problems in Kuttanad. It forced closing of TMB for prolonged period, from December to May or even up to June, varying

between 81 days to 181 days, which in turn created several ecological problems (see previous section on Ecological security of Kuttanad). The current recommended period of shut down is 90 days from December 15 to March 15. In addition, the relaxed *punja* crop calendar, particularly delayed sowing due to multiple reasons, promoted incidences and intensity of pests and diseases warranting heavy application of pesticides and fungicides, which in turn led to serious environmental pollution in this sensitive region. Yet another adverse impact on local ecology from the annual cultivation using high yielding varieties arises from the intensive application of chemical fertilizers, often unscientifically without soil testing. This also heavily contributed to the environmental pollution and eutrophication of water bodies with many adverse cascade effects

Despite these investments in infrastructure to minimize the crop loss from floodwaters or intrusion of saltwater and increased productivity from high yielding varieties, rice cultivation in Kuttanad has become less and less attractive. This is reflected in the nearly 38 % decline in the area under rice since last three decades from 1970. While 60,921 ha area was cultivated with rice during the pre-TMB period, it shrunk to 37,624 ha in 2003. According to the ground validated remote sense data from Kerala Landuse Board, about 12,677 ha is lying fallow and 5,048 ha area is under waterlogged state in 2003. The area converted for non-agricultural purpose has increased from 1,406 ha in 1967 to 4,020 ha during period indicating huge expansion of urbanization. The area under mixed crops has increased from 56,351 ha in 1967 to 60,444 ha in 2003 due to land reclamations and conversions indicating shift in cropping pattern.

The current reasons for the agricultural distress in Alappuzha district and the remaining part of the Kuttanad in Kottayam and Pathanamthitta districts are low profitability from farming and increasing indebtedness of farmers who continue with farming. Those who abandoned farming join the workforce and face distress due to lack of adequate employment. Major corrective measures should focus on better profitability from farming, redressal of indebtedness, better access to farmer-friendly markets and enhanced opportunity for employment and on farm and off farm income generation. Better profitability from agriculture may be achieved through multiple approaches. Each of these approaches is important and needs to be harnessed to make the profitability sustainable. The agriculture based income enhancement although has primarily to be leveraged on the two major crops, rice and coconut, other components such as livestock and fishery, particularly their integration, offer new opportunities in the region.



In the case of rice, low profitability is largely due to three major factors. First, the recurring annual cost on infrastructure such as maintenance of outer bunds, motor *thara*, pump shed, *vachchal* construction, etc. Secondly, the increasing cost of labour and decreasing input per mandays. Third factor is an uncertain market and market price for the produce. There are also productivity restraining factors such as non-availability of quality seeds and other inputs on time, risk of crop loss at every stage including terminal post-harvest stage from summer rains, and deficiencies in technology transfer and services. In the case of coconut, the increasing yield loss from diseases and pests, decreasing productivity and declining produce price are primary reasons contributing to farm distress. Absence of additional income from alternate on-farm or off-farm sources also places the farmer at a highly vulnerable economic state. The institutional mechanism at *padasekharam* level, in the form of *Padasekhara Samithi*, which represents political interests and landowners of the *padasekharam*, is constrained in assisting farmers. It has restricted its role to serve as a conduit in delivering the various subsidies provided by the government to farmers. The involvement of multiple government departments in providing assistance to rice cultivation in Kuttanad and the bureaucratic functioning of these departments are adding to the problems of farmers rather than providing them relief. Farmers as a small land asset holding producer entities and landless farm labourers who depends on these small and marginal farm holding for their livelihood are facing unprecedented economic crisis.

### **2.2.1 Padasekharam outer bund**

Outer bund construction and strengthening around *padasekharams* is critical to prevent frequent distress from flooding related crop loss. The traditional *katta kuthu* process of outer bund strengthening used to simultaneously deepen the adjacent canal. However, lack of experienced workers for *katta kuthu* and increasing labour cost have been making the annual bund strengthening a difficult and costly task. The labour demand for this is nearly 20-30 % of the total labour requirement. Absence of periodical *katta kuthu* is resulting in increased silting and eutrophication of waterways, obstruction to water navigation and increasing the flooding intensity. An Expert Committee appointed by the Government of Kerala for studying paddy cultivation in Kuttanad in its report (1999) had suggested permanent bunds around *padasekharams*. A project was also taken up from the 1970's by the Kerala Land Development Corporation (KLDC) to strengthen the outer bunds using granite lining. Such strengthening is

reported to prevent periodic silt harvesting during monsoon and leading to decreased soil fertility. More over, this bund strengthening was done by extending the bund into the waterways due to the reluctance of farmers in giving required area from within *padasekharams*. This reduced the flood area. The KLDC project was called off half way due to the paucity of funds. The stones used for lining have fallen down in many places and absence of maintenance is taking matters back to square one. The advantages of bund strengthening using stiff clay excavated from *Kayal*/channel bed and bio-bund on the bund-water interface instead of concrete/stone lining are its ecological acceptability and the least maintenance option. It is also important that bund construction does not lead to narrowing of waterways. While this Committee recognises the necessity for granite pitching and other masonry work, it strongly urges that such work is restricted to only at essentially required points in the *Kayal* area and Lower Kuttanad, and use stiff clay based bund in conjunction with bio-bunding at the water side in much of the areas. Granite pitching and masonry protection may be unavoidable at selected sections bearing high searing action and flood pressure, which may not be resisted by clay bund. The clay bund may be largely used and this may be stabilized and strengthened on the waterside with economically useful grasses grown using geotextile as binding material. *Padasekara Samithi* may regulate the periodic cutting and maintenance of the grass, other biosystem and the bund. Other infrastructure facilities such as adequate bund width for tractor/machinery mobility, motor *thara* and shed, ramp for machinery ingress and egress, threshing yard, sluices or permanent culverts and other water regulators, are essential components of the outer bund. A thumb rule of one HP to drain one ha m water in 15 days may be used to arrive at the HP requirement of dewatering pump. Usual capacity is either less than or more than 25 HP. Protection to leading canal to motor *thara* (*vachal*) is required in certain places, which has to be done largely by stiff clay bunds with very restricted need based masonry work, wherever such clay is not available or the water flow demands such strengthening.

Another critical element to be considered while strengthening of outer bund is appropriate determination of its height in different parts of Kuttanad to avoid problems in silt harvesting and adverse ecological impact from reduced floodplain. This Committee deliberated this matter at length with hydrology experts, engineers and persons with long familiarity on Kuttanad flooding and crop loss. The consensus emerged is to limit the outer bund height at a level 30 cm above the peak flood level during the decade preceding. The slope of the bund has to be scientifically determined on the basis of its location, vulnerability to scouring erosion caused by wind induced

wave action, water currents during flood and tidal action, plying motor boats, etc and the bund width. In larger *Kayal* padasekharams, provision of retaining wall at the padasekharam side may have to be considered. In general a bund slope of 1:5:1 may be appropriate. Coconut on outer bunds adds charm to the backwater area. Therefore one well-spaced row of coconut along the bund without obstructing the bund road is desirable. In the past multiple agencies like the *padasekhara samithi*, KLDC, Dept of Water Resources, Soil Conservation Unit and Engineering wing of Department of Agriculture, Minor and Major Irrigation Departments have had undertaken outer bund strengthening in haphazard manner adopting diverse methods and standards. This should not happen in future and standards for outer bund construction on area and location basis have to be determined and followed. Continued regular maintenance in prescribed manner at lower cost may be entrusted with the concerned *Padasekara Samithi* and the local panchayat with required annual financial allocation by the government.

Deepening and widening drainage canals and strengthening their sidewalls all across Kuttanad and rest of Alappuzha to facilitate free flow of water are an important requirement to promote paddy cultivation. The present abysmally neglected state of these canals with prolific growth of waterweeds and stagnation of putrefied water are the causes for major ecologic disasters currently plaguing the region. These canals silted heavily, tampered badly by the sand miners, neglected for years by all concerned have become breeding grounds for predators and vectors, which now is creating a very serious health problem in Kerala and adjoining states. The recently large-scale spread of viral diseases including chikungunya from Pathanamthitta region is a major setback to the public hygiene and health standards of Kerala. This aspect is discussed in detail in the section *Ecological security*.

### **2.2.2 Dewatering**

Dewatering, building motor *thara* and pump sheds, installation of water pumping system, construction of *vachals* and threshing ground (*methikkalam*) are another group of important recurring activities demanding substantial cost under the crop production charges. Speed and efficiency of dewatering facilitate timely sowing. This has important role in influencing the crop calendar. The institutional mechanism in place for dewatering and the associated subsidy have been causing first derailment of the crop calendar. According to the Kerala Irrigation Act dealing with the dewatering system and pumping subsidy for Kuttanad rice area, the administration of

dewatering process is controlled by the *Puncha* Special Officers (PSO) at Alappuzha and Kottayam, who functions under the Revenue Department. Dewatering of each *padasekharam* is assigned through contract determined in public auction. Although the government through PSO is expected to pay for the dewatering charges to the contractors, the latter collect additional amount, called ‘additional *nerma*’ from all farmers of the *padasekharam* for raising temporary ‘motor *thara*’, pump house, and all and sundry. In effect farmers are compelled to pay a substantial part of the dewatering cost. This has created considerable bad practices by contractors. More over, the *Padasekhara Samithi* has no control over them for ensuring timely completion of dewatering. The highly bureaucratic functioning of the PSO only adds to the woes of farmers. This Committee came across widespread complaints on the functioning of the PSO and these include: (i) the contractor is allowed by the PSO to assume a superior position in determining the cost involved and time of dewatering leading to delay in getting the *padasekharam* ready for sowing, which upsets the crop calendar, (ii) the two to three seasons long delay at the PSO end in the disbursement of pumping subsidy to the contractor in turn promotes enhanced ‘additional *nerma*’ from farmers, and (iii) many farmers from the remote *padasekharams* are not able reach at the PSO office to participate in auctions and they want auctions conducted in different regions easily accessible to farmers. The Committee noticed much consensus shifting the responsibility for dewatering from the office of PSO to the *Padasekhara Samithi* under the supervision and control of local ‘Krishi Bhawan’ and to abolish the office of the PSO.

### ***2.2.3 Other infrastructure***

Associated with outer bund and dewatering is the *vachal* construction and its maintenance, in which individual farmers make substantial investment depending on the location and contour of the *padasekharam*. Threshing yard is another infrastructure requested by farmers and *Padasekhara Samithies*. Harvesting is either manual or increasingly mechanical using separate harvesters and threshers and more recently combined harvesters. The manual and mechanical threshing is normally done on temporary make shift place on bunds and roadsides. This contaminates the grain with mud and pebbles. In the absence of any infrastructure for handling the harvested and threshed grain, it is usually left in separate heaps by each farmer in the field, on the bunds or roads. Under the best of circumstances, grain is placed above a plastic sheet or tarpaulin and also covered with similar material. Normally the harvested grain may have

moisture above 15 % and its drying is not possible without transportation to homestead or other suitable place outside the *padasekharam*. However, the homestead of many farmers is away from these paddy fields and transportation of threshed grain under the prevailing loading and unloading labour cost is economically unviable option. Therefore, farmers' prefer to dispose the produce 'as is in the threshed state' within few days of harvest. Summer showers are a common phenomenon during harvest, particularly in April. When such showers come continuously and with squally winds, the grain is badly exposed to wetting and germination. This leads to very serious loss to farmers at the terminal stage of cultivation. This Committee had opportunity to witness such sad plight of farmers during April 2007, when summer rains were reported to have damaged to about 3-5 % of the harvest. In this context, availability of permanent threshing yard in *padasekharam* may partially help farmers.

With the mentioned moisture content in the harvested grain and possible threats from summer rains for causing damage to the produce, its immediate mobilization to safety is important. There are two options for such mobilization. First, is immediate procurement and movement of paddy by suitable agencies soon after harvest. Second is immediate movement of paddy from the fields, bunds and roads to a place where it could be dried and stored till marketing. Currently, the first option is being practiced under the government-sponsored procurement, which is quite a slow process. There is also year-to-year uncertainty on procurement policy and price. The slow moving procurement does not offer protection to farmers against produce loss under summer rains. This can indeed be made to help farmers with the government procurement policy announced before crop season and procurement agency kept well geared in advance. The second option involves considerable capital investment for creating grain drying system and building of huge godowns or silos for storage at few locations. More than this the high recurring cost on every tonne of grain on account of (i) gunny/other bags for transportation and storage, (ii) loading and unloading, (iii) transportation by boats and lorries, (iv) drying the grain to a moisture level appropriate for safe storage, (v) storage overheads and (vi) the annual maintenance of drying and storage system may make this option economically unviable. It is another issue who meets this recurring cost, farmers or the government? For the government, this will substantially add on to the existing different subsidy components. The storage option, according to the considered opinion of this Committee, is economically unviable.

Thus from the farmers' point of view, immediate fair marketing of grain 'as is in the threshed

state' and quick disbursement of the cost will be more advantageous and practical. In this context, the present procurement process and the payment of price have to be rendered more farmer-friendly. The Civil Supplies Department (CSD) of Kerala is facilitating the current procurement at the MSP fixed by the State government. The better job that the CSD had done during 2007 helped in substantial reduction of the loss to farmers from grain damage due to rain soaking. However, the procurement system as it operates now has to be far more farmer-friendly. The procurement policy of government from time to time differs and most often it is unknown to farmers before the crop season. The CSD does not have adequate staff and infrastructure in Kuttanad for efficient and expedited procurement of a huge quantity of grain coming out of fields in less than a month's time. The practice followed is that the rice millers are allotted specific quantity of paddy and area and they conduct the procurement. The officials from Department of Agriculture oversee the grain quality during procurement. The prescribed grain quality for the fixed MSP is that it shall not exceed 17 % in moisture and 3 % in unfilled grains and foreign body content. Whenever these quality limits are crossed, adjustment of such quality

**Box 8 : THE ROYAL RICE MILL, Chambakkulam- A model to replicate**

Kuttanad produces about 18 % of the rice in Kerala. Still there are not many rice mills in and around Kuttanad, Many rice mills in and around Kuttanad. Nearly half-a-dozen mills were established earlier under public and private sector, at Mannar, Punnappra, etc and many of them remain non-functional due to a variety of reasons. More than 80 % of marketed paddy goes outside Kuttanad for processing. This Committee closely studied a rare rice mill successfully functioning in Champakkulam, in the middle of *punja* fields. This mill offers a right model for replication of rice mills in Kuttanad for processing the entire produce and marketing a branded Kuttanadan *punja* rice. This will bring additional prosperity to the region through a variety of new opportunities.

P.J. Joseph, Managing Partner of the Royal Rice Mill, says his rubber roller type mill with capacity to parboil, dry, hull and polish 17 t paddy in one shift (8-10 hr) costs about Rs. 1 crore. It can work round the clock and round the year to process annually about 6,000 t paddy. The mill operates on low-tension power, supply of which is available without much interruption.

The mill procures paddy @ Rs 850/q. The cost of processing and handling one quintal of paddy is Rs. 94, including Rs.12 given to farmers towards handling charges. The branded parboiled rice of Jyothi variety fetches Rs.1,450/q. The mill also gets additional income from husk and brawn. Bank provides working capital at 10.5 % interest. Thus, a Kuttanad based mill may be able to manage the business under a narrow margin of profit. A mill of this size provides round the year employment for 50 odd workers @ about Rs.200/day.

This success, however, depends on many external factors. Most critical is the understanding between labour and management that the former does not resort to trade union practices. The workers are not permanent but work on mutually agreed contract rate for each item

deficiency is made out in the grain weight eligible for payment. There is avoidable arbitrariness in this practice, which tends to exploit the farmer. This process of procurement is rather slow for reasons of deficiency in service by the CSD, lack of infrastructure for transporting the procured grain, and the slow pace followed by millers. This creates considerable distress to farmers year after year, particularly when summer rains cause serious damage

to grain.

According to the procurement contract between millers and the CSD, the former having procured the paddy of specified standards at the MSP, shall mill the grain and return to the CSD 680 kg of rice for every tonne of grain. The CSD makes no payment to the miller for the processing. The payment to farmers on procured paddy is made by the CSD. The high milling recovery of Jyothi and Uma is an advantage in this deal. The payment to farmers is routed through two banks, the Canara Bank and the Federal Bank, which extend commission-free payment services. Nevertheless, there is considerable delay in farmers receiving the payment. This delay goes on to 3 to 6 months or even later in rare cases. It is reported that about 60 % of the cultivation in Kuttanad is not managed by the landowners, but by the lessees. Such leasing is on annual basis with no lease records. The *padasekhara samithi* is represented by the landowners and hence does not recognize the lessees in decision making and sharing subsidies. These lessees also face difficulty in marketing their produce through the procurement system and receiving payments. Prompt procurement on fair terms and expedited payment of price may remove avoidable distress and loss to farmers.

The successful case of Royal rice mill in Chambakkulam (Box 8) establishes that it is not impossible to promote processing of entire paddy of Kuttanad here itself. Current production of Kuttanadan *punja* from about 30,000 ha @ 4.5 –5.0 t paddy/ha is of the order of 1.3-1.5 lakh tonnes. Assuming that 80 % of this paddy is available for commercial milling, it would provide round the year raw material for about 17 mills with capacity of 6,000 t/year. Establishment of these mills would help the local economy in terms of increased employment directly to about 1,000 persons and indirectly to many more. This will also promote secondary industries on the rice mill by-products, such as husk, brawn and broken rice. The consumer benefit will be availability of branded quality Kuttanadan *punja* rice with produce traceability.

#### **2.2.4. Partitioning of huge *Padasekharams***

Some of the *padasekharams* in the *Kayal* Area and Lower Kuttanad are known for their huge size. These *padasekharams* are largely located in Pulimkunnam, Neelamperoor, Kainakari, Veliyanadu and Kavalam panchayats. The huge *padasekharams* with their reported area are D Block (729 ha), E Block (402 ha), H Block (783 ha), R Block (619 ha), Raja Ramapuram *Kayal* (539 ha), Mangalam *Kayal* (402 ha), Parampady Ponupakke padom (352 ha), K & L Block and Aappu *Kayal* (340 ha), etc. The huge size of some these *padasekharams* requires more than 2 km trekking from one end to the other. When each of these *padasekharams* were owned by one or few farm families, the logistical aspects of managing cultivation in them with the help of boats

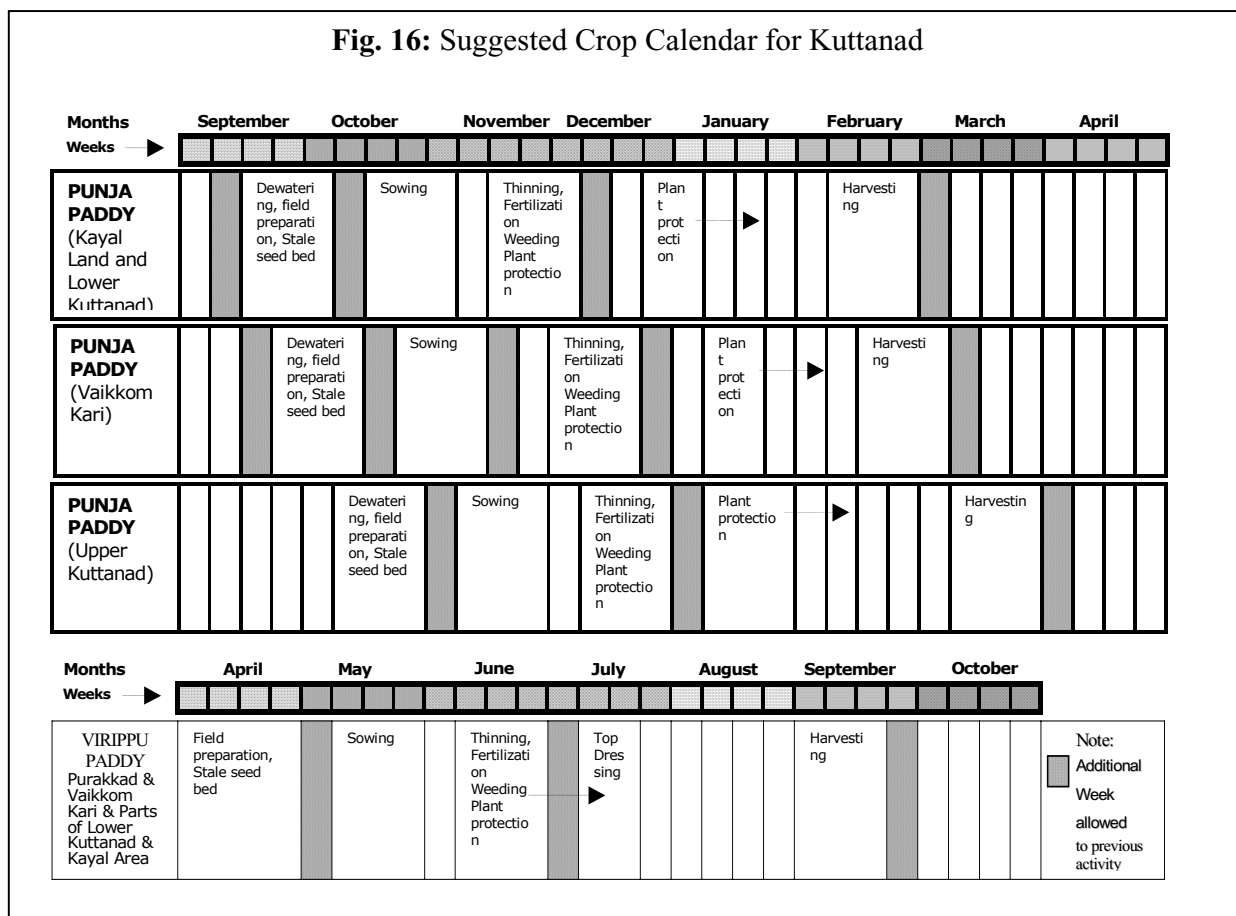
were less complex. Currently, each of these *padasekharams* is owned by a few hundreds of households with individual household ownership not exceeding 1-5 ha. For example, the Q (196 ha), S (240 ha) and T (204 ha) *Kayal padasekharams* have 490, 600, and 510 farm holdings, respectively, where the average size of the holding is 0.4 ha. The farmers who own the field deep inside the huge *padasekharams* are required to meet exceedingly high cost in carrying the farm inputs in and the produce out of their fields. Under the present high cost of manual transportation, the cultivation charges of these farmers become prohibitively higher. Hence, there is wider acceptance from farmers to the proposal for dividing larger *padasekharams* to sizes manageable in terms of cultivation logistics. In consultation with farmers it is decided to recommend not dividing *padasekharams* with area less than 240 ha (600 acres) and also not to undertake a division, which may lead to pieces less than about 140 ha. Division of *padasekharams* less than 280 ha (700 acres) is not favoured for reasons that large area may be used for construction of dividing bund and smaller *padasekharams* may diminish the scenic beauty being added by the emerald paddy fields of Kuttanad. However, any such division may be taken up only with the consensus of concerned farmers and the *Padasekhara Samithi* may take full responsibility on the management of the bund.

#### **2.2.5. Crop calendar**

The *punja* crop calendar for the *Kayal* Lands, Lower Kuttanad and North Kuttanad is the most important determinant to the period and duration of TMB shut down, which in turn impact mainly on fishery resources of the *Kayal* south of TMB, the accumulation of pollutants therein and the proliferation of waterweeds in downstream canals and other waterways. An appropriate determination of *punja* crop calendar and its strict enforcement are, therefore, very important for promoting rice production while safeguarding and sustaining the Kuttanad Wetland Ecosystem. When such crop calendar allows telescopic schedule for the *punja* crop in *Kayal* Lands, Lower Kuttanad and Northern Kuttanad in one cluster, Upper Kuttanad and Vaikom *Kari* in other separate clusters, it would offer increased number of employment days to the farm labour, staggered time to organize farming services such as time-bound dewatering, preparatory cultivation, supply of credit and farm inputs and deployment of farm machinery, including for harvest. Other possible benefit of this calendar is reduced incidence of pests and diseases and hence reduced application of pesticides. The *punja* crop calendar finalized after interaction with many farmers and district officials of DoA requires that sowing is first completed in *Kayal* Lands, Lower Kuttanad and North Kuttanad, then at the *punja* area in Vaikom *Kari* and lastly in



**Fig. 16: Suggested Crop Calendar for Kuttanad**



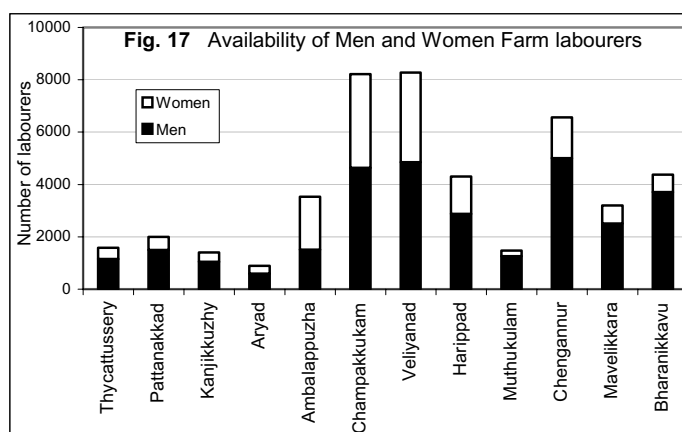
Upper Kuttanad. The recommended crop calendar for *punja* and *virippu* in Kuttanad is depicted in Figure 16. *Virippu* is grown in Purakkad Kari, parts of Lower Kuttanad and *Kayal* Area and in parts of Vaikom *Kari*. There is little scope to modify the *virippu* crop calendar. Calendar for *Mundakan* grown in a small part of Vaikom *Kari* is not indicated here.

The recommended crop calendar (Fig.16) shows the cropping schedule with time limit for various major operations. Accordingly, sowing of *punja* crop in *Kayal* area, Lower Kuttanad, North Kuttanad and Vaikom *Kari* starts from second week of October and completes in first week of November. The crop is harvested in February extending maximum up to first week of March. The Sowing in Upper Kuttanad may commence and completes in December. It comes to harvest by mid March to mid-April. This crop calendar may be brought into effect and enforced with the cooperation of all concerned *padasekhara samithies* in tandem with the recommended tasks on TMB and outer bund strengthening. The other pre-conditions for adopting and enforcing this crop calendar are: (i) Timely facilitation of common services like dewatering, availability of

soil ameliorants, labour and machinery and other inputs, (ii) Formation of farm service providinacility for a cluster of *padasekharam* covering 2,500 ha, (iii) All departments providing support to agricultural activities make positive support for enforcing the crop calendar, (iv) By disallowing sowing of the medium duration varieties beyond the sowing deadline and encouraging use of short duration varieties (100-105 days maturity) for sowing delayed up to two weeks, and (v) The *padasekhara samithi* shall take responsibility for in enforcing the crop calendar and the concerned departments shall coordinate the enforcement across *padasekharams*.

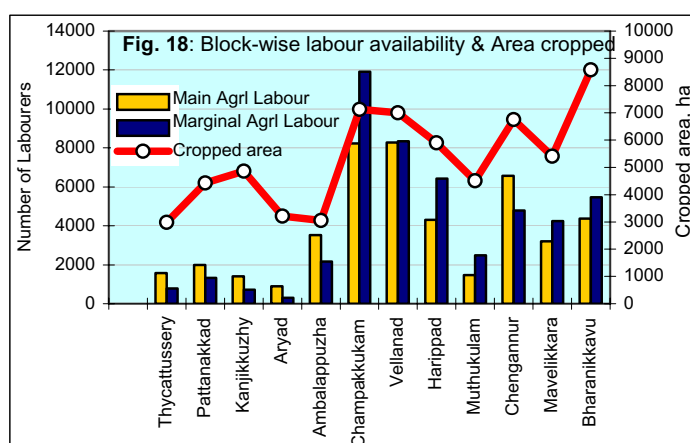
### 2.2.6 Farm labour and crop calendar

The agricultural labour of Kuttanad are proud owners of a rare legacy, the invincible power of human labour in transforming major part of the Vembanad *Kayal* into golden paddy fields. The hundreds of *padasekharams* in the Kuttanad, reclaimed from the *Kayal* over 150 years stand as the living testimony to their hard work and engineering skill. They have been the strong allies to farmers in their continuous struggle with the recurring natural calamities of the region. These workers possessed many skills and commendable dedication in executing tasks uncommon in other areas of rice farming. However, with the march of time these unique skills and work culture of agricultural labour of Kuttanad is on decline and Kuttanad is now facing labour shortage during peak periods of agricultural operation. They constitute one of the most well organized groups in Kuttanad. The younger generation farmers as well as farm labourers are less keen to come and stay in agriculture. With the change of time, working conditions and working hours of the labour have undergone significant change. The current widely followed daily working hours is 4 hours for ploughing, 5 hours in *Kayal* lands for all work, and 6 hours in rest of the area. The ruling daily wages for man and woman are Rs.175 and Rs. 90, respectively with additional proportionate rate for every extra hour of work. For harvesting, 16 % of the produce is given as wages and this is applied even if machine is used at additional cost for harvesting and staking. Loading and unloading of inputs and produce are charged on contract basis; with restriction that only specific group of labour is entitled to this contract in a given *padasekharam*. Agricultural labour,



on the other hand, complains that the labour days available in a year are less and this have to be enhanced. The woman labourers want enhanced wages, if not on par with that of men. Although the different operations require almost equal number of men and women, 80 % of the current labour force in paddy cultivation is woman. This is notwithstanding the available data on agricultural labour in different Blocks of Alappuzha district showing that men labour far exceeds women in many Blocks (Fig. 17). More men are moving out of agricultural sector.

On an average about 150 mandays are used to grow one crop/ha in Kuttanad. Different estimates show, 60 to 78 % of cultivation cost is attributed to labour cost, depending on whether or not machinery is used. The labour unions *suo moto* enhance the wage levels, particularly when the government decides to increase the procurement price. With the declining availability of labour, increasing shift to mechanization is an essential imperative. However, three strategies may be adopted to enhance the employment days per year and add value to labour skill and time. First is establishment of labour banks in each panchayat, which may create rough database on the unskilled and skilled gender-wise agricultural labour of the area as well as the annual labour demand from the local agricultural activities, particularly the local *padasekharams*. The distributions of main and marginal agricultural labour



and the cropped area in each Block of the Alappuzha district (Fig. 18) shows that there is a huge mismatch between local available labour and the net cropped area in many Blocks. According to the 2001 census, the agricultural labourers in Alappuzha, Kottayam and Pathanamthitta districts are 48,878, 57,650 and 44,922, respectively, although much of these numbers are not available on the farm. During peak rice farming activities, the labour supply is far inadequate and this can upset the crop calendar, in the absence of mechanization. For example, the crop calendar demands simultaneous *punja* cultivation in about 28,000 - 30,000 ha area in *Kayal* area, Lower Kuttanad, North Kuttanad and Vaikom *Kari*. This requires about 12 lakh farm labour, @ 40 labour /ha, in a month's time to complete operations up to sowing. This offers an opportunity to empower the youth with skill development for operation of machineries, input supply and other farm services. This calls for creation of institutional system to train and build capacity of

workers, particularly in using and maintaining machinery. The new crop calendar with staggered period for *punja* cultivation in Upper Kuttanad and the 'one paddy-one fish' rotation in some areas offers opportunity for increased number of labour days per year.

### ***2.2.7 Farm input supply to suit crop calendar***

Like the timely availability of common services of *padasekharam* and availability of adequate labour, supply of inputs on time is very important to enforce the crop calendar. For efficiency and expediency, these supplies may better be organized at the level of each larger *padasekharam* or a cluster of adjoining smaller *padasekharams*. Advance access to soil test results and recommendations on application of soil ameliorants and manures and fertilizers, timely availability of credit and recommended inputs such as soil ameliorant, feticide, seed and fertilizers are important to complete the sowing on time. Farmers widely reported difficulty in the timely supply of recommended ameliorants, direct fertilizers and seed.

Among these, availability of seed emerged as the most critical issue in all meetings with farmers. Unlike in other places, Kuttanad farmers in recent times do not save *punja* crop seed for re-using during next season and this is the only crop most of them grow. They attribute practical problems in drying the seed after harvest and its safe storage with out losing viability for eight months under high ambient humidity as reasons for not saving the seed. Hence, supply of fresh seed every season is necessary. Currently, the National Seeds Corporation and Karnataka State Seeds Corporation through the DoA meet much of the seed demand on the two currently ruling varieties, Jyothi and Uma. Although the recommended seed rate is 100 kg /ha, farmers use higher seed rate up to 150kg/ha, often as a precaution against possible poor seed quality. Due to shortage of quality seeds all kinds of seed reach farmers during sowing season, leading to problems like poor germination, seed mixtures and poor yield. Only a small part of the certified seed supplied is locally produced and bulk of the seed, therefore, comes from the Karnataka State Seed Corporation. Farmers at all meetings and through many memoranda stressed the need for local production and supply of quality seeds.

A conservative plan for production of certified seeds of two varieties for 35,000 ha @ 100-140 kg seed /ha is as follows. Total seed requirement of these varieties is about 4,200 t. One may go for one-stage or two-stage Foundation seed production. By following the two-stage Foundation

seed production method, the said certified seed may be produced starting from 700 kg breeder seed. This breeder seed may be first increased to 10.5 t at Foundation seed I-stage in 7 ha area, at multiplication ratio of 1:15. Foundation seed I may be further multiplied to about 210 t at Foundation seed II-stage in an area of 105 ha at a multiplication ratio 1: 20. This Foundation seed II, at a multiplication ratio 1: 25 would provide 5,250 t certified seed in an area of 210 ha.

Suggestions came before this Committee to use Rani and Chithira *Kayal padasekharams* for seed production. This Committee is of the view that low lying areas of Kuttanad, particularly in the *Kayal* area, is unsuitable for seed production for multiple reasons not elaborated here. Palaghat and Thrissur regions were also suggested for basing seed production. These options are also not favoured on grounds of phytosanitary considerations. The area most appropriate for seed production, this Committee views, is the Upper Kuttanad during *punja* season. Here, according to the crop calendar, *punja* crop comes to harvest during late March. This is expected not to coincide with summer showers and allow cost-effective processing of seed and its storage. The storage period of such seed is only about five months before the next *punja*. This seed production may be successfully organized by involving the Regional Rice Research Station, Mankombu for breeder seed production, State Seed Farms in the district for Foundation seed production and farmer participatory approach under the supervision of scientists for certified seed production. The necessary logistical support, drying, grading and storage facility along with seed testing facility would make the programme self sustainable and beneficial to farmers. How far involvement of Kerala State Seed Development Authority would help in promoting the cause of seed production and supply without bureaucratic hindrances may be examined.

In the case of other inputs like chemical weedicide, manures and fertilizers, and insecticides there is considerable scope to improve the quality of material, timing of supply and optimization of application. Due to the water-borne weeds and high cost of manual weeding, application of weedicide, 2-4 D sodium salt, is common. Weedicide efficiency can be improved by ensuring supply of quality material and optimal dosimetry. There is wider impression among farmers that this weedicide is becoming less efficient. It is not known whether weeds are building resistance against the weedicide or the material is spurious. Eventually, with the better management of waterweeds, dependence on weedicide may be reduced. Application of organic manure is not common and the soil has high organic content. Although the recommended fertilizer package for Uma and Jyothi varieties is 90:45:45 NPK as straight fertilizers, farmers apply higher doses of

more costly complex fertilizers. There is scope to moderate this fertilizer application and to minimize the nutrient leaching to water bodies. While over years there is no substantial reduction in the fertilizers used in Kuttanad (around 20,000 t NPK nutrients), an increase in the practice of 'one paddy and one fish' is expected to impact substantial reduction in fertilizer and other agricultural chemicals used. The third important group of agricultural chemicals widely used and contributing to environmental pollution is pesticides and fungicides. During the recent years, pesticide use has come down with increased awareness on its ecological footprints. Their use may be further optimized with the help of better advance pest/disease warning system, better application machinery, collective management of pests/diseases within and across *padasekharams* and following integrated pest/disease management approach. The changed crop calendar and its enforcement are expected to bring down the severe instances of pests/diseases leading to substantial reduction in the use of these chemicals. Although the application of pesticides has decreased, there is scope to achieve further reduction in their use and move to collective management of pests and diseases by integrated approach. Technical backstop like periodic soil analysis and supply of soil health cards to promote calibrated application of right fertilizers, and services on quality analysis of chemicals to check trade on spurious product are important to cut cultivation cost, efficiency and minimize environmental pollution from these chemicals. The switch over to 'one paddy one fish' rotation may drastically bring down pesticide use.

### ***2.2.8 Mechanisation***

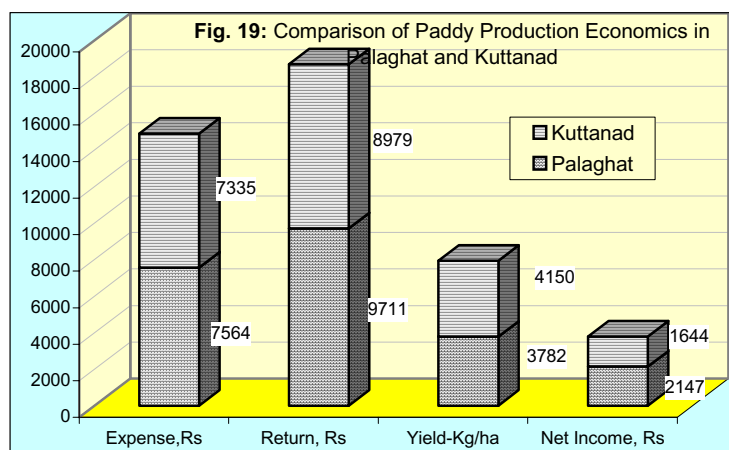
Over a century, rice cultivation in Kuttanad, including dewatering, was carried out with only manual labour. The first mechanization was the entry of a special pumping device called *petti* and *para*. Until few years back there was fierce opposition against mechanization from organized labour. With the decline in labour availability, decrease in profitability from rice farming and farmers abandoning rice farming on economic grounds, the organized resistance to mechanization is selectively reducing. Currently about 50 % of farmers use mechanized ploughing, including power tiller, despite in some areas they have to make the traditional payment to the ploughman. About 21 % of the paddy farmers are exclusively depending on animal ploughing, another 20 % use animals only for one round of ploughing. All input applications and weeding are totally manual. Despite high intensity application of herbicide, the cost on manual weeding is the largest among farm operations. Mechanisation in harvesting started with thresher, moved to harvester and then to combine harvester-cum-thresher. Most of

the combine harvester comes from outside and farmers are required to pay exorbitant charges. Even then, farmers prefer to use machinery as it makes harvest and threshing faster, because manual harvest and threshing take 2-3 weeks to complete and this causes substantial post-harvest yield loss. There is widespread demand for providing farm machineries and related service support within Kuttanad at reasonable rate. Some of the region requires specifically designed tools and machinery to suit the local needs, such as harvesting *Pokkali* rice in standing water. Hence, there is a well justified ground for establishing a Centre for Farm Machinery Research, Development and Training in Alappuzha to undertake research to design and develop locally suited and farmer friendly machinery, to provide training to youths on operating and maintaining machinery and to provide back up service to all farm machinery of the district.

### 2.2.9 Cost of production vs produce price:

Across Kuttanad, the costs of rice production and average yield vary across the six agro-ecological zones. While the *virippu* yield of Purakkad *Kari* is the lowest, the *punja* yield in Lower Kuttanad and *Kayal* area is the highest. The components of cultivation cost also vary. For instance, the cost on soil ameliorant is high in Purakkad *Kari* and cost on dewatering and outer bund strengthening is high in *Kayal* Lands and Lower Kuttanad. Similarly, the cost on fertilizers, weeding, plant protection, and machinery hiring vary across the agro-ecological zones. Therefore, cost of cultivation presented here is largely based on the *punja* paddy cultivation in most parts of Kuttanad leaving Purakkad and Vaikom *Kari* lands. A calculation made by Expert Committee on Paddy Cultivation in Kerala in 1999, estimated the cost of *punja* rice cultivation in

North Kuttanad at Rs. 10,761/ha with a net loss of Rs. 1,422/ha. This report also stated that despite the Kuttanad productivity being 10% higher than that of Palaghat, the net income in Kuttanad is 24 % lesser (Fig.19). According to a report presented to this Committee By Shri. S.K.Manoj, Member of

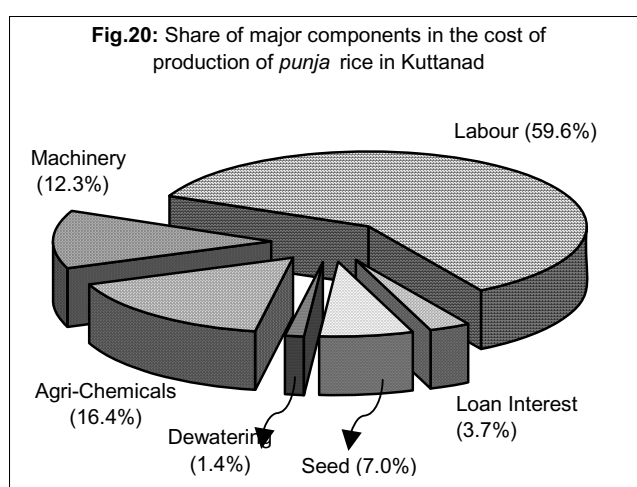


Parliament, the cost of cultivation for an unspecified period is Rs. 15,000/ha and net profit is Rs. 5,625/ha. The period appears to be 2002, on the basis MSP used for the costing. This Committee took a comprehensive estimate on cost of cultivation based on inputs from farmers, agricultural

officials and scientists. According to this estimate, the *Kayal* Land, Lower Kuttanad and Northern Kuttanad incurred a cost of Rs. 25,850/ha. At yield of 4.0t/ha and paddy price of Rs.8,500/t, the net profit /ha is Rs. 8,150. These estimates show that loss and profit are common in paddy cultivation and when there is profit, it is between one-sixth to one-third of the cost of cultivation. This predicament destabilizes the economic viability of paddy cultivation in Kuttanad, where the average yield is one of the highest.

Examination of various components of cost of cultivation by the Expert Committee on Paddy Cultivation in Kerala in 1999 showed 66-69 % of total cost is paid as labour wages and among

the inputs, soil ameliorant took major share of cost, followed by manure and seed. The decomposition of the cost of cultivation generated by this Committee is given in the Fig. 20, which shows that share of labour is about 60 % and with service cost of machinery added, it is 72 %. The prices of rest the inputs such as seed, manure, pesticides, etc are either subsidized or fixed by the government. Major gain in



profitability to farmer, obviously can come only from regulation of components, which share 72 % of cost. Major expenses on labour come from outer bund strengthening, land preparation and weeding. Mechanisation is slowly increasing in Kuttanad. Institutional support to mechanisation and making the mechanised services at favourable charges may help to increase the profitability to farmer and strengthen the economic viability of rice farming.

The increasing unfavourable economics of paddy cultivation with hired labour is encouraging leased cultivation of paddy, where the lessee with out paid family labour manages to earn a better profitability. It is widely stated that nearly 60 % of the cropped area in Kuttanad is under leased cultivation. The leasing is usually for a very short period, may be for 1 or 2 crop seasons, and this is agreed between the lessor and lessee on oral agreement with no lease records. Care is also taken to change the lessee after a lease cycle. Annual lease charge is increasingly paid in cash and in advance, varying between Rs. 5,000-10,000/ha. Lease rate is largely based on soil productivity, field location and bargaining skill of lessees, etc. Under such leasing, the lessees do



not take much interest in maintaining outer bund or improving soil fertility. Lessees are also excluded from eligibility for most of the support and subsidies extended by the government. The lessor continues to be in the *padasekhara samithi* and the lessee is often not a member.

Although the decline in rice cultivation in Kuttanad is relatively lower than the same in rest of the Alappuzha district like Onattukara or Thuravoor *Kari*, there is substantial withdrawal of farmers from rice cultivation. This is happening irrespective of the holding size. An instance is the fallowing of Rani (T-Block) and Chithira (Q-Block) in the *Kayal* land of Kuttanad, which are owned by many small landholders.

#### ***2.2.10 Redressal to paddy cultivation in the Kari lands of Purakkad and Vaikom***

The *Kari* soil in southwestern region of Kuttanad spreads over 3,500 ha in four panchayats, the whole of Purakkad and parts of Karuvatta, Thakazhi and Ambalappuzha panchayats. There are 43 *padasekharams* ranging in size from 4 to 195 ha, situated 1.3 to 2.0 m below MSL. Much of the area is wetland and a part of it is reclaimed as garden land by widening the *padasekharam* bunds. The distress of farmers of this region primarily arises from the nature of the soil, its low productivity and the heavy risk they continuously face from flooding and saltwater intrusion. The *Kari* soil gets its name from the dark colour due to rich organic carbon content. It is heavy in texture due to clay content, poorly drained and hence not well aerated, high in acidity and concentration toxic compounds of iron, aluminum, and manganese. High fixation of P, makes this nutrient least available to the crop. The toxic soil compounds also get adsorbed into the crops. All these make the soil less suitable for agriculture. On the basis of soil nutrient status, about 92 % of the area is moderately suitable for paddy and remaining area near Thottappally is marginally suitable. The Purakkad *kari* faces flood during monsoon, shortage of fresh water and ingress of saline water during summer. The area is directly linked to the flood levels of the TSW. Hence silting in leading channel and other drainage channels increases the propensity of flooding here. The saltwater intrusion happens from Kayamkulam *Kayal* through different inlets such as Kannukali Palam Thodu, Danapadi Thodu, Kottaravalavu and Thrikkunppuzha canal. The rice yield in *Kari* lands is about 2 t/ha, which is half of the yield in Lower Kuttanad, although the cost of cultivation in *Kari* lands is as high or even higher than that of Lower Kuttanad. Notwithstanding this fragile economics of *Kari* soil cultivation under high vulnerability to natural disasters, farming is the only means to eke out a livelihood for the people

of these regions. This is the major cause of distress and agriculture related debt burden in this region.

These distresses may be minimized by direct and indirect approaches. Usually only *virippu* crop is grown here, although there is potential for a second crop in limited areas. The crop season coincides with the southwest monsoon and flooding. The drainage of floodwater to the Arabian Sea is designed with the help of the TSW, the leading channel and few other canal systems of the region. Many of these canals have become less efficient due to heavy silting and poor management, which aggravates the flood damages to the paddy fields. The *padasekharams* with poor outer bunds are highly prone to flood damages and this is becoming as a major disincentive to farming in the area. For this reason a large area of the region is left fallowing. Revival of rice cultivation in the region demands farm infrastructure such as, strong, safe and well-maintained outer bunds of *padasekharams*, facility for movement of farm machinery, permanent motor *thara*, pumps, and pump shed. Safeguarding the region against severe flooding may be done by regular protection and desilting of the leading channel and other drainage systems and proper maintenance and timely operation of TSW. Similarly, prevention of salinity intrusion into *padasekharam* area by erecting appropriate spillways, in the place of temporary '*oorumuttus*' in major canals carrying the salt water up is another important safety measure. Due to its high acidity and presence of toxic salts, the *Kari* lands requires heavy application of quick lime, almost double of the level applied elsewhere in Kuttanad. Drying of *Kari* soils aggravates its acidity and toxicity problems and hence keeping the soil submerged round the year is important to check and regulate these soil problems. Farmers are not able to do this important soil management activity for want of fresh water during summer and absence of pumps and power connection to let the water into the *padasekharams*. The process of precipitating and leaching out the toxic salts requires copious fresh water. Therefore, field preparation for *virippu* crop cannot be done either without rain or fresh water pumped into the *padasekharams*.

There is wider opinion among *Kari* land farmers that the functioning of the PSO is not helpful and they also desire that water management may totally be entrusted with the *Padasekharam Samithi* with official control vested with the local Krishi Bhavan. The fragile and often loss making rice production economy of Purakkad *Kari* cannot withstand even a single crop loss from flooding, and such predicament may surely leave the farmer indebted. For this reason, a larger part of the *Kari* area is under fallow since the last crop loss due to flooding a few years back. To

return to profitable and sustainable rice farming Purakkad *Kari* farmers demand *padasekharam* infrastructure, enhanced subsidy on soil ameliorant and waiving off bad debt. Such revival is the only major economic opportunity for the largest number of people.

Major interventions required to address the distress of Purakkad *Kari* farmers are (i) Repairing and streamlining TSW and the leading channel for efficient drainage of floodwater. This may require desilting the leading channel and to deepen it by about 1 m, strengthening its side walls and raising the side walls by about 1 m, repair and periodic maintenance of TSW for smooth functioning, timely removal of sand bar and involving Purakkad *Kari* area farmers in the TSW Management Committee, (ii) Widening one side of the leading canal bund to facilitate farm machinery movement, (iii) Widening and deepening of Kariyar *thodu*, Kari *thodu*, Kunnumma *thodu* and Korankuzhy *thodu* to enhance the flood water flow from Pamba river, (iv) prevention of unauthorized sand mining from these rivers, (v) Creation/strengthening of *padasekharam* infrastructure, such as outer bunds with width and strength to allow farm machinery movement, sluices, motor *thara*, motor sheds, machinery landing facility, provision of pumping systems (*petti* and *para*) and making available electric power after the crop season to maintain fields in submerged state, (vi) Supply of quality paddy seeds and design and development of location-specific farm machinery, (vii) Prevention of saltwater intrusion from Kayamkulam *Kayal* through the different waterways (mentioned above), shifting of Pulikkeezh bund towards north, re-building Trikkunnapuzha bridge with increased width to suit widened canal to accommodate modern lock systems (the National Waterways Authority, which regulates this canal may be requested to do the renovation in accordance with the composite needs of local community), (viii) The area has potential to introduce ‘one paddy-one fish’ rotation in combination with the *virippu* crop wherever fresh water is available during summer. Such areas may be identified for extending technical and logistical support for generating additional income. It is important that brackish water fish culture should not be allowed in fields, (ix) As the *Kari* lands require higher quantity of soil ameliorant application and the productivity level of the soil is low, grant of full subsidy on the quantity of soil ameliorant recommended to the region may be considered, (x) Production bonus being given to this area currently @ Rs.140/acre may be enhanced to Rs 200/acre, (xi) Waiving off the bad debt, providing agricultural loan at low rate, prompt procurement of paddy and immediate payment of its price, and establishment of rice mills in the area are other demands of farmers.

### **2.2.11 'Gandhi smrithivanan'**

Government of Kerala had acquired about 400 acres of paddy fields from Manakkal *padasekharam* in Purakkad for the purpose of establishing a project called 'Gandhi Smrithivanan'. This prime paddy land, reported to be under the current custody of Kerala Forest Department, is left abandoned for over 15 years without implementing the proposed project. Continued neglect has made the area into a marshy forest with growth of weeds and infestation of snakes and rodents, causing problems to the nearest paddy fields and human habitation. Taking away the land from farmers and leaving in such utter neglect is a public loss. Respecting the current regulation on conversion of paddy fields for alternate or non-agricultural uses, the government may take a re-look at this land and decide to bring back to rice cultivation.

### **2.2.12. Vaikom kari**

Vaikom *Kari* lands forming a part of Northern Kuttanadu is a unique low lying area criss-crossed with canals and waterways spread over 11 Panchayaths in Kottayam and Vaikom Taluks of Kottayam district. The area is demarcated by Aymanam panchayat in Kottayam Taluk in the South and Chempu panchayat in Vaikom Taluk in the north. This backwater area lying adjacent to Vembanadu *Kayal* has a total area is about 28098 ha, comprising of 10398 ha of paddy lands lying below 0.5 to 2 m MSL, 12424 ha of garden lands at 0.5 to 2.5 m above MSL and the rest waterways and backwater area of Vembanadu *Kayal*. Like elsewhere in Kuttanad, coconut is the major crop in garden land. During June to August most of the area gets submerged under the floodwater brought by the Meenachil River and its branch canals. The soil is silt loam to silt clay and is by and large similar to the Purakkad *kari* in physical and chemical properties with slight differences in colour, organic content and pH. The organic matter decomposed to various levels goes up to 25 %. The soil acidity ranges from pH 2.5 to 3.5 when the fields are dry. It is classified as fairly good for paddy cultivation. The paddy area is constituted into several *padasekharams*, most of them with inadequate outer bunds and vulnerable to crop failure from flooding. Like in the Purakkad *Kari*, continued submergence of this soil, leaching and drainage are important to improve productivity. Although the region allows three paddy crops annually in *virippu*, *mundakan* and *punja* seasons, *virippu* is grown in 5,520 ha, *punja* in 2,400 ha and double crop in 1,200 ha, mainly in Arpookara and Aymanam. Like in Purakkad *Kari*, rainy season (*virippu*) cultivation facilitates in reducing the acidity and achieving an average yield of

4.5 t/ha. The *punja* crop, which faces problems from acidity and salinity on an average, yields about 4.0 t/ha. About 1,300 ha is currently left as fallow.

Major infrastructure requirements of Vaikom *Kari* area are: (i) Strengthening outer bunds of *padasekharams* with needed facility for movement of machinery, culverts, sluices, motor *thara*, pump house and ramps for machinery landing, (ii) Enforcement of *punja* crop calendar (Fig. 8), (iii) The entry of salinity in Vaikom *Kari* area is regulated by TMB, three major *oorumutts* at Kariyar (313 m wide), Vadayar and K.V. Kanal (17 m), 5 small *oorumutts* in Thalayazham Panchayat (at Mathunkkal, Madankkari, Thrippokudam, Palachuvadu, and Anuyidu) and 4 *oorumutts* in Vechoor Panchayat (at Kochuthodu Chirattakari, Poonkavil Thyazhethodu, Kochuthodu Poonkavu and Anachunal Thodu). A critical infrastructure need of this region is construction of three permanent spillways at Kariyar, Vadayar and K.V. Kanal. This is expected to bring about 2,500 ha area under second crop, apart from stabilisation of current paddy and coconut cultivation and bringing 1,000 ha fallow land under cultivation, (iv) 'One paddy-One fish' rotation is at present practiced in six *padasekharams* of Vaikom area with fish culture following *virippu* rice. The area has potential to expand the One paddy-One fish' to more *padasekharams* with improved infrastructure.

### **2.2.13 Declare Kuttanad as a Special Agricultural Zone**

Kuttanad region as well as the agriculture here are very unique in many ways. The characters of this uniqueness are that farming is done below the sea level, the farming region is part of a fragile but beautiful wetland system which is declared as Ramsar Site, the farming is under recurring natural vagaries like flooding and salinity intrusion, the farming is done under regimented practices for ensuring ecological security of the region, the density of farming population is intense with huge majority of them being small farmers, and the farming is land based and water based with meagre profitability. Paddy cultivation is essential for conserving the services of the wetland system. It is also intensely linked with the livelihoods of the people. Farmers of this region face several disadvantages, which their counterparts elsewhere are facing for pursuing similar kind of farming. Under this unique predicament, generation of additional economic activity, promotion of investment, creation of employment opportunities and development of farming infrastructure facilities in Kuttanad cannot be achieved without a special consideration to this region from the State and Central Governments. To serve these purposes it is important that Kuttanad region is declared as a Special Agricultural Zone. It is clarified that SAZ unlike the Special Economic Zone does neither displace farmers nor lead to deprivation of

their land, but facilitate to receive regular support from the Central and the State governments for infrastructure and agricultural prosperity achieved through farming, where farming is integrated with end to end linkages and in tandem with ecological security of the region.

## ***2.2. 14 Agricultural distress in Onattukara region***

Of the 48,537 ha of area constituting the Onattukara region in the Alappuzha district, 30.5 % is wetland and 56.5 % garden land with Karthikapally taluk sharing 58 % of the wetland and 49 % of garden land. Onattukara was once famous for prosperous agriculture with intensive cropping of two rice crops and a sesame or pulse in rotation and mixed farming. Since last few years rice farming had become unattractive in Onattukara and farmers had abandoned the cultivation. A part of the paddy area is converted to garden and commercial lands and the rest lying as fallow. Extensive land conversion was promoted with the establishment of the NTPC Thermal Plant and its township at Kayamkulam and laying of the Mavelikkara-Alappuzha rail link. These conversions had created major drainage problems to the remaining wetland and this has become an important ecological problem hampering rice cultivation in these lands. It is estimated that currently only about 5,000 ha is under rice cultivation and more than 8,000 ha is under fallow for short to long years. The fallowing for many years has resulted in the neglect and loss of all common wetland assets of this region, such as field bunds, irrigation canals, water drains and many big and small water tanks. They got choked with silting and continued neglect or become dysfunctional due to land conversion and encroachment. Such neglect and degradation of common wetland assets had promoted further land conversions and encroachments. Mindless mining of paddy fields for sand or for clay in brick industry are also being allowed in few panchayats. Such huge disuse of land resource, which once provided rich harvest of rice, coconut and sesame is alarming. This Committee understands that the DoA made an earlier effort for promoting cultivation of banana, vegetables and tubers and also planting of coconut on mounds in waterlogged areas as an effort to revive agriculture in the area, which however, failed to make any impact. Interestingly, all farmers, their associations and elected representatives of this region who met or represented to this Committee showed high enthusiasm to getting back to rice cultivation and requested for strengthening of paddy field infrastructure.

Another impact of continued fallowing of the paddy fields in this region the farm labourers had moved to alternate occupations and hence the area suffers from acute shortage of farm labour. Although 91 % of the 1,20,285 farm holding in Onattukara falling under Alappuzha district owns

less than 0.5 ha and only another 6 % has holding size between 0.5 and 1 ha, many of these holdings depends on farm labour to conduct the cultivation. Therefore, return to rice cultivation under these circumstances also requires considerable mechanization, which in turn may require some kind of cooperative or group efforts.

Onattukara was very famous for production of medicinal rice variety like the *Njavara* and indigenous sesame varieties, which are highly valued for preparing ayurvedic hair oils. Such special and high value varieties, although low in yield, may offer premium price and firm niche market, particularly when produced under organic farming. Along with the decline in rice area sesame area also had decreased to about 550 ha. This region was also known for production of tubers and still holds a place of prominence for the supply of planting materials of tubers. This is the strength that this region may be able to capitalize and establish a production and supply chain in the state for the planting materials of different tubers. Necessary support from the Department of Agriculture and the Central Tuber Crops Research Institute may be leveraged for this programme. Vegetable cultivation has large potential in this area, particularly in coconut gardens. This region has large area under coconut, which unfortunately is severely affected by the root wilt disease. Coconut management system, integration with other farming components, value added product development and marketing as a group activity suggested elsewhere in this report might enhance the income.

Onattukara offers great opportunity for developing crop-livestock integrated homestead farming involving buffalo, cow, goat and poultry. There are a number of successful models on smallholdings engaged in profitable stall-fed rearing of three to four goats. Such goat rearing is a unique model proved successful in Kerala, where the governmental institution extended the health care facilities. Onattukara has the potential to establish goat rearing in about 10 % of total farm holdings. Similarly, the availability of many ponds and waterlogged areas in Onattukara offers opportunity for buffalo and fish rearing. The proximity of Buffalo Breeding Farm at Kollam could be used for a buffalo up gradation programme through breeding and productivity enhancement. This region was once a major egg production center with Kayamkulam serving as the marketing hub. Egg produced in Onattukara and Kuttanad used to be dispatched to Chennai, Kolkata and Mumbai. Chengannur Central Hatchery was started in 1960's for the promotion of deep litter system of poultry farming. This enterprise also faded away under pressure of competition from neighbouring states. Now, with the availability of good quality indigenous

birds and demand for their meat and eggs produced in homesteads, there is an opportunity to revive backyard poultry in the area. There is scope to establish and promote more than 10,000 backyard poultry units spread across the taluks of Mavelkara, Chengannur, and Thiruvalla. A project by putting the farm families at the central place and institutions like Department of Animal Husbandry, the Poultry Development Corporation, DoA, and KAU as facilitators may be evolved and implemented supported by required bird healthcare service and market connectivity.

The Pamba Irrigation Project (PIP) and the Kallada Irrigation Project (KIP) are two major infrastructure created to promote intensified rice cultivation in parts of Onattukara served by these projects. Instead of serving as a boon to the agriculture of this region, these projects have become more a curse to farmers. The disastrous construction of PIP is causing heavy seepage in several areas, which is degrading the good agricultural land with water logging and flooding. For instance, more than one-tenth of the 1,000-acre Karingali *punja* in Palamel, Nooranad and Panthalam panchayats has virtually become a tank due to seepage of the PIP and cultivation in this area had been abandoned, as draining out of the water is not easy. Similarly, the KIP is damaging the *puncha* crop area in Vallikunnam. These are only illustrations and the harm caused by these two irrigation projects is more extensive.

Large number of water bodies available in Onattukara may be properly maintained and profitably be used for inland fish culture. A rough estimate made by this study shows that at least about 3,000 homestead or groups could take up such fish culture. A joint participatory exercise by the Department of Fisheries and KAU may identify appropriate species and species mixtures for culture in these fresh water bodies and periodically provide fingerlings to the farmers, or farmer groups who undertake the farming. *Krishi Vigyan Kendras* and other local institutions may be involved for training and capacity building of farmers in the fish culture. Matsyafed, local banks and local panchayats may be roped in to facilitate required bank credit and marketing of the harvest. Scientific and ecologically sustainable integration of fish culture with other agricultural activities is important in the sustainability of income generation.

After a long paddy fallow period, the revival of agriculture in Onattukara with the primacy to paddy and paddy based rotation in wet lands and improvement in coconut productivity as well as integration of crop production with components like dairy, gottery, fishery and poultry demands substantial infrastructure and operational investment together with focused capacity building,



market integration and facilitation of credit and services. Infrastructure investment is on restoration of all natural and man made blocks to canals (*thodus*), waterways and other drainage systems, revival of community ponds, restoration of cultivation in abandoned lands, and introduction of farm machinery in lieu of labour shortage. Restoration of paddy cultivation additionally requires strengthening outer bunds in areas adjoining the Upper Kuttanad and support for initial land preparation and planting cost. The revitalization should touch up on the local line departments for supply of quality agricultural inputs, servicing to agricultural machinery, credits, production and supply of forage and feed, animal healthcare, supply of fish fingerlings and fish feeds and assured market at declared support price. In view of the very small holding size (less than 0.4 ha), institutional support involving local panchayats may be required to promote cooperative or group farming by owner farmers, or by lessee farmers or by self help groups like the '*Kudumbasrees*' to achieve economy of scale and enhanced economic viability. A mass movement has to be created by the government and local panchayats among all farmers to take these lands, where infrastructure is created with high investments, back to farming led economic growth. The government and local panchayat also has to take responsibility for safeguarding and maintaining the infrastructure, including community assets like farm roads, canals, ponds, etc. The bottom line of sustainable integrated wetland and garden land cultivation is insurance of a steady net income of at least Rs. 15,000 to 20,000/ ha at the current costing.

#### **2.2.15 The Pokkali rice**

*Pokkali* rice is a unique traditional rice farming system perfected by farmers of Pattanakkad and adjoining coastal region over generations. Unfortunately, this system is losing ground on various reasons. This is causing distress to farmers, who depend on the crop for livelihood. *Pokkali* rice lands are prone to salinity due to proximity to sea and seawater inundation during summer period, when the soil is relatively dry. The soil is sandy loam with marshy characteristics, which makes working on this soil difficult when water logged. Depending on the maturity period of the traditional varieties used in the cultivation and the soil and water regime under which they are grown, there are two interesting systems of paddy cultivation, called *Pokkali* system and *Koottumundakan* system. The traditional varieties of the region have fairly good resistance to salinity, although they are not good yielders. Planting in majority of areas is done during *virippu* season and a second crop was common during *mundakan* season. Prior to South-West Monsoon, the soil is ploughed and formed in to many mounds. During the following monsoon the salinity

from the soil mounds is washed out. Subsequently, during June-July, sprouted traditional seeds, such as *Pokkali* and *Chettuvirippan*, are planted on the mounds. Vyttila 416 is an improved salinity resistant variety with better yield developed by the KAU. When the seedling reaches 30-35 days, the mounds are broken and seedlings are dispersed in the field. Normally, no or least fertilization is practiced and *Pokkali* is virtually organic by default. The specific quality of this rice and its organic production may be exploited to carve out a niche market. Harvest is done during September-October in standing water. Usual yield is 1,000-1,200kg/ha.

The *Koottumundakan* system is a kind of unique relay crop, where two varieties of different maturity period are mixed and sown. Sowing is done like in the case of *Pokkali*. The two varieties used are *Pokkali* (duration 105-110 days) and *Koottumundakan* varieties (duration 150-170 days) and these are mixed in 7: 3 ratio. The *Pokkali* is harvested in September and the longer duration *Koottumundakan* gets chopped in the process. However, having high regeneration capacity it grows rapidly and becomes ready for harvest by November-December. The yield of *Koottumundakan* is lower than the *pokkali* and is around 600-900kg/ha. This unique system obviates working on soil after first crop, which is tedious due to the swampy nature of fields.

With the increase in cost of cultivation of rice, which is common in Alappuzha and elsewhere in the State, *pokkali* cultivation become more unviable due to its low productivity. According to farmers the return from the crop hardly or slightly exceeds the cultivation cost, which is about Rs. 8,000/ha and this discouraging the continuance of cultivation. The area also suffers from non-availability of labour during critical operations like harvest. Delayed harvesting in standing water may lead to heavy yield loss. There is also no machinery suited to the local conditions and needs. Since 1999 several major *padasekharams* are left without cultivation. Some of the *pokkali* rice lands are now being diverted to prawn farming, which is profitable. An Integrated Development of *Pokkali* Fields for incurring shrimp production was introduced by the State, which provided seeds for stocking. Further strengthening of such schemes with more reach is important.

Revival of economically viable rice cultivation in this area, which is of high importance to the livelihood of several farm families and farm labourers, requires creation of new infrastructure strengthening of existing infrastructure, location specific improved technology for higher yield, need-based mechanization and fair market for the produce. The infrastructure has to (i) regulate

saltwater intrusion to the paddy area. This demands repair of two non-functioning and obsolete spillways in Andhakaranazhy and erection of saltwater exclusion vented cross bar at 19<sup>th</sup> Mile in Pattanakkadu and at 16<sup>th</sup> Mile in Kadakkarappally. The existing non-functional spillways in Andhakaranazhy were constructed more than 50 years before with 10 manually operable wooden shutters, which are not easy to open and close. Few of the shutters and a part of the structure were damaged during the 2004 tsunami. (ii) introduce an innovative technology/machinery for harvesting the rice crop in standing water, (iii) strengthen the outer bunds of many big *padasekharams* to prevent crop loss during flood and to promote one paddy-one fish rotation and (4) renovate the drainage system of the area including public ponds. Other support systems required for the agricultural revival are (a) extend assistance to farmers to get organic certification for the *pokkali* rice and to establish niche market for the produce or its value added products, (b) assist the farmers of *pokkali* rice in establishing a geographical indication on the produce, (c) extend required service support for one paddy-one fish rotation in all fields growing *pokkali* rice, (d) use some of the renovated ponds for augmenting drinking water supply of the region along with water supplementation through lorry supply, and (e) encourage water harvesting in ponds and at household levels.

#### **2.2.16 Location specific research**

The study area is being served by the KAU and the Indian Council of Agricultural Research (ICAR). The KAU has four Regional Agricultural Research Stations at Kumarakom, Monkompuzha, and Thiruvalla, all within the Kuttanad region and the Regional Research Centre at Onattukara. The ICAR has Regional Centre of the Central Plantation Crops Research Institute at Krishnapuram in Onattukara region. The focus of research for this CPCRI center is on coconut root wilt disease. In addition, there is a duck hatchery at Niranam under the Department of Animal Husbandry and a few seed farms under the Department of Agriculture in Kuttanad area and rest of Alappuzha. The focus of research on most of these research centers is on rice, coconut, sesame, vegetables and sugarcane. Since the closure of the two sugarcane-crushing factories in the region, sugarcane cultivation has virtually disappeared, except in few pockets where the cane is crushed to make the locally popular '*pathiyan*' jaggery. The crop is also not viable under the rising cost of production. The research in the RARS Kumarakom and Mankombu has impacted the Kuttanad and neighbourhood agriculture in substantial manner.

The RARC at Kumarakom has made lead contributions in conservation of fish diversity in the

Vembanad *Kayal*, developing locally adaptable integrated models of farming system suited to the Kuttanad with components like different fish species, and livestock like duck and pig, culturing giant freshwater prawn in dike channel and the more popular model on 'one paddy- one fish'. The Centre also played role in successful elimination of *Salvinia*, another aggressive alien invasive species spreading the water bodies and rice fields of Kuttanad, using biological control with the help of the tiny weevil, *Cyrtobagus*. The Centre has evolved technologies for homestead integration of agriculture, aquaculture, animal husbandry and apiculture for many fold enhancement of sustainable income from smallholdings. The Centre has perfected techniques for captive breeding of few economically important endemic species of Kuttanad to facilitate their ranching. The Centre also undertakes research on local crops other than rice and integrated pest and disease management, where biopesticide development is given focus. The research experience and technology wealth of this Centre have to be effectively leveraged for the successful implementation of some of the recommendations. The Centre also needs to be strengthened to promote the good work it is doing for the economic benefit of poor farmers and fishermen of the region.

The Rice Research Station, Mankombu established 65 years ago have few major contributions to its credit. KWS is a hotspot for many pests and diseases of paddy. In the recent times, pests, which were considered as minor had assumed proportions of major pests. Multiple resistance breeding into high yield background is a very challenging task, which the Station had achieved with variable success. It has bred varieties resistant/tolerant to brown plant hopper, gall midge, blast and sheath blight. Dormancy, which is important to the Kuttanad rice varieties, has been introduced in few varieties. Over the years, the Station has evolved 20 high yielding varieties. Out these currently only one variety, Uma, has become most popular and out yields Jyothi, the second current popular variety bred at Regional Rice Research Centre of KAU, Pattambi. Currently Uma is reported to occupy 60 % area in Kuttanad. All these varieties, although yielding two-three-fold higher than the traditional varieties, are longer in duration by 15-20 days over the latter. This change in duration and the loose crop calendar followed in *Kayal* area and Lower Kuttanad had promoted extended *punja* cultivation, compelling prolonged period of closure of TMB. There is a widely felt research need to evolve high yielding and pest and disease resistant varieties with duration around 105 days. The Station is reported to have a few short duration varieties. These have to be evaluated in farmers' field for performance assessment and suitability for using for late sowing in conjunction with the recommended crop calendar. Similar

performance assessment has to be made on the varieties developed for *Kari* area. The Station should develop infrastructure for the production of adequate quantities of breeder seeds of all these varieties and serve as an important link for the proposed production of certified seed in Upper Kuttanad for totally meeting the seed demand of Kuttanad.

The annual economic return to Kuttanad provided by this Station with its one variety, Uma, at the current level of coverage, productivity and price is about Rs 25-30 crores. However, the Station is utterly lacking from important infrastructure essential for enhancing and intensifying the research. Being built on land reclaimed from paddy fields, its main laboratory block is sinking with cracked walls. It has to be rebuilt with modern facility. Its laboratory facility is archaic and unsuitable for the modern rice research. Facility is lacking on evaluating varieties for pests and disease resistance, grain quality and milling. The center has to be strengthened for infrastructure to provide back up to the Kuttanad seed production programme by providing required breeder seed and other technical support. The station has to undertake a time bound (six years) variety improvement programme to produce few short duration (maturity around 105 days) high yielding varieties with required pest and disease resistance/high tolerance, dormancy of at least one month, better grain quality and milling quality.

The Research Station at Onattukara has done good work on rice and sesame breeding, and development of management measures for enhancing income from coconut. It also produces rice and vegetable seeds. Major constraints are the lack of laboratory facility and seed processing and storage facility.

### **2.2.17 Coconut**

Considering that the coconut occupies the largest area in Alappuzha district and Kuttanad region, and that it is the second important crop in providing economic sustenance to farmers, the revitalization of coconut farming and productivity in shortest possible timeframe must receive highest priority for minimizing and removing distress of farmers. Coconut touches up on the life and livelihood of almost all households of the region in different ways. For instance, extraction of coir fiber and small-scale production of many coir-based products provides employment to almost 70 % of the womenfolk of the Chythala-Thrikkunnappuzha belt. Incidentally, the coir fiber production involving coconut husk retting in the shallow waters of the Vembanad *Kayal*

and its waterways is a major contributor of water pollution. Alappuzha is an oldest area of coir industry and coir products from here are traded world over.

Coconut in Alappuzha and Kuttanad together occupies more than 78,000 ha. A significant proportion of the palms in this area is affected by root wilt disease to different degrees and also affected by the major insect pests like red palm and rhinoceros weevils and the mite. While there are effective methods to treat the palm free of the pests, the only practical course to enhance productivity of farms affected by root wilt disease is by following a two-pronged approach. This involves (a) removal of severely affected palms and re-plantation with healthy seedlings (Box 9) and (b) nursing back partially diseased palms to a state to provide better and sustained

**Box 9: Mother palm selection and quality seedling production**

Kuttanadu and Alappuzha district being a hot-spot for coconut root wilt disease, the planting materials used for replanting should have certain level of resistance/tolerance to this disease. Research has shown that such level of resistance/tolerance to this disease is available in three types of planting materials, namely the West Coast Tall (WCT), the Chowghat Green Dwarf (CGD) and the Chowghat Orange Dwarf (COD).

Seedlings from the mother palms of these varieties are considered to have better tolerance to root wilt disease, offer better productivity for enhancing coconut based income in this region. In the case of WCT, mother palm is selected if the palm has typical WCT characters, is above 35 years in age, high yielding and is absolutely free from root wilt disease, when such palm is immediately surrounded by palms, at least of 80 % of which are affected by root wilt disease. The yield level of the selected mother palm must be 60 nuts or more per year and it must also have regular bearing habit. The open pollinated seed nuts of such selected WCT mother palms are to be used to raise nurseries in large scale to undertake rapid replantation. These progenies are expected to be disease-free and high yielding compared with unselected seedlings.

CGD is normally found to have higher level of resistance to root wilt disease and hence a suitable genetic stock for planting in homestead gardens in disease affected areas. Its dwarf nature and early bearing habit are other advantages.

COD is also high yielding and known for its preference for tender nut purpose. Better tolerance of this variety to coconut root wilt disease helps in providing satisfactory yield even when the palms are diseased. CPCRI has identified a selection of COD superior in tender nut purpose. Tender nuts of this variety will find a ready market, particularly among the tourists visiting Kuttanadu. Hence this variety has special appeal to Kuttanad. Mother palms of CGD and COD should show their typical characters with regard to stem, crown, leaf and nuts. They should be at least 15 years of age and providing a yield 60 or more nuts per year per palm, when surrounded by palms which are at least 80 % affected by root wilt disease, in an endemic area.

productivity. On a consideration that on an average 20 % of the palms of the total area are to be replanted, it would work out to be a gigantic figure of 28 lakh palms.

It is important that such replantation scheme is taken up faster so that the farmers, who are largely small and marginal would benefit at the earliest. A fast track programme to replant the gestimated 19 lakh plus palms in a period of five years would require about 4 lakh quality seedlings every year. A

hectare nursery area is expected to accommodate 1,00, 000 seedlings. As discussed later replantation programme being under taken in Kerala by the Coconut Development Board (CDB) under the Technology Mission on Coconut is very slow and far insufficient to mitigate the

distress state of Alappuzha district and Kuttanad. Hence, this programme in Kuttanad and rest of Alappuzha has to be put on fast track with additional resources.

The mother palm identification, nursery raising and re-planting/planting could be organized at the level of each Panchayat or Block with farmer participation and involvement of experienced technical personnel from DoA, State and Central Coconut Research Institutions and Coconut Development Board. Expertise of retired Agricultural Officials/ Scientists may also be leveraged. Similar association of experts/officials along with concerned farmer is important for identification of palms to be removed and replanted. Training may have to be provided to farmers whose holdings contain mother palms, farmers raising the nursery and local agricultural officials. Training should cover selection of mother palms, harvesting of seed nuts, sowing of seed nuts and nursery management, selection of good quality seedlings, and accreditation standards for coconut nurseries. Farmer participatory community based nurseries may be raised in every Panchayat for largescale production of good quality planting materials of the above three varieties, under the close supervision of experts. It is desirable that seedlings produced from the mother palms identified in each Panchayat/Block/Taluk and confirmed by scientific testing for the phytoplasma are used for the respective area.

The current coconut development programme of the State excludes re-planting, but includes a low reach integrated pest management programme, integrated nutrient management programme and support for providing irrigation facility. This may have a low impact on nursing palms back to healthy state. But the dimension of this activity in Kuttanad and Alappuzha district is a miniscule. The CDB has introduced the “Integrated Development of Coconut Industry in India and Technology Mission on Coconut” with Rs. 40 crores fund for the year 2007-08. The activities under this Mission across Kerala State broadly include four programmes. These are (i) promotion of production and distribution of genetically superior quality planting material, (ii) support for area expansion under the crop, (iii) promotion of integrated farming, and (iv) market promotion. Under the first programme one nucleus seed garden of identified variety/hybrid for production and distribution of its planting material with a subsidy of Rs. 8/seedling is carried out. The approximate reach of this programme is about 800 ha in one year, while Kerala has about 9 lakh ha under coconut. Under the second programme, a subsidy of Rs. 4,000/ha for two years is given to take up scientific coconut cultivation. Its reach is about 900 ha a year. The third programme is most important as it seeks to produce and supply quality seedling, promote

integrated coconut management regime involving removal of severely root wilt affected palms, replanting with healthy seedlings, nursing back mildly affected palms and inclusion of organic management. The annual reach of this programme is removal and replanting of 10,000 sick trees. Unfortunately, the pace of this programme is slower than snail and would require many years to replant the guestimated 20 % sick palms in Kerala. Hence there is need to have a special fast track programme on revitalization of coconut economy for the Alappuzha district and Kuttanad with five year time frame.

### **2.2.18 Integrated coconut development and income generation**

Better agronomic care to nurse back about 75 % of the palms, which are moderately and lightly affected by root wilt disease in Alappuzha district and Kuttanad region has to be done by multiple approaches with area specificity in choosing these approaches. The current coconut

#### **Box 10: Promotion of Group and Organic Farming**

Cherthala taluk, which is the northern part of Alappuzha district, is notable for farmers with very poor resources, very small holding and endemic poverty. With soil being sandy, low fertile and fresh water availability very limited, the area has only few agricultural options. Major employment of the region is from coir industry. Very little developmental impact has touched the life of nearly 1.3 lakh households in Patanakkad, Thycaduchery, Kanjikkuzhy and Aryad blocks over the last sixty years.

The economy of the region was severely hit by the root wilt of Coconut, which is the mainstay of income. Increased income generation from agriculture is a tall order in this region. In this backdrop, an innovative income generation programme with vegetable cultivation being claimed in Kanjikkuzhy panchayat deserves examination and replication. Vegetable cultivation is not a common practice in the area. The local panchayats in 1995 – 96 initiated the homestead vegetable cultivation with the active participation of the villagers, organized in groups.

Households were mobilized to take up vegetable cultivation with the combined campaign from Krishibhavan and panchyath. Quality vegetable seeds and manure and a leaflet on vegetable, floriculture and vermicompost production were first distributed to 6000 households in 1996-97. These households on an average of 10 cents each produced 60 tonnes of vegetable and an average profit of Rs. 50. Later households were organized as units with area increasing up to 200 acres, production to 200 tonnes and profit to Rs. 4600 per unit in 2006-07. Over the eleven years, area of cultivation increased by more than three-fold, productivity stay put and profitability swinging between Rs 5000 to 7000/acre. This group based income generation programme promoted by the panchayats assumed high attention and they repeatedly won the best panchayat award. These panchayats have strength and experience to make organic production of vegetables, seeds, organic coconut, processed organic tender coconut water, organic banana, organic flowers, organic milk, vermicompost, vermiwash. and more other organic products.

development programme of the State on integrated pest and nutrient management and expansion of irrigation for coconut require many-fold expansion in Alappuzha district and Kuttanad to provide faster reach to all farm holdings. Organic farming, production of vermicompost at household level for manuring coconut or intercrops like vegetable grown among coconut could be added to the agronomic management.

Even with improved productivity, coconut alone will be insufficient for adequate income enhancement in more than 95 % of the farm holdings, which are very small with less than 0.3 ha



area, on average. The chances of an average farm holding having more than 50 palms are very rare. The same garden land usually provides habitation to the farm family.

It is therefore imperative these lands, where coconut is the main crop, have to be optimally integrated with a variety of on-farm and off-farm income generation activities. The options available, depending on the local situation and market availability, are annual crops like tubers, vegetables, floriculture, fodder grass, pepper, ginger, etc and livestock such as cow, buffalo, goat, rabbit, poultry, duckery, fishery, etc. Multiple crop and livestock integration to achieve higher economic synergy is feasible. These integrations in smallholdings with optimum intensity using family labour may generate increased employment and cascading economic gain in larger proportions. The vegetable cultivation promoted by panchayats in Kanjikkuzhy offer a model on group based activity on vegetable production in coconut garden (Box 10). The benefit of such integration would also be reflected in coconut productivity. Kerala has a scheme sponsored by the Centre on vegetable and fruit production, including commercial cultivation and seed production. Under this, the Vegetable and Fruit Production Council, Keralam, extends irrigation facilities and infrastructure for production and support for marketing. The programme leverages SHGs like '*Haritha Sanghom*' and local groups supported by panchayats, for instance the Kanjikkuzhi group, to undertake vegetable cultivation in more than 6,500 ha.

Income generation from coconut and other produces generated from integrated farming can be increased in few-folds with value addition, particularly as a group approach by the members of the smallholdings. Coconut offers opportunity for a variety of value added products, some of them enjoying niche market at high value. Market and value addition linked clusters of smallholdings with standardized quality for the produce may help to achieve economy of scale.

Income generation from coconut and other produces generated from integrated farming can be increased in few-folds with value addition, particularly as a group approach by the members of the smallholdings. Coconut offers opportunity for a variety of value added products, some of them enjoying niche market at high value. Market and value addition linked clusters of smallholdings with standardized quality for the produce may help to achieve economy of scale. The coconuts harvested by the members of the cluster, involving 30-50, depending on holding size, can be pooled, husked and coir fiber extracted, processed into geotextiles. The coir pith can be composted either using *Plunotus* fungus or earthworms, which may be recycled to coconut or vegetables and other inter crops for better soil health and sustainable production. The group can

also create common facilities for copra drying, virgin oil production, collection of coconut water for bulk supply to the vinegar making unit, making activated charcoal using coconut shell, etc for higher income realization with same level of farm production. This will also generate considerable employment to totally absorb family labour including unemployed youths. Further income augmentation may be possible with organic cultivation, provided there is market to pay premium price for organic products.

In all on-farm enterprises, the critical importance of market, its character and linkage should be well mapped and understood. The rich experience Kerala has in the Self Help Group (SHG) movement, such as '*Kudumbasree*', '*Ayalkkootom*', '*Haritha Sangom*', etc could be strategically used to create a platform for group approach among farmers. The good work done by some leading Non-Governmental Organizations (NGOs) in the region could also be leveraged to promote such income generation enterprises by group of farm families. However, economic success and sustainability of SHGs depends largely on the group homogeneity, choice of right business plan with appropriate technology, institutional, information and credit service, market networking and connectivity and public policy support. Verifiable performance of these SHGs in terms of facilitation of economic enhancement with equity and inclusiveness should remain important criteria for public policy support.

### ***2.2.19 Supplies and services***

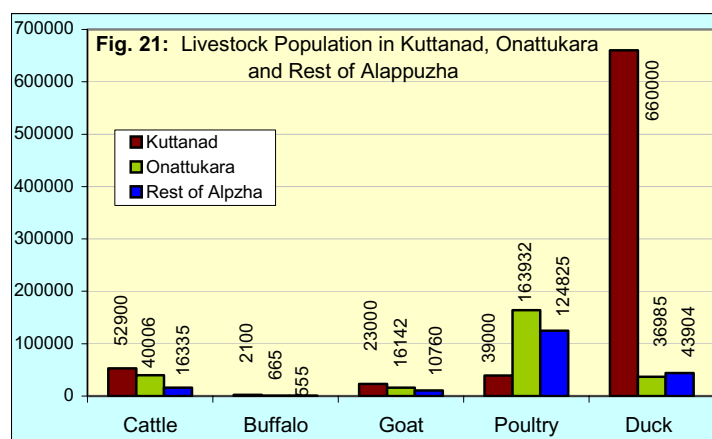
The supplies and services for paddy production in Kuttanad and elsewhere have to be put in sync with the local crop calendar and better technology service. The services may include timely and faster dewatering, timely availability of labour and machinery, soil analysis and *padasekharam*-based recommendations on nutrient/soil ameliorant, transfer of information on pest and disease monitoring, operation and maintenance of machinery, timely supply of quality inputs, organising group-based approach for protection of common infrastructure like outer bunds, *vachals*, drainage canals, plant protection and water management, etc demand a strong and committed service system at every unit level. The 'Agri-Clinics' approach already in place in the district could be expanded and integrated with common service centers and VKCs. Each such integrated Agri-Clinics may cover an area of about 2,500 ha, constituted by a cluster of *padasekharams*. The CSCs may be manned by experienced farmers and trained local youths drawn from marginal or landless farmers or farm labourers. The youths, women and men, may be trained in various farm operations, operation of machinery, machinery maintenance and on the importance of delivering each service in quality and within the timeframe. These trained

personnel may be operating the farm machinery being provided to the panchayat for use in *padasekharams*. The service units may be encouraged to develop linkages with public institutions and laboratories for checking the quality of inputs like fertilizers, weedicides, pesticides and seeds. The Agri-Clinics may coordinate with all concerned government departments for timely delivery of support expected from them. Thus, in all respects, each Agri-Clinics will closely work with concerned *Padasekhara samithis* and the panchayats for promoting paddy production, fish production, wherever ‘one paddy and one fish’ is followed, and good production practices. The charges for each type of service may be fixed jointly by the Agri-Clinic, *Padasekhara samithi*, and local panchayat.

### 2.3. Livestock integrated Agriculture

According to 2003 figures, Kerala’s share in all India cattle population is 1.13 % with Buffalo population accounting 0.07 %, goats 1.01 % and pigs 0.54 %. Kerala produced 2.3 % of milk, 3 % of egg in 2003-04. Rural Kerala accounts for nearly 94 % of the livestock population and 80 % of the livestock farmers are marginal farmers and landless agricultural labourers. Women constitute 60 % of the workforce in this sector. Most of the cattle rearing units have only one cow. Livestock sector is facing serious shortage of forage as a result of continuing sharp decline in the area under paddy and other forage providing seasonal crops. It is estimated that the State produces only 60 % of the roughage requirement for cattle. For the cattle feed concentrate, State is in short supply for more than half

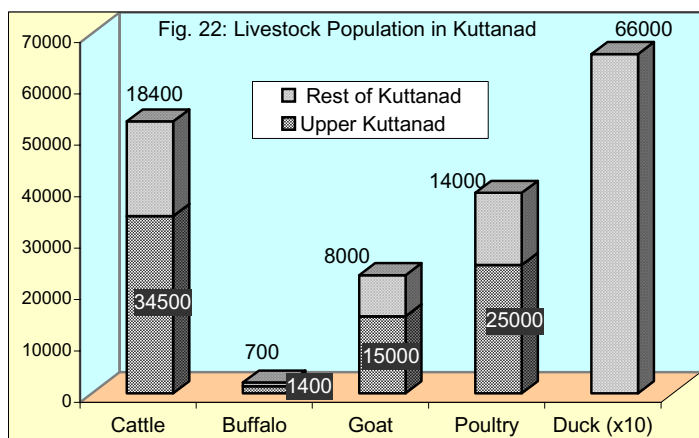
of its requirement. Thus, shift to livestock unfriendly cropping pattern, increased labour cost, scarcity of input for cattle feed etc, and heavy dependence on “imported cattle feed” are making dairying difficult and unattractive. All types of livestock have been showing a declining trend



in Kerala after 1996. Buffalo population declined by 80 % during 1997 to 2003, while the decline of poultry population during this period is 56 %. The positive change had been increase in the proportion of high yielding crossbred cattle with increased productivity. The average milk yield per animal per day remains low at 6 litres, although the potential is 8-10 litres. Livestock in

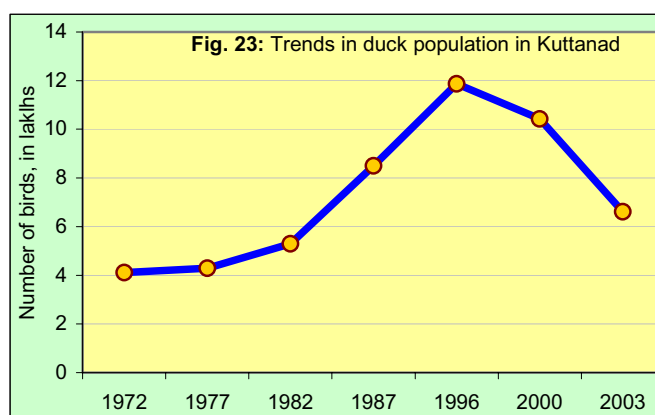
Kerala faces biggest threat of foot and mouth disease because of large-scale inflow of cattle from the adjoining states.

Livestock population of Kuttanad, Onattukara and rest of Alappuzha districts are presented in Fig. 21. Kuttanad has high population of all livestock except poultry. Out of the livestock population in Alappuzha district and Kuttanad area, 48 % of cattle, 63 % of buffaloes, 46 % of goats and 89% of ducks are in Kuttanad. Within Kuttanad, most of the livestock, except ducks are in Upper Kuttanad. Upper Kuttanad has 65 % of cattle and goat, 67 % of buffalo and 64 % of poultry of the Kuttanad (Fig. 22).



Almost the entire duck population is in Lower Kuttanad, although Onattukara and northwestern parts of Alappuzha share 11 % of the ducks. Onattukara and northwestern parts of Alappuzha together share 88 % of poultry of the region, with Onattukara accounting for 50 %. Low backyard poultry in Kuttanad is due to high mortality during rainy season.

Ducks face sudden mortality due to breakdown of immunity despite regular vaccination for duck plague and pasteurellosis. Increased pesticide load in the water environment is suspected to cause immunosuppression in ducks. The local breeds, 'Chara' and 'Champally' are proved to have better resistance than the 'Khakhi Campbell', a breed imported from United Kingdom for its smaller egg size. There is facility for free vaccination of birds. A mobile service unit to reach birds for vaccination and awareness generation to duck farmers on the need for periodic vaccination is a necessity being felt.



Absence of insurance cover to these birds, particularly the large flocks, is a major constraint in duck farming. The floating nature of the flock is held as a reason for not extending insurance cover. Duck farmers are also facing increasing resistance in feeding ducks in harvested paddy

fields. All these are adversely affecting duck farming and decline in duck population in Kuttanad (Fig. 23). The Duck Farm at Niranam is the only hatchery in the State with a turn out capacity of 30,000 chicks a year. It has 1,770 female and 240 male parental stocks. The center has developed capacity for sexing day old chicks, but reported inadequacy of staff for attending the sexing work. Expansion of this hatchery with 15-20 additional hatchery sheds, facility for transportation of chicks to different parts of Kuttanad and chick sale facility at about 10 panchayats are requirements to promote duckery in this region.

There are a number of model group farming initiatives on cattle rearing. Two notable initiatives are the '*Ksheera Samrudhi*' and '*Kamadhenu*' projects supported by the State Bank of Travancore, the lead lending bank in the Kuttanad area. Under the '*Ksheera Samrudhi*' project implemented since 2005 along with an NGO in Alappuzha, Rs. 3.45 crores are given on loan to

**Box. 11: *Kamadhenu* Project of SBT**

The '*Kamadhenu*' project started by the State Bank of Travancore in 2005, aims to support 500 groups with a financial outlay of Rs. 16.25 Crores. Each group, SHGs or cluster group, with 7-10 members is held on joint liability. The project provides three types of 6-year loans @ 8.5 % interest for milch cow, heifer and she-goat. Loan of Rs. 50,000 is available to buy one cross-bred milch cow, construction of animal shed and erection of gobar gas plant. Loan of Rs. 20,000 each is provided either to buy 9-10 month old heifer, meet feeding and insurance cost and construction of shed, or to buy one mother goat with 2 or 3 lambs and five rabbits including four female and one male, construction of barn and cultivation of fodder. According to the bank, the annual net income from each milch cow is Rs.14,000, from the heifer, which has calved in 11-20 months and given milk for 1,000 days is Rs. 15,000, and from goats and rabbits is Rs. 6,400. The project is expected to establish 500 gobar gas plants.

101 groups, involving about 1000 families. These groups, with each group having two cows is reported to produce 540 lakh litres of milk production and generating additional employment of 21,90,000 man days. The net income claimed this project is Rs. 11,900/unit/year. The project is linked with skill development to farmers, paddy straw supply, milk collection centers and veterinary assistance. The '*Kamadhenu*' programme is also cluster based with three

kinds of options in cattle rearing (Box. 11). SBT has similar group based programmes on prawn farming ('*Matsya Plus*'), and rabbit farming ('*Rabbit Plus*'). Its other cluster based projects on crops are '*Annapporna*' for promoting 100 cluster groups for paddy cultivation on leased lands in Alappuzha with a financial outlay of Rs. 2.85 crores, '*Haritha Boomi*' for vegetable and fruit production with an outlay of Rs. 20 crores to finance 800 groups, '*Kerasree*' to produce quality coconut seedlings in 16 nurseries at an outlay of Rs. 24.83 lakhs, and '*Kalparaksha*' for replanting disease affected palms in 4050 ha at an outlay of Rs. 30 crores, and '*Janma Bhoomi*' to benefit 5,000 landless cultivators/marginal farmers for purchase of agricultural land with an outlay of Rs. 25 crores.

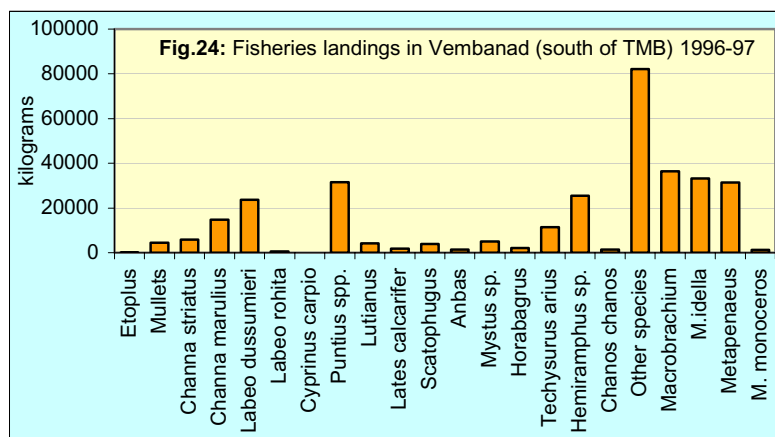
Some of the above projects are progressing well their reach is very slow due to organizational and fund limitations. Successful models from these on-farm projects have to be identified and multiplied with larger reach in the Alappuzha district and Kuttanad for augmenting income of small and marginal farm families and landless farmers. It is important that such stand alone livestock and crop production projects are integrated in farming system along with insurance for all required infrastructure. While choosing different livestock for such integration in Alappuzha district and Kuttanad, care has to be taken on aspects like local scarcity for straw/fodder and concentrates and the threat from nematodes, trematodes and foot and mouth disease for cattle, plague for duck and monsoon mortality for fowls. The recommendations on rice production are expected to increase rice area and availability of straw. Integrated farming with cow and buffalo has to provide option for homestead forage production with appropriate fodder crop choice. Similarly, adequate supply of leafy feed is important for stall feeding of goats. The region has adequate veterinary institutions to take care of the health of animals and birds, although a few logistical supports are essential to enhance the efficiency in service.

#### **2.4 Fisheries based agriculture**

Notable fisheries resources of the KWS, particularly in southern part of the Vembanad *Kayal* are suffering a set back due to the construction of TMB, its haphazard opening and closing and consequent cascading ecological changes in the KWS. Over exploitation of these resources during the phase of its decline also accelerated the present crisis in Kuttanad fishery and the related distress in to the livelihoods of the local fishing community. In addition, the fishing community is notable for overall backwardness, poverty and subsistence livelihoods and indebtedness. This study examined ways and means of augmenting the fisheries resources in the KWS and mitigating the distress to the dependent fishing community and possible good practices for the management and optimal utilisation of this resource in the context of the Vembanad wetland system and its associated drainage basins having brought under the Ramsar List of Wetlands.

The total aquatic fauna were classified as finfishes and shellfishes by the fisheries group of the Indo-Dutch study. Most of the fishes have been described from fish landing centres distributed through the banks of the Vembanad *Kayal* on its southern side (Fig 24). They are commercially

important in that they contribute to the net incomes of the fishermen. A few species among them deserve special mention because of the high value they earn in the markets. The other commercially important category is the molluscs, particularly black clam (*Villorita cyprinoids*) valued for meat and shell.



The fishes on the basis of their habitat preference could be classified as migrant marines, resident estuarine, resident oligohaline and migrant limnetic aquatic. The migrant marine fishes and prawns spawn in the sea and return to the brackish water as juveniles or post-larvae. Fishes include grey mullets (*Liza parsia*, *L. macrolepis*, *Muil cephalus*, and *Valamugil cunnesius*). Other marine fish species observed in the Vembanad *Kayal* are sea bass (*Lates calcarifer*), milk fish (*Chanos chanos*), and scads (*Caranx ignobilis*). Crustaceans include the smaller marine prawns (*Metapenaeus dobsoni*, *M. monoceros* and *Penaeus indicus*). The second category of resident estuarine species is the permanent residents of the *Kayal* habitats. They are also well adapted to salinity values ranging from traces to as high as 33.8 ppt. These species breed and grow to their maximum weight in brackish environs. They have been found to be most widespread occupying marine as well as freshwater zones in the Vembanad *Kayal*. These fishes include pearl spots (*Etroplus suratensis*) or *karimeen* in local parlance, catfishes (*Tachysurus maculatus*, and *T. subrostratus*), half beaks (*Hyporhamphus limbatus*), estuarine sprats (*Ehirave fluviatilis*), gerreids (*G. filamentous*), and glassy perchlets or ambassids (*Ambassid commersonii*). Crustaceans include edible crabs (most common species is *Scylla serrata*). The pearl spot, locally called as the '*karimeen*' fetches anywhere between Rs.100-400 per fish. The third category is oligohaline species, which prefers fresh water zones and capable of marginal salinity conditions up to 5 ppt. They are also resident species and not migrants. Half beaks (*Hyporhamphus xanthopterus*) certain species of ambassids (*Ambassid dayi*), pearl spots, Tarpons (*Megalops cyprinoides*), etc. belong to this category. The fourth category of migrant limnetic species belong to those, which originate in the rivers and are found to migrate to the *Kayal* when its fresh water load is high. These species spawn upstream in the rivers and their larvae are cast by the rivers flowing to the *Kayal*. The most commercially important member of

this category is the palaemonid (freshwater category) prawns called giant prawn or tiger prawn (*Macrobrachium rosenbergii* and *M. idella*), known in the local parlance as *kuttanadan attu konju*. The *Kuttanadan attu konchu* is very expensive and fetches up to Rs.100 per piece.

#### **2.4.1 Distribution of fisheries:**

The estuaries, floodplains, *Kayals*, ponds and canal networks, and lagoons present in the Vembanad wetland ecosystem is home to a wide variety of fishes and other economically important aquatic organisms that have adapted to the widely fluctuating salinity conditions and water levels in the wetland. The fish species diversity and density are governed by a natural rhythm of cyclical shift in fresh and saline water phases, the salinity concentration gradient extending from the northern *Kayal* end close to the sea right up to the river basins and the free mobility of the species across this gradient.

While the wetland remains largely a fresh water body during the monsoons, fresh water species brought in by the rivers dominate, and when the water turns saline in the summer, aquatic species adapted to brackish waters and migrating from the sea dominate. Several species are truly endemic to the fluctuating salinity in the brackish waters and can be seen throughout the year. There are species completing their complete life cycle in the estuary and those spend their lives in brackish and fresh water domains and go to the sea for the remaining part of their lives. It was found that generally marine migrants and estuarine species dominated the *Kayal* at landing centres closer to the sea and during times of peak salinity intrusion. Species distribution also considerably varies during the year. While the number of marine migrants and estuarine species dominate throughout the year, the limnetic and oligohaline species decline with advance of summer and salinity. In the fresh water part of the *Kayal*, south of TMB mesohaline species and freshwater prawns dominate. Species count of fisheries was a maximum during summer from February to May with a peak observed in April, and declined with the onset of monsoons. Pearl spots, perchlets, fresh water giant prawns or *attukonju* and freshwater catfishes are found closer to the reclaimed paddy lands, channels and waterways of lower Kuttanad, where fresh water is found during most part of the year.

A comparison was also made between species distribution north of Thanneermukkom and south of it. The marine fauna north of the Thanneermukkom barrage was found to be rich and



diversified, made of a mixture of marine, estuarine and brackish water species. It has been reported that when summer progressed, between February and March, faunal composition changed and becomes similar to that of the sea and the species increased from 47 in July to 70 during summer. With the closure of TMB, the fish diversity in the *Kayal* south of the barrage remained almost similar during summer and monsoon period. It has been estimated that over the last thirty years, the TMB resulted in reduced fish diversity from 150 to 36 species. Some species are also reported to be extinct, threatened and endangered (Box 12).

**Box 12: Endangered Endemics**

The endemic carp of Central Travancore, *Labeo dussumieri* (Toolipullan), the esteemed golden catfish of Kuttanad, *Horobagrus brachysoma* (Manjakoore), the riverine coldwater fish, *Gonoproktopterus curmuca* (Kooral), *Wallago attu* (Attuvaala), the glass perch, *Parambassis dayi* (Nandan), *Macropodus cupanus*, and *Nandus nandus* (Andikalli) are some of the endangered endemic rarities of these wetlands. The highly threatened endemic species in the fresh water reaches include *Channa micropeltes* (Manalwaaha), *C. leucopunctatus* (Puliwaaha) *Pristolepis malabaricus* (Pannakarimeen), *Ompok bimaculatus* and *Clarias dussumie* (Mushi).

**2.4.2 Migratory habits of some fishes:**

Mulletts (marine migrant species) migrate to the sea to spawn during December to April and large numbers of young ones return to the Vembanad *Kayal* soon after monsoon breaks. The penaeid prawns, abundant in the estuarine habitats, breeds in the sea. Juveniles and post larvae migrate with the high tide currents, mostly during the pre-monsoon, into the Vembanad *Kayal*. Then it spends 6-9 months in the backwaters, where it completes most of the growing period. In the estuary, they anchor to mangroves and other aquatic plants which act as nursing grounds. A salinity range of 15-20 ppt is desirable for the prawns to attain their maximum growth. As they grow older, they become intolerant to such low salinity range in the backwaters and migrate back to the sea where it breeds again. As a result most of the high value catch of prawns is from the sea, not from the backwaters.

The palaemonid prawns or the freshwater prawns, on the other hand, migrate between the rivers and the estuary. During the monsoon, the larvae are carried by the flowing rivers to the estuary. These prawns are found to reach beyond the TMB as far as Vaikkom in the north during November-December (Box 13). They grow rapidly in the moderately mesohaline environments of the estuary and then migrate back to the rivers during December - January for breeding. The commercially viable size of giant freshwater prawn is 18-32 cm. It is also noteworthy that most of these migrations coincide with the closure period of the TMB. Thus, the species diversity,

their breeding and population build up heavily depend on the seasonal fresh water-salt water rhythm in the Vembanad *Kayal* and the disruption created to this rhythm by the TMB has seriously affected the fishery resource of the *Kayal*.

### 2.4.3 Decline in fish stock:

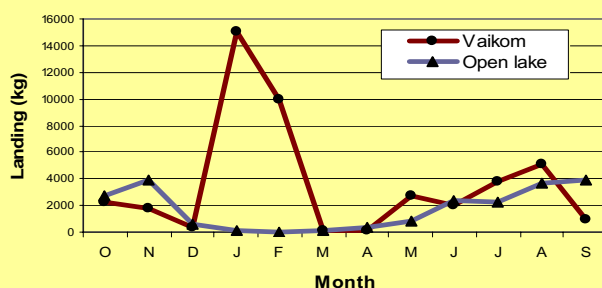
Despite many studies on the Vembanad *Kayal* fishery south of TMB, a major draw back of the

#### Box 13: Impact of TMB on Kuttanadan Konchu, *M. rosenbergii*

The life cycle of Kuttanadan *kocnch* (*M. rosenbergii*) requires brackish, mildly saline and fresh water at different stages of development. During December, the berried females normally start the downstream migration to the breeding grounds in the northern side of the TMB. The reverse migration of the post-larvea crosses the TMB during January to May. The larvae appear to catch up in growth in the *Kayal* during the monsoons and attain a peak towards the close of the post monsoon months. Therefore, its catches have characteristic peak during the post monsoon period (figure 25). The date and duration of shut down of the TMB critically impact the movement of berried females and the post-larvea leading to the decline of the lucrative Kuttanadan Konchu in the *Kayal* south of the barrage.

A comparison of *Macrobrachium* catches before and after commissioning of the TMB shows significant impact of the barrage on the fish landing. In the pre-barrage period, the highest catch reported was 429 tons in 1960 and the lowest 189 t in 1962. This landing during the post-TMB period dwindled to a mere 39 t in 1988-'89, and to 112.9 t, 129.4 t in 1995, 36.3 t in 1996-97, 65.2 t during October 1999- September 2000, and to 26.72 t in 2000-01. This alarming decline of *M. rosenbergii* is attributed to the disruption of its December to May migration being caused by the TMB, which normally shuts down for 3-5 months from December. A comparison of the fish catches on either side of the barrage revealed that the fishery zone, immediately north of the barrage which accounts for only 15.3 % in area contributed 53% of *Macrobrachium* and over 20 % of the *Etroplus* catches.

Fig:25 Seasonal fluctuations in landings of *Macrobrachium rosenbergii* in the open lake



north of TMB accounted for 93 % of the total annual estimated fish production, while the part south of TMB for only 7 %. The common species of prawns, *P. indicus*, has been reported to be completely absent in the catch composition in the southern part and the *aattu konju* dominated this region.

data available is that they are scattered temporally and spatially. This creates difficulty in interpreting species decline and the extent of such decline. The Kerala Fishery Department also does not maintain time series data on fish catch and its diversity. This study therefore summarises the declines elaborated by various studies. Shortage of fish availability in the south of TMB appears to have led to 30 % increase in price over that in the north of TMB. Estimates suggest that the *Kayal*

It has been estimated that over the last thirty years fish catch reduced from 1,60,000 t to 7,200 t in 1989 and to as low as 838 t during 1999-2000 and 687 t in 200-2001. Highest catch of *attu konju* reported during pre-TMB period was 429 t. With the TMB preventing migration of this prawn, the decline in catch after TMB was 39 t during 1988-89. However, they are inconclusive for want of comparative data adjusted to the location, and season. Most of the current estimates are one-point data and temporal evidence has not been made available thus far. Strengthening database and having a baseline for comparison is very essential. Nevertheless, there is conclusive evidence to say that prolonged closure of TMB has been one of the major reasons for the overall decline in fisheries.

Reasons for the decline in fisheries diversity and density are (i) Disruption of hydrology caused by blocked waterways, disruption to the physical and biological continuity of the *Kayal* with the coastal waters and the estuarine system causing large bodies of freshwater conditions have

**Box 14: Benefits of Mangroves on fisheries and livelihoods**

Estuarine mangroves that fringe the shores of the backwater system provide breeding grounds for a variety of estuarine fish species. The complicated root systems of mangroves are the nursery and breeding grounds of the coastal fisheries and sustain the high productivity of coastal waters. Mangroves are recognized as being one of the coastal systems that provides effective shield against rough storm waves and allow silting of debris. There is a strong view that the damage from the Indian Ocean tsunami could have been reduced if more coastal areas had maintained their protective shields of mangrove swamps. Over 172 families were saved from the tsunami in the fishing village of Thirunal Thoppu in the state of Tamil Nadu only because the mangroves were thriving and dense there. Most unfortunately in Kerala, known to have a mangrove expanse of over 70000 ha during early part of the last century has only less than 100 ha of mangrove areas now. When most tropical countries are struggling to rehabilitate the mangroves as coastal shelter belts, many parts of naked Kerala coast are regularly facing severe sea erosion with loss of dwellings and livelihoods.

changed the ecological character of the wetlands and changes in salinity regimes, ii) Dredging increases suspended sediments, which can affect filter-feeding organisms, such as shellfish, through clogging and damaging feeding and breathing equipment, (iii) Mangrove destruction in backwaters has caused loss of breeding habitats along the *Kayal* and river basins. This is particularly relevant to the breeding of pearl spot (Box 14), (iv) water pollution significantly contributed to the ecological aggravation and fishery decline, (v) Augmented freshwater inflow from Muvattupuzha River during dry

season after the commissioning of the Idukki hydel project, (vi) Removal of endemic and wild fish species to promote ornamental fish trade, (vii) Large scale unscientific reclamation for agricultural intensification and tourism promotion, and (viii) Irresponsible and destructive fishing habits such as dynamiting, poisoning and use of fishing nets with fine meshes or massive hunting of spawner stocks.

It is believed that ecological restoration will go a long way in solving many of these issues. Programs for the restoration of existing mangroves and regenerating adequate cover along the Vembanad *Kayal* need to be addressed. This coupled with bio-hedging or bio-bunding is believed to provide adequate habitats for fish to be nursed. It is important to recognise that ornamental fisheries must on no account be exploited. The dredging needs to be severely regulated. All forms of exploitative fisheries using totally inappropriate fishing tools are to be prohibited at all cost. There is a need for responsible fisheries with a code of conduct to prevent this from happening.

#### **2.4.4 Clam and live shellfisheries:**

Molluscs are abundant bottom-dwellers in the Vembanad *Kayal*. The predominant species is black clam, *Villoritta cyprinoids*, more adapted to the less saline water areas south of the TMB. They are found spread over 1,565 ha over the entire Vembanad *Kayal* north and south of the TMB. The other species of clams found restricted are *Meretrix casta*, *Paphia malabarica* and *Sunetta scripta*. Production of black clams appears to have increased from 20,542 t in 1965 to 31,430 t in 2000. This provides an important livelihood opportunity.

Lime shells (white clam) are sub fossil deposits of clamshells found 2-6 m below the *Kayal*bed. Vembanad *Kayal* is reported to have large deposits (20 – 45 lakh tonnes), south of the TMB around Muhamma, Pathiramanal, Aryad, Kavattinkara, Kumarakom, Puthen*Kayal*, Vechoor, and Thanneermukkom. These shells are major sources of calcium carbonate, raw material for the highly priced white cement industry of Kerala. The Travancore Cements Ltd and Travancore Electro-Chemical Industries, which together uses more than 40,000 t /year carry out regular dredging and mining. There are also several lime-shell cooperative societies, both authorised and unauthorised, reported to collect white shells from the Vembanad *Kayal*. Mining at rate of 100 t/day has been reported by deep dredging.

#### **2.4.5 Major issues in clam fisheries:**

Clams are an important source of income and livelihoods to fishermen in several villages situated close to the Vembanad *Kayal*. They face problems due to following reasons: (a) Reduction in the water spread area of Vembanad *Kayal* has reduced the area for spat settlement, (b) Dredging and mining operations destroy habitats for fisheries, especially bottom dwelling aquatic species such

as clams. Large scale dredging is carried out in Vaikom and Alappuzha in Vembanad *Kayal* by TCL using ‘cutters’ which goes down to 7 m and has a pumping capacity of 2,500 gallons /minute, (c) Salinity reduction has affected growth of black clams, (d) Clam juveniles also called ‘baby’ clams or *mallikakka* is exported to nearby States and this is affecting recruitment during the next generation, (e) TCL is not offering fair price to black clam shell and promoting black clam collectors, and (f) Diving in polluted water for clam collection is affecting health of fishermen, particularly with skin diseases. An arrangement for the health insurance of clam collectors is a helpful step.

#### **2.4.6 Poverty and socio-economic status of fishermen community:**

Alappuzha and Kottayam have 12,541 active inland fishermen engaged in fish farming for their livelihoods. Together they make up 35 % of the total active inland fishermen population in Kerala. Among the fishermen community here, about one-fourth have been registered. It is

##### **Box 15: Prawn Peeling centres: a special study**

Peeling or the pre-processing appears to be out sourced from major exporting units and being done by contractors in relatively low infrastructure, unregistered sheds erected on public lands where there is no facility to dispose the waste. The peeling shed owners, who employ large number of women and girls to peel them, bring the shrimp, squid, cuttlefish etc. Peeled product is graded and sold to the processing factories for further processing and export. Peeling sheds employing 50 to 250 people depending on the availability of raw material and the type of process. These sheds function erratically. They do not maintain any sanitary and hygienic conditions. Workers have to continuously squat on the floor of the peeling sheds, which creates problems like stiffness to the joints, severe backache and prolapse of the uterus. No supply of potable water is made in peeling sheds. The solid waste and wastewater are discarded in public areas and canals causing major public health problem. Example is *Kappithodu* in Ambalappuzha.

reported that around 5,000 inland fishermen registered in eleven lime shell societies are heavily dependent of black clam for their livelihood. Women make up 47.12 % of the total fisher work force (marine and inland). Traditional fishermen involved in capture fisheries, as their main occupation constitutes about 70 % of total fishermen. The others include shell collectors, crab collectors, seed collectors, those engaged in fish culture, sale of fish by head loading them, etc. Nearly, 80 %

are full-time fishermen or full-time vendors. In the absence of alternative sources of income, the vast majority of the fishermen households depend exclusively on inland fishing, which yields low and uncertain incomes. Fishermen are organised into cooperatives for marketing the produce. Assessments made in 2000 reveal that there are 7 registered cooperatives in 17 villages. Cooperative societies play a major role in marketing black clamshells and sub-fossil deposits. Several women are employed in peeling centers for prawns (Box 15).

The number of inland fishing families of Alappuzha, Pathanathitta, and Kottayam below the poverty line has been estimated at 76 %, 83 % and 79 %, respectively. Fisheries are reported to contribute to about 60 % of the total incomes of these households. This community and their dwelling areas are situated close to their working environment, the backwaters and riverbanks and in small islands or '*thuruthu*'. More than one-third of the fishermen live in small and untidy huts without proper ventilation. About 60 % of their houses do not have electricity connection. Most fishermen households are in debt. The communities have been categorised as belonging to the social group of 'other backward classes'. Drinking water is scarce and insufficient for about 50 % of inland fishing communities. A majority of them own 0-5 cents of land and their houses are made of *kutchu* houses. However educational status reveals a high degree of literacy rates with only 14 % illiterate persons.

#### **2.4.7 Marketing and storage:**

All the catch is usually sold the same day in the local market. Marketing is done both by women and men. During times of good harvest, the prices collapse because these fishermen do not have storage facility. They requested the Study team to provide this important cold storage facility to consolidate their income.

#### **2.4.8 Rice-fish integrated farming system:**

Integration of fishery with rice under 'one paddy-one fish' ('1P-1F') offers vast opportunity in Kuttanad as discussed earlier. This farming system was developed after many years research in the RARC, Kumarakom. A scientific mix of species comprising Indian major carps, common carps, and the Chinese carps such as Silver carps and grass carps and the most locally adapted *aattukonchu* (*Macrobrachium rosenbergii*) have been demonstrated to be the most suitable candidates for polyculture in such rice fields. The *aattukonchu* has been demonstrated to grow to 180 - 200g in 6-7 months. In the rice lands that are prone to salinity, such as Purakkad *Kari* and *Pokkali*, euryhaline fish and prawn species such as milkfish (*Chanos chanos*), pearl spots (*Etroplus*), 'naaran' (*Penaeus indicus*) or 'kaara' (*P. monodon*) can be the right candidates for polyculture. Unlike pond fish culture, fish farming in the vast rice lands, it may not be possible to remove all predatory fish species. It is therefore recommended to stock fish fingerlings of advanced size to ensure better survival. To raise small fish seeds to desired size for release, an *in*

*situ* fish nursery is made in the paddy blocks, *padasekharam*, at approximately, 2 % of the size of the grow out field. Fish seeds are raised during the rice-growing season for release into the fields just after the rice harvest and a stocking density of 10,000 numbers/ha is generally followed for grow out stocking.

Under the rotational / sequential system of farming, fish / prawns are cultivated in rice fields after one rice crop in a year cycle. Since each *padasekharam* is owned and operated by several farmers, fish integration in such *padasekharam* is facilitated under group approaches. Under the Group Fish Farming (GFF) system, expenses and income are shared according to holding size.

**Box 16: Rice-Fish Integration**

A number of farmers in Kuttanad had ventured into 'one rice and one fish' on their own initiatives. Some of them received technological guidance and assistance from the RARC, Kumarakom and Aquaculture Development Agency of Kerala (ADAK). Four such farmers, Dinesh Kumar of Chambakkulam, Sivan and Alexander of Edathua, and Joseph Kora of Ramankari shared their experience on 'one rice and one fish' with this Committee. They practiced this in paddy fields ranging from 3.5 to 9.5 ha. The post-punja fish culture attempted by these farmers used prawn, silver and grass carps and cutla. These efforts during early years met with mixed bag of failures and success in different measures. From the failures, lessons were learnt on the choice of species, the density of stacking, feeding practices, and managing growth of prawns and predators.

There is unanimity that fish culture is highly profitable and it is more with prawn culture than with polyculture. Market is not limiting for prawn, but can be for other species. Cost of production of rice and fish culture provided by these farmers is Rs.59,600/acre. Decomposition of this cost to major components is: 6 % on nursery pond, 7 % on stacking cost, 29 % on feeding, 45 % on labour, and 6 % on energy and dewatering, The labour demand, including on outer bund protection, is 135 man-days/acre. Fish yield in about 7 months is 480 kg prawn and 300 kg grass carp. The income from prawn @ Rs 200/kg is Rs.96,000 and from grass carp @ Rs 20/kg is Rs.6,000.

The rice variety Jyothi was grown initially and this was later replaced by Uma. Yield of Jyothi was 16-1700 kg/acre and after three or four repeating cycles of rice-fish, the yield of Uma increased to 1900kg/ac under organic-like growing condition. Continued rice cultivation in fish cycles with no agrochemicals made the entire production eligible for organic certification. Organic rice fetches a market of Rs. 10,000/t. Thus the one rice-one fish offers an attractive option for the economic and ecological problems in certain area of Kuttanad with enhanced labour demand.

Management of 'common fish nurseries' and group fish farming are to be taken up collectively by the farmer groups.

Rice fish integration complements the ecology and economy of wetland farming (Box 16). The agricultural wastes can be essential inputs for freshwater aquaculture and at the same time wastes emerging from aquaculture could be ploughed back into the agricultural farming system. Water being the most valuable resource in

low land rice fields, farming system that integrates aquaculture along with the main rice crop is the most suitable strategy in the context of shrinking per capita land availability. Crop residues such as rice stubs and detritus supplements become food for the fish and the fish rearing is known to enrich soil conditions leading to increased rice yield. Rice-fish rotation is also considered to be effective in suppressing weeds, pests and diseases. Rice-fish integration also has

the capacity to render paddy farming more organic and environmentally friendly thereby meeting the ecological goals of reduced pollution from excessive use of pesticides and chemical fertilisers to the water bodies.

At present farming is under taken only in 2,500 hectares. With the exception of large *Kayal padasekarams*, in most of the other lowland paddy areas, where ever only one crop of rice is raised annually and the fields are left fallow during rest of the period, rotational farming of rice and fish is easily achieved. Of the 20,000 ha of paddy fields in the Upper Kuttanad, 10,000 ha is considered to be suitable for fish farming. The integrated system offers possibilities of increasing rice yields and more particularly the income by 40 %. Another important benefit is that it offers additional employment opportunity to farm labour, when farmers are not keen to go for second paddy crop.

Designing the spread of rice-fish integrated farming will have to be dependent on the availability of inputs, especially fingerlings, and market demand for fish/prawns. The model fish farm

**Box 17: Proposal for clam fisheries development proposed by Travancore Cements Ltd (TCL):**

A study conducted during 1983-85 by 9-member Technical Committee led by the then Fisheries Development Advisor to the Govt. of Kerala has earmarked potential areas in the Vembanad *Kayal* for clam culture: north of Vaikom, east of Thykkattuserry, east of Vayalar, south of Pathiramanal and north of Muhamma. This will work out to a total of 30,000m<sup>2</sup> area.

In these areas, TCL proposes to work in smaller units of 40 sq.m. Activities would involve levelling clam laying areas and fencing using bamboo poles, nets and nylon ropes and monitoring of clam growth. Since 2 batches of clams can be cultured in one year, there are potentially 2 seasons per year. TCL has worked out the total cost per season to be Rs.3,940/unit area for a period of 6 months which includes fixed costs on the culture cages and operational costs of maintaining it. One unit is believed to last for 4 seasons and total cost works out to Rs.8,020/unit for 4 seasons. The actual culture would be transferred to local cooperative societies who will undertake clam culture up to its harvest. Meat from clams may be sold by societies while the shell will be purchased by TCL at negotiated prices. It is believed that these societies will bear the actual costs of other inputs needed to culture clams, if extended for 4 seasons this will work out to approximately Rs.60 lakhs.

Pallom, Kottayam set up by the Fish Farmers' Development Agency (FFDA) is a point in example. The farm is reported to have produced 3.38 lakh fingerlings under the people's fish farming scheme in 1999-2000. The agency has also distributed one crore fingerlings in 1999-2000.

The important steps to be taken for revival of livelihood based on black clam are (i) regulation of

dredging in accordance with a proper environment management and monitoring plan. Monitoring of the area and immediate environs spanning about 1 km upstream and downstream may be made during the pre-dredging, dredging and post-dredging periods if dredging operations continue for months, (ii) assess carrying capacity of the Vembanad *Kayal* for the extraction of



sub-fossil shell, (iii) provision of alternate livelihoods and welfare measures for fishermen dependent on the dredged area and immediate environs, including support for undertaking clam culture (Box 17).

#### ***2.4.9 Integrated project for the development of S&T Kayals:***

It has been noted that the large areas of paddy lands in Lower Kuttanad and *Kayal* area that are lying fallow. They have provided ideal nursery grounds for sub-adults and juveniles. It may be a good idea to demarcate some of these lands that may not be cultivated for this objective. One such example is the QST *Kayals*. The Rani and Chithira *padasekharams*, in the event of its continued fallow, could be utilised for the conservation of fisheries resources such as scampi, the fresh water prawn and suitable fishes within a mangrove environment under the aegis of the Department of Forests, Department of Fisheries and the Tourism Development Corporation. The vast expansion of *Kayal* around the project area will facilitate fishing through out the year.

#### ***2.4.10 Ecological restoration and habitat strengthening:***

Many measures suggested earlier on renovation of waterways, minimising pollution, enhancing salt water mixing, etc are expected to restore the fishery habitats and breeding. Measures like fish ranching also would strengthen this process. In addition, specific program needs to be initiated to strengthen the threatened species along with simultaneous programs for restoring their habitats. Participatory restoration within the capacity of sustainable extraction of fisheries resources would be a practical approach. This has been demonstrated in the *Karimeen* and *attu konju* restoration programs.

Another important measure for conservation is enforcement and compliance with a ‘Code of conduct for Responsible fisheries’. The basic elements of this may include (i) regularise mesh size of gears, (ii) reduce the number of stake nets used for preventing capture of prawn juveniles and gravid females in the nursery grounds, (iii) curbing the use of illicit operation of stake nets during high tide, (iv) allow protection of an endangered species to *M.rosenbergii* during the downstream migration of gravid females, (v) introduce observance of ‘closed fishing seasons’ and ‘forbidden fishing zones’ to promote recruitment of endemic species. (vi) prevent harvest of young and undersized black clams, (vii) strongly curb practices of catching fishes using

explosives, animal poisons, etc., and (viii) regulate the spread of clay water slurry during dredging.

#### ***2.4.11 Suggestions for augmenting fisheries and fishery-based livelihoods:***

Ecological rehabilitation of KWS and modernisation and better management of TMB is expected to substantially contribute towards augmenting the fishery resources of Kuttanad. Hence, the first and foremost measure is appropriate enforcement new *punja* crop calendar, high priority for modernisation of TMB and management to keep the shutters closed only during 15 December to 15 March immediately and may be for lesser time after enforcement of the new crop calendar. A research study has to be undertaken to explore the possibility of snap opening and closing during the December-March period to examine how far this would help fishery population and affect *punja* rice. Apart from this some focussed programmes are essential for revival of fishery based livelihood opportunity for the local fisher folk under the 46 panchayats. These measures may include providing common and social infrastructure for the development of fisheries, development of models of integrated practices, and extension services to enable technology transfer of successful models.

Fish ranching is a beneficial approach for enhancing population of fishes, whose fingerlings could be reared in hatcheries. Department of Fisheries of Kerala had initiated a large-scale ranching of hatchery-reared post-larvae in various parts of Vembanad *Kayal* and its confluent rivers since 1992 under a Social Fishery Scheme. This activity is not being done regularly and adequately. Economically important species can be increased by this approach. Strengthening of this activity is important for improving the livelihood of fishermen. Such schemes may be extended to cover other species as well. One such example is the development of clam culture and ranching developed at the RARC, Kumarakaom.

Fish culture in open water areas under regulation of panchayats could be utilized for fish/prawn/crab farming in cages or in pens. This will provide employment opportunities as well as increased fish production of valued fishery like giant fresh water prawn and pearl spot. Poor fishermen, landless poor and small farmers may be assisted for such culturing. Each cage occupies about 60-65 m<sup>2</sup> area and a cage fishing unit may have up to 50 cages. This could be practiced as a group activity.

Fish culture in homesteads was discussed earlier using ponds, canals, etc under integrated farming. With such aquaculture it is easy to integrate with livestock like poultry, ducks, dairy, piggery etc. High value fishes like giant fresh water prawn and pearl spot along with carps could be used.

Promotion of '1P-1F' in areas identified suitable for this integrated farming with minimum risk from flooding and predator problems. As a healthy practice, polyculture should alone be promoted in Kuttanad and the fish culture should not be interfering with the recommended crop calendar.

The ornamental fish culture could be developed as a lucrative enterprise using stock from culture fisheries rather than extraction from the wild. This can be group or cooperative based on a demand driven mode.

#### ***2.4. 12 Research, extension and training:***

Conservation of fishery resources of the Vembanad *Kayal* is little attended area. There is need for generation of scientific statistically quantified database on fisheries diversity, migratory fishes and their habits. The lead work done by the RARC, Kumarakom may have to be strengthened. Integration of fish with other components of agriculture has vast potential in Kuttanad. Further research is important in this area including monitoring the larger impact of one paddy-one fish on the Kuttanad ecology. Here again, the RARC has strength and hence supported for strengthening developmental research on farming system. An area receiving no attention is on the regular monitoring of the water quality in major rivers and different points of the Vembanad *Kayal*. This assumes importance in the context of measures being recommended for revival of Kuttanad ecology and water quality. Hence, an environment surveillance unit with laboratory capacity for water quality analysis may be established in the RARC. The KAU may have to provide the required support of scientific personnel to manage the recommended facility.

The various agencies under the DoF catering to different fishery development needs are listed in Box 18. programmes. The DoF may support the fishery revival by completing the registration of

fisher population; conducting training for their capacity building on various aspects of ecology, fishing, processing and marketing (particularly involving fisherwomen); organising similar training to farmers on 'one paddy-one fish'; organising hatchery centres with farmer participation and in government farms for the supply of required quality fingerling of all important culture species; promoting group farming, particularly in cage farming, *padasekharam* fish culture and homestead fish culture; and undertaking regular ranching with multiple species in the Vembanad *Kayal*. Women groups, particularly the *Kudumbashree* and *ayalkootam* units may be promoted in each of these areas for far outreach of programs. Programmes like 'Women in fisheries groups' similar to the 'Women in Agriculture' being implemented by the Department of agriculture could be initiated.

**Box 18: Agencies under Department of Fisheries catering to the development of fisheries in Kerala**

**1. Kerala State Co-operative Federation for Fisheries Development or Matsyafed** is the apex federation of the Fisheries Co-operatives in the state. A three tier system of fisheries co-operatives with 594 primary co-operative societies at the base, is functioning in the State. Matsyafed implements various schemes on the following:

- ❖ Monitoring and Marketing of Fish Landings through primary co-operatives.
- Supply of various fishing implements such as craft, gear, engine etc to the active fishermen
- ❖ Housing schemes for fisher folk
- ❖ Insurance schemes for fisher folk.

**2. Kerala State Fishermen's Welfare Fund Board or the Matsya Board** implements various welfare schemes for the fisher folk by operating a contributory fund viz. fishermen's Welfare Fund envisaged as a per the Kerala Fishermen's Welfare Fund Act-1980. Welfare Schemes are being implemented by the Matsya Board. Major Welfare Schemes currently implemented by the Matsya Board are

- ❖ Old Age Pension for fisher folk
- ❖ Group Insurance against accidents for fishermen
- ❖ Financial assistance to fisher family for the death of fishermen while fishing
- ❖ Marriage grant for the daughters of fishermen
- ❖ Financial assistance to fisher family for the death of fishermen due to natural causes

**3. Agency for Development of Aquaculture, Kerala (ADAK)** is a state level agency constituted by the Government of Kerala for implementing various projects on development of aquaculture in the state.

**4. Fish Farmer's Development Agency (FFDA)** is a district level agency constituted by the Government of Kerala. There are 14 such FFDA's in the state, one each in every district. FFDA is a 'Government of India Scheme' implemented by the State Government intended for developing of freshwater fish culture in its jurisdiction.

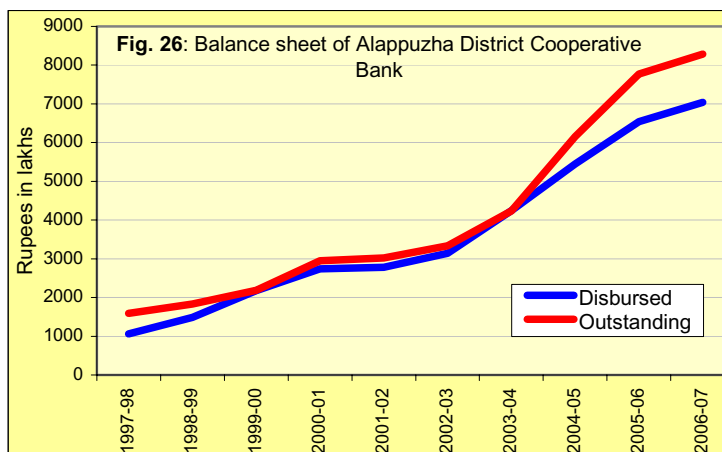
**5. Brackish water Fish Farmer's Development Agency (BFFDA)** is a zonal/ district level agency constituted by the Government of Kerala. There are 6 such BFFDA's in the state. BFFDA is a 'Government of India Scheme' implemented by the State Government and intended for developing of brackish water aquaculture in its jurisdiction

## 2.5 Default in Agricultural Credit Society loan in Alappuzha district

In Kerala, apart from national banks, agricultural credit is largely administered by Primary Agricultural Credit Societies (PACS) and 44 affiliated Primary Co-operative Agriculture and Rural Development Banks supported by the Central and Apex Co-operative banks. There were about 1,600 functional PACS in 2003-04. In Alappuzha district, rural credit is administered by

multiple cooperative institutions comprising 187 PACS, 4 Primary Co-operative Agricultural and Rural Development Banks, 3 Urban Co-operative Banks, 28 Consumer Co-operative Societies, 138 Coir Societies manufacturing coir yarn, 64 Coir Mats and Mattings Co-operative Societies (Coir product manufacturing units), 135 Fishermen Development Societies, 90 Employees Co-operative Societies, 151 Dairy Development Societies and more than 300 other types of societies like sericulture, marketing, labour contract, industrial, weavers, etc. and the District Co-operative Bank (DCB). The agricultural credit and supply of agricultural inputs are through Primary Agricultural Co-operative Societies (PACS) and Primary Co-operative Agricultural Land Development Banks (PCALDB). According to a report from the Alappuzha District Cooperative Bank, while the deposits from the PACS as on 31 March 2007 were Rs.591.83 crores, the loans outstanding on the same date from PACS was Rs.777.29 crores.

The short term credit for Seasonal Agricultural Operations and mid term credit for Allied Agricultural Activities are disbursing through PACS. The agricultural inputs are also provided through PACS for which DCB is providing overdraft facility to PACS. The DCB being the central agency for agricultural



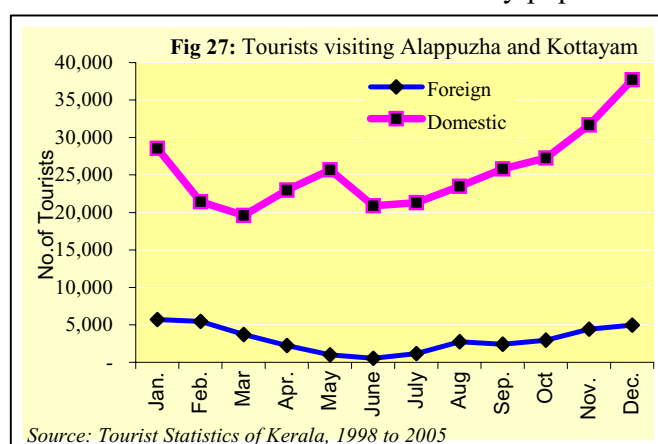
credit in the three-tier co-operative credit structure is providing 100 % refinance for the credit extended by PACS for agricultural and allied agricultural activities. The outstanding agricultural credit at the Alappuzha District Co-operative Bank (ADCDB) as on 31/3/07 was Rs.82.81 crores (Fig.26).

In addition, more than 12,000 SHGs are linked with DCB and PACS in Alappuzha district, out of which about 7,000 are eligible for lending as per the grading they received. Among them 5,467 groups are indebted to either DCB or to PACS, as on 31 March 2007. During 2006-07 loans to the tune of 28.68 crores have been disbursed by DCB and the balance outstanding in this head in DCB comes to 39.11 crores.

## CHAPTER 3

### BACKWATER TOURISM

Tourism in Kerala, particularly in Alappuzha and Kottayam districts, is growing at a rapid pace and emerging as one of the few economic alternatives available to people. The income and employment generation potential of tourism is receiving increasing priority in policy formulations. Revenue generated in tourism is estimated at about 6 % of the GDP of Kerala. The revenue from Kuttanad area is reported to be Rs.250 million. The Vembanad backwater tourism and houseboat cruise are widely popular among foreign and domestic tourists visiting

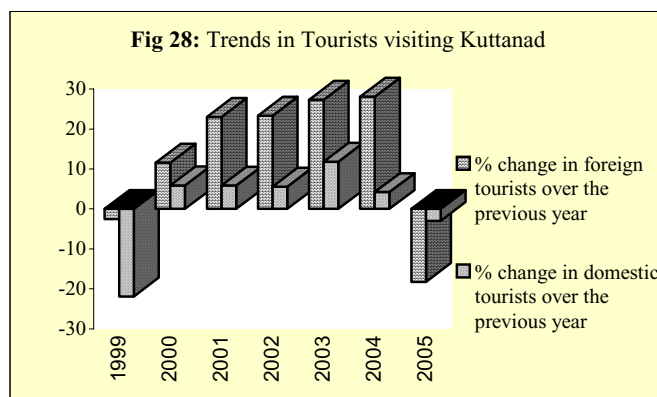


Alappuzha and Kottayam. Many traditional boats have disappeared here to give way for houseboats of different luxury classes.

Tourist statistics published by the Department of Tourism, Government of Kerala reveals that Alappuzha and

Kottayam together accounts for about 6 % of the total tourist arrival in Kerala, largely because of the backwaters. The average monthly distribution of foreign and domestic tourists reaching these two districts based on 8 years data between 1998 and 2005 is given in Fig. 27. Foreign tourists form only 13 % of the total tourists and they prefer to visit during November to February with visitors peaking during December-January. Tourist arrival data during the last

five years (2000-2005) show that there has been a 100 % increase in the number of foreign tourists and a 26 % increase in domestic tourists (Fig. 28). However, in 2005 there was a steep fall of about 20 % in foreign tourists and 3 % in domestic tourists over the previous year. The



growing dangers to public health and degrading ecology of KWS do not augur well for tourism growth.

Houseboat tourism is a largely a private enterprise with the government acting as a catalyst and facilitator. There are currently 5 major routes and their interconnecting canals through which houseboats cruise. National waterway No.3 offers extended scope. There has been a mushrooming of resorts, houseboats and associated infrastructure. Statistics show that the tourism infrastructure includes 6 major hotels/ resorts, about 457 medium hotels and 21 small hotels, about 350 house boats with only 300 among them reported to be with license, 40 country boats, 300 motor boats and a few speed boats. There are also about 200 houses, most of them in Kottayam side, with paying guest facility. The houseboats cruise along waterways during 180 days a year and reported to generate average revenue of Rs.108 crores/year. It is reported to provide employment to about 2,000 persons for 180 days a year.

Pollution and water stagnation and the foul smell emanating from putrefied fish and decomposed organic contents are growing challenges to sustained tourism. Lack of navigation aids such as channel identification marks, route or direction boards, signals, floating buoys and lighting system are other important deficiencies. Lack of wayside amenities for tourists such as drinking water, clean eateries and adequate rest rooms make the tourist tied up in the boat with no interaction with local communities. These facilities are also lacking in terminal jetties. Lack of adequate safety measures is another aspect pointed out by local people during interaction. In this context, a scheme on infrastructural facilities for cruising through the Pampa River developed by the National Transportation Planning and Research Centre (NATPAC) is worth mentioning. The infrastructure includes construction of terminal jetties at Alappuzha and Kottayam sides, construction of wayside jetties and eateries at several minor towns, construction of halting centres at R block, Vattakayal, Nedumudi, Kotharathodu, Kanjipadam, Pallathuruthy, etc. and construction of water sports complexes at terminals.

The water tourism is reported to contribute to the ecological degradation of Kuttanad. The houseboats and tourist resorts add to the pollution load on water with more solid wastes, notwithstanding that few of them are holding a “Green Palm” certificate from Tourism Department. It also contributes considerable fuel contamination from outboard motors and boat cleaning docks. Adequate study is not conducted on the carrying capacity of boats in the

*Kayal*, and the Irrigation Department, which issues license for boats, has no precise information on the number of un-licensed boats.

For local inhabitants, who use the waterways for bathing and washing, the discharge of human waste from houseboats right before their eyes is highly objectionable. Some have expressed disquiet at the dress-style followed by many foreigners and at their photographing bathing local women at the banks. Tourism development is alleged, justifiably, to have promoted land conversion for building resorts along with encroachments into the Vembanad Lake. Persistence of resorts to have widest possible waterfront with tight security is also increasing conflict with local fishermen.

While the big tourist operators, resorts and houseboat owners corner the lion's share of the income from tourism, the spill over to the locals is negligible. Currently tourism development does not bring to its fold the farmers and local community, despite their contribution to the greenery adding to the natural beauty of the region. The changes being wrought on the local socio-cultural fabric and huge inequity in the economic benefits are alienating local people from tourism.

This Committee in an interactive meeting with boat operators suggested they voluntarily impose a code of conduct on rule-based operation, and implement the sanitary and pollution prevention methods to promote water tourism for health and happiness. They unanimously agreed to this suggestion. They may also subject themselves to a 'Green and Health Audit' procedure, which they can develop with the help of the Centre for Science and Environment, New Delhi. The code of conduct should include operation under registration and license, maintaining prescribed standards for boat, inboard engines, solar energy tapping, installing eco-friendly biological waste disposal system, encouraging tourists not to dispose waste on water bodies, etc.

It has been generally understood that tourism in Kerala is mainly nature-based and for this specific reason, if its development has to be sustainable, it has to be essentially eco-friendly with stress on the conservation of ecology and preservation of pristine environment. Development of one sector must not be at the expense of the other sectors. Tourism development has to be responsible and it has to reach out to the local people and their livelihoods with adequate opportunities to the people to benefit from the development.



## ANNEXURES

### Annexure 1

#### Classification of Kuttanad Agro-ecological Zones

The Reclaimed land of Kuttanad is divided into six distinct agronomic zones. These regions are as follows:

1. **Kayal Land:** The *Kayal* lands have 9,464 ha area at elevations 1.0 m to 2.0 m below MSL with bund levels ranging from 0.6 to 1.1 m above MSL. There are over 600 *padashekharams* reclaimed more recently. In 'R' block, bund level is 1.4m above MSL.
2. **Lower Kuttanad:** This is the core area of Kuttanad, located at the southeastern side of the Vembanad *Kayal* and measuring 16,280 ha with much of the area falling in Alappuzha district. Majority of the *padashekharams* are here in elevations ranging from 1.5 m below to 1.0 m above MSL and the bund levels at 0.3 to 1.3 m above MSL.
3. **Upper Kuttanad** – On the south east of Kuttanad, with higher elevations from 0.5 m below to 6.0 m above MSL and bund levels vary from 0.3 m to 5.0 m above MSL. Occupies an area of 10,576 ha, much of it is further south of lower Kuttanad and east of Purakkad *Kari*, where the seven tributaries of Pamba converge and a part of the Pamba joins Achenkovil before flowing to the Vembanad *Kayal*.
4. **Purakkad Kari** – Constitutes a small area measuring 3,500 ha along the south-west coast spread across 43 *padasekharams* over four panchayats of Ambalappuzha and Karthikappally and situated 1.5-2.0 m below MSL. This region is vulnerable to flooding and saline intrusion through Thottapally spillway and Ambalappuzha-Thakazhy canals.
5. **North Kuttanad:** The low lands around the lower Meenachil forms North Kuttanad. It has an area of 6,556 ha and includes north and eastern side of the Vembanad *Kayal* falling in Kottayam district, including the Kumarakom town.
6. **Vaikom Kari** – Constitutes an area of 7,748 ha falling in Kottayam district located at north of North Kuttanad and includes Vaikkom.

### Traditional Practices in *Punja* Rice Cultivation in Kuttanad

Immediately after harvesting, the operations for the next years' crop start with a minimum of two rounds of ploughing, one length-wise and the other cross-wise along with the application of powdered burnt lime to neutralize the acidity of the soil. Then water is let through sluices in the bunds to flood the fields and the water remains there throughout the southwest monsoon period. The flooding suppresses the capillary rise of salts from below the soil. The acid soils of Kuttanad require regular liming. Recommended dose is 600 Kg/acre. Government gives subsidy on 250 Kg of lime or dolomite. *Kari* soils are more acidic requiring more liming.

**Wet ploughing:** The second round of ploughing starts when the floodwaters of south-west monsoon subside. The ploughing is done in waist deep water and is known as wet-ploughing. It helps to stir up the soil and allow fresh water to percolate into the soil. This ploughing has to be done by the locally assigned ploughman. Although, the ploughing these days is being done with machinery without involving ploughman, the farmer is required to pay the charges for two manual ploughing to the assigned ploughman as a social obligation enforced by the labour association.

**Dewatering:** Dewatering the fields commences soon after the wet ploughing and the completion of repairs to the outer bunds. This is done with special pump called *petti and para*, driven by oil engines or electric motors in each *padasekharam*. Electric pump sets of 30-50 HP are used. The pumping out of water continues till the fields get completely drained of all excess water, and the process goes on for about 15 to 20 days. The *Puncha* Special Officers (PSO) at Alappuzha and Kottayam control this activity as per the provision of Irrigation Act. The PSO with judicial powers was instituted in 1942 by the government to encourage regular cultivation of water-inundated *padasekharams* by facilitating the process and granting pumping subsidies. This subsidy, initially to the tune of 40 % of expenditure was later enhanced to full subsidy. The subsidy is determined based on the expenditure on different items for pumping. The PSO, through public auctions attended by the farmers of the *padasekharams* assigns the right of pumping to pumping contractors. Although this contract is given to the lowest bidder, the *padasekharam* farmers are also forced to pay additional amount known as 'additional *nerma*' based on the cost anticipated by the contractor. All concerned farmers of a *padasekharam*, on the basis of their land area, jointly share the 'additional *nerma*'.

This system puts the farmers into the following disadvantages. (a) Contractor exercises an upper hand in determining the time of dewatering and cost involved, (b) The existing rules disallow pumping subsidy if the crop is lost before 'full harvest' due to natural calamity, (c) Subsidy is denied when seasonal fallow occurs for succeeding crop, (d) A dual system of administration exists with DoA recognizing only the *Nellulppadhana samithy*, which is

registered under Charitable Societies Act, while the *Padasekhra* Committee is involved in pumping operations, (e) The disbursement of pumping subsidy by the PSO is very late, so that at any point of time it will be outstanding for the last 2 to 3 seasons and this promotes enhanced 'additional *nerma*' from farmers, (f) the auctions in the office of the PSO is inaccessible to many farmers in the remote *padasekharams*, (g) The outdated rate fixed for different items of dewatering process to assess the compensation payable to pumping contractors during natural calamities is unrealistic, and the current rates are 4-10 times higher.

A part of the expenditure incurred on dewatering, representing mainly the electric current charges, is at present subsidized by Government.

Strengthening of outer bunds, which may have been damaged by flood, usually begins after *Onam*/in August-September when water goes down to manageable levels. The materials used for this operation are clay, shrubs, straw etc. Clay is dug out from the adjoining canals and rives by *katta kuth*, which involves diving to the *Kayal*-bed for clay and bringing other materials from nearby places by country canoes. Strengthening of these bunds in accordance with the level and force of floodwaters is important to prevent breaches and consequent serious crop losses. Normally bunds are breached during high flood and high tides. Some of the *padasekharams* have permanent outer bunds strengthened with granite pitching, which has substantially reduced the risk of breach and crop loss. An endemic wild grass (*Karakam*), used to grow along the waterside of the bunds adds strength to the bunds. But this is virtually destroyed on ground that it promoted rat and snake infestation. The *padasekhara* committees are made responsible for the annual maintenance of bunds. Individual farmers of each *padasekharam*, on the basis of the area they own, share the cost of the maintenance work.

Similar maintenance for de-silting of adjacent canal is done collectively, once in 4 or 5 years. Due to the non-availability of experienced labour for *katta kuth* and high cost involved, de-silting is not being done by farmers, while limited bund strengthening support is given by the government. When dewatering is completed, the smaller inner bunds demarking individual plots within each *padasekharam* are repaired. This is known as '*edavaranmbu-kuthal*'. Along with this, repairs to inner irrigation canals are also done. The soil is then slightly raked by passing a harrow. This process is called '*pallikkadi*'. Weeds are removed during this process in order to make the soil into a soft puddle.

Apart from the outer bund, the minimal infrastructure in a *padasekaram* include pumping stations (motor *thara*), motor sheds and water draining channels called *vachals* which may have no or few branches. Water inlets in the polders are closed by grass or wood. Outer bund also serves as a temporary threshing ground and storage place for threshed grain.

**Repairs to inner bunds and raking First weeding and puddling:** A peculiar feature of the *puncha* cultivation of Kuttanad is that weeding has to be done even before sowing takes place.

**Seedbed preparation:** Preparation of stale seedbed includes draining out of water after ploughing and exposure of field to sunlight for 3 days to allow sprouting of weed. At this stage, water is again let in for 10-15 days to decay the weeds. This is an effective practice to control weeds like “*Kavada*” (*Echinochloa colona*).

**Varieties:** Prior to the 70's traditional varieties maturing in 100 days and offering less than 1.000 kg /ha were used. These were almost totally replaced by improved varieties having 110-120 day maturity. The improved varieties earlier used in Kuttanad were I.R. 8, Annapoorna, Aswathi, Rohini, Triveni and Jaya. The entire Kuttanad *punja* is now sown with two varieties, Jyothi and Uma. Jyothi, released in 1974 by the RARS, Pattambi remained as the most popular *puncha* variety, covering 90 % of the area until 2000. It matures in 110 days, and has yield potential of 6 mt/ha. Its grain is nearly slender, red, long bold and highly preferred. The Brown Plant Hopper (BPH) resistance initially present in this variety appeared to have broken down. Its double susceptibility to BPH and gall midge, the two major hazardous pests of Kuttanad, has rendered it less preferable. *Uma*, the second popular variety was bred at the RRS, Mancombu. It has duration little more than 115 days and yield potential slightly higher than Jyothi. It is resistant to gall midge and tolerant to BPH and currently covers more than 60 % of the *puncha* area. However, its short bold grain fetches low market price. A most desirable variety of Kuttanad must have 105-110 day duration, long bold red grain, resistance to BPH, gall midge, blast and sheath blight and yielding 6-7 t/ha.

**Seed supply, Seed rate and Sowing:** There is difficulty to farmers to get quality seed of the preferred varieties on time. Farmers are not able to keep the seed of previous *punja* crop due to quick loss of viability under high humidity conditions of Kuttanad. Hence timely supply of quality seed is important. The seed supply being provided by the Agricultural Department and the National Seeds Corporation is not satisfactory, according to farmers. Usually direct sowing of sprouted seed in 5-10 cm of standing water is practiced. Transplanting is followed in comparatively lesser area in Ambalapuzha and Karthikappally Taluks. The recommended seed rate for Kuttanad is 125 kg/ha, which is higher than the rate in other paddy areas. But farmers use even up to 150 Kg/ha. Low viability of the seed supplied and the need to suppress the weed with dense planting are reasons put forth for higher seed rate. However, dense planting also promotes BPH and sheath blight incidences. Seeds are packed in screw-pine bags and soaked for about 8 to 12 hours and then the water is drained off to induce sprouting in 2 to 3 days. The sprouted seeds are then sown in ankle deep water, which would be let into the fields. After three or four days, the water is pumped out of the fields completely and the fields are left to dry for 6 to 8 days till the soil develops crow-feet wrinkles on the surface except in *kari* lands where the soil has to be kept moist always. Sowing is done by broadcasting in most parts of the area. Transplantation is also adopted in some places.

**Time of sowing:** The date of sowing has significant bearing on the incidence of pests and certain diseases as well as on the management of TMB. Traditional *punja* sowing time is the mid-October while the *virippu* is planted in May. Late sowing usually attracts many of the pests like thrips, stem borer and often BPH. Regulation of the *puncha* sowing to period not beyond mid-November and *virippu* to within May is important in Kuttanad. However, after the commissioning of the TMB, and increased coverage of improved varieties, crop calendar has shifted with sowing delayed up to end of December. Non-availability of labour and other input is also a reason mentioned for protracted sowing. This has become an important cause for increased incidence of pests and diseases and enhanced pesticide use.

**Manuring:** With continuous siltation, Kuttanad soils, particularly the *Kayal* lands, are rich in humus. Application of organic manure, cow dung or any other farmyard manure, is quite uncommon in Kuttanad. Nearly 2/3<sup>rd</sup> of the straw left behind during harvest is the major contributed organic matter. Apart from organic carbon, every tonne of straw adds 6 kg N, 1 kg P & S, and 15 kg K. About 3-4 t of straw is decomposed. Organic matter is further enriched by the growth and decomposition of many aquatic plants, ferns and alga and fish activity during the submergence period. In general soils have substantial incompletely decomposed organic matter, wider C: N ratio and acidity, low available N and P and high K. Wider C:N ratio indicates that the organic matter available is possibly insufficient for the crop growth in certain soils. However, application of farmyard manure, compost or green leaf manure is not a common practice, although this is recommended in the package of practices. More over, supply of organic manure is not adequate and demands additional labour cost for its application. Notwithstanding this, the rice yield is far above par *vis-à-vis* the state average.

**Fertilizer application:** Application of chemical fertilizers is very common, particularly with the improved varieties. Usually it is applied in 3 splits doses, two doses at 12-15 and 30-35 days after sowing, each containing half of P (available), 1/3 of N and 1/3 of K during, and the remaining N and K at 45-50 days after sowing. While the recommended package is 90:45:45 NPK as straight fertilizers for Uma and Jyothi varieties, farmers usually apply higher doses of more costly complex fertilizers to achieve higher yield. While rock phosphate is seldom used, ammonium phosphate (Factamphos 20N: 20P) is most commonly used. Application of rock phosphate is reported to offer lesser yield response compared with complex fertilizers. Usually a good crop in Kuttanad may yield up to 6.5 t/ha under good management condition. The estimated application of plant nutrients to *puncha* crop is 4,481 t N, 2,393 t P, and 3,144 t K, while the same for first crop is 2,358 t N, 1,273t P, and 1,577 t K. Fertilisers are applied in the fields and water is let in and maintained to a depth of 5 to 8 cm. Better efficiency of fertilizer use is a requirement is desirable to cut cost of production and to regulate water pollution.

**Gap filling:** Twenty five to thirty days after sowing, the over-crowded portions are thinned out and the gaps filled. Along with this, one more weeding is carried out. Top-dressing with fertilizers in also done at this stage.

**Weed control:** Application of weedicide is very common in Kuttanad. Virtually only one weedicide, 2-4 D sodium salt, is widely used at a dose of 1.2 kg/ha during 17-20 days after sowing. The main weeds controlled are broad leaved kinds and sledges. There are many complaints on the effectiveness of 2-4D. There is need to study whether weeds are developing resistance to 2-4D and to identify alternate and effective weedicide or the weedicide quality is spurious.

**Water Management:** Water management is important with the process of letting in and draining out being continuous throughout the cropping season for washing out the salts and regulating soil pH to the optimum for better crop growth. Irrigation is usually at weekly intervals by opening the sluices in the outer bunds. The usual water management schedule is as follows: (a) Draining the field before preparation of land and stale seedbed, (b) Letting in water for killing weeds, (c) Maintaining 2 - 5 cm deep water during sowing, (d) Draining out 2 days after sowing, (e) Letting water in 5 days after and maintaining 2 - 5 cm water until first fertilizer application, (f) Draining water for first fertilizer application and letting water in, (g) Draining out water at peak tillering stage for second top dress and letting in water, (h) Maintaining 5 cm of water after maximum tillering stage, (i) Draining out for giving third top dress and letting in till heading stage, (j) Draining out 15 days prior to harvest. However, farmers' practices use more than the required water quantity.

**Management of Pest and Diseases:** The proclivity for the incidence of pests/diseases is high in Kuttanad due to the prevalence of high humidity and temperature in the area, high coverage with predominantly one high yielding variety, protracted crop calendar, and application of higher doses of fertilizers. Hence, regular incidences of pests and diseases are major problem to the rice cultivation in Kuttanad. Indiscriminate prophylactic spray schedule and use of unrecommended chemicals are very common. The incidences of BPH and gall midge are becoming more frequent, most serious and damaging to the extent of 30 to 90 % yield loss. The common diseases are sheath blight and blast. Unfortunately both the popular varieties are susceptible to sheath blight. Spraying and dusting with different kinds of pesticides are usually done two or three times during the crop season. Pest surveillance assumes importance in minimizing loss and optimizing pesticide application. Here the Pest Surveillance Unit at Mancompu has important role. Pesticide application based on the surveillance data alone has to be enforced.

**Harvesting:** Harvest is largely manual and combine harvesters are recently introduced, although there is opposition from farm labourers to mechanization. Harvesting is largely done at one-third top part of the stalk, leaving much of the straw in the field. The harvest is kept in small heaps in the field and another batch of labourers tie the harvest into sheaves and takes to the threshing grounds. Threshers on the bunds and roadsides are now increasingly doing threshing. The threshed grain is packed in gunny bags and transported by another group of labourers. Country crafts take the threshed paddy along the waterways for sale or storage. In many areas workers, inputs and produce are transported along waterways.

The harvest charges are paid in 16 % of the produce. In the case of combine harvester, Rs.1500 is paid for harvesting one acre.

**Mechanization:** Mechanization is becoming increasingly common in Kuttanad rice cultivation, particularly in dewatering using electric motor, use of tillers and tractors for land preparation, and for threshing and winnowing by power threshers specially designed for Kuttanad.

**Land law:** Limits 5 ac of land per family. Only when cluster of such holding belonging to relatives are cultivated as a single unit, the economic viability of cultivation improves.

**Labour:** The widely agreed working hours on a day for farm labour is 4 hrs for ploughing, 5 hrs in *Kayal* lands for all work, and 6 hrs in rest of the area. Current daily wages for men and women are Rs.175 and 90, respectively. In totality, an acre of land uses almost equal number of men and women for various operations. 16 % of production is paid as labour cost for harvesting and threshing. About 60 % of cultivation cost is on labour. Mechanized ploughing is getting more popular (46 % of farmers). Even so, many farmers still use animal drawn ploughing either totally or partially. About 21 % of the paddy farmers in the study area are exclusively depending on animal ploughing, another 19 % of them use draught animals for only one round of ploughing while 46 % use either tractors or power tillers for this purpose. According to 2001 census, Alappuzha has 48,878 main agricultural labourers, 67 % of them are male and 47 % of the total concentrated in Chambakkulam, Veliyanad and Chengannur blocks. These figures for Pathanamthitta and Kottayam are 44,922 and 57,650, respectively.

### Process documentation

The methodology adopted was a participatory approach involving all the stakeholders who are directly and indirectly affected by the distress and who hold a direct stake in the development of the region. The study was structured in three phases. The first was data exploration and field visits coupled with a desk-study of the situation at hand and proposals received. Two preliminary field visits were made during the months of December and January. The vast *Kayal* expanse and the major blocks in the area preventing free flow of floodwater, such as the blocks between C-D and Rani-Chithira Blocks were visited by boat. The study team were witness to the dense growth of weeds that prevented easy navigation. Various issues related to the *Kayal* were discussed with the people and their representatives. During visits to the inner areas of the canal network, the study team was able to capture the extent of roadblocks and weeds that prevented the free flow of water along the canals. Problem areas such as the Alappuzha-Changanasseri (AC) road and the encroachments on the AC canal, Thottappally Spillway and the leading channel, Thanneermukkom barrage, Thrikkunnappuzha lock system and surrounding Purakkad *Kari* area were visited. The issues concerning Pokkali cultivation and salinity intrusion in Andhakaran *azhi* were also understood. Onattukara region was also visited to get a first informed report of the issues of water logging and irrigation. Concerns of prawn peeling units and the pollution in Kappithodu were visited. Several fishermen were also present during the visits and the study team got a preliminary view of their issues. During these trips, discussions were also held with agriculture research stations, governmental departments and various non-governmental agencies, members of the academia, and retired government officials who have been actively working in Kuttanad. Various study reports, evaluations conducted by governmental and other agencies, and publications on Kuttanad issues and development, were consulted. The first phase culminated in a set of interim recommendations, which was presented to the Government of Kerala during early February 2007.

The second phase was a series of public consultations organised with multiple stakeholders. A total of 15 public consultations were held with the people of Kuttanad. More than 1,500 representatives from all sectors participated in them. These discussions were spread across all the major agro ecological regions and each discussion invited local stakeholders and touched upon local issues. Several memoranda and proposals running to more than 500 were received during all these discussions from all the stakeholders involved. The first among the consultations were held under the leadership of Prof. Swaminathan with local elected representatives of the Legislative Assembly (MLAs) and Members of the Parliament (MPs) from Alappuzha. The MLAs and MPs from the Kuttanad part of Kottayam and Pathanamthitta districts were also interacted with the study team. Based on the majority suggestions received during this meeting, the scope of the study was expanded to include, apart from Alappuzha district, parts of Kuttanad in Kottayam and Pathanamthitta also. The reason being, that, although a major part of the wetland ecosystem is in Alappuzha, the watershed for the wetland extends to adjoining districts of Kottayam and Pathanamthitta as well. The study team proceeded to have a series of



consultations with representatives of farmers, fishermen, coir workers, women in agriculture, representatives from houseboats and resorts, environmentalists, industrial representatives, elected local leaders of the Panchayat at all the three tiers of the PRI, and representatives from the mass media. Prof. Swaminathan attended some of these meetings. The respective elected leaders and members of the legislative assembly and the parliament represented the political body and were actively involved in each of these area specific discussions. Several governmental agencies partnered for holding the consultations and took the lead in organising the public consultations, and providing logistic support. The District Collector served as very helpful nodal agency and the government officials who were present at all the discussions represented the bureaucracy. They include the Agriculture Department, Labour, Health and Social Welfare, Department of Fisheries, District Tourism Promotion Council, the State Pollution Control Board, the Department of Local Self Governance or the District Panchayat Office, the Coir Board and the Coconut Development Board, and the Public Relations Department. The other departments that were consulted are the Department of Animal Husbandry, Matsyafed, Department of Water Resources, the NABARD, Forest Department, District Cooperative Bank, Kerala Information Mission and Kerala Land Use Board. Research stations under the Kerala Agricultural University, the Rice Research Station, Mankompu, and the Regional Agricultural Research Station at Kumarakom, the Central Plantation Crop Research Institute, Kayamkulam, Coir Research Institute, Alappuzha, Centre for Water Resources Development and Management (CWRDM), Kozhikode, senior representatives of Oil Palm India, Travancore Cements Ltd., the NTPC from the region, were also involved in the discussions. Non-governmental organisations included the Kuttanad Vikasana Samithy, Alappuzha, Gandhi Smaraka Grama Seva Kendram, Alappuzha, Pampa Parirakshana Samithi, Thiruvalla, Aloysian study centre on Kuttanad, St. Aloysius college, Edathua to name a few.

Several case studies were undertaken to gain insights to specific issues and successful models. Discussions during field visits were held with farmers who have been innovative in their approach to integrated farming such as ‘rice-fish’ integrated farming, ‘rice-duck’ integration and organic methods in paddy cultivation. Other case studies involved the integrated coconut village in Vayalar, experiments conducted on cage fish cultivation, coconut lagoon in Kumarakom, fish sanctuary in Vembanad Kayal, the R-block, paddy-sesame rotation in Mavelikkara Block, an example of farm tourism in Kumarakom, traditional rice mill in Ramankari and Royal rice mill at Chambakkulam, the *Kudumbashree* unit at Puthiyur, the Little Flower Nursery at Aroor.

The third phase has been the finalisation of the recommendations of the study. All the memoranda received were carefully read and their issues and suggestions were catalogued categorised issue-wise and region-wise. Discussions were held with several governmental departments and autonomous agencies, non-governmental agencies and public sector undertakings for their ideas related to addressing specific issues of Kuttanad and proposals were received from them. Conflicting issues were raised before a specially selected group of farmers, scientists, government officials and the expert committee members selected for the study, to

evolve a common ground. A final round of discussions was held with the expert committee members where the skeleton of the final recommendations was framed. The recommendations were then elaborated in full and laid before the Chief Minister, the political representatives and his Government for their scrutiny. Based on the suggestions received from them, this was further modified. The feedback received from the Government of Kerala on the draft recommendations and the response of the study team is presented in Annexure 4.

#### **Schedule of Consultations, Meetings and Field visits conducted by the Study Team**

	<b>Date</b>	<b>Time, hrs</b>	<b>Stakeholders consulted in meetings</b>	<b>Venue</b>	<b>Participants, #</b>
1	11-03-07	16.00-19.00	MP's and MLA's of Kuttanad region in Alappuzha dt.	State Govt. Guest House, Alappuzha	33
2	13-03-07	11.30-14.00	Meeting with Kuttanad farmers	Vidyadhiraja Auditorium, Nedumudi	91
3	14-03-07	14.00-17.30	Meeting with Kuttanad fishermen community	N.S. Auditorium, Civil Lanes, Alappuzha	64
4	15-03-07	09.30-13.30	Farm labourers of study area	Block Panchayat Hall, Monkombu, Chambakulam	70
5	09-04-07	10:00-12:30	Women in Lower and North Kuttanad	Kuttanad Vikasana Samiti, Ramankari, Alappuzha	138
6	10-04-07	10:00-12:30	Women in Upper Kuttanad	Maharaja Palace, Store Junction, Mannar in Upper Kuttanad	194
7	10-04-07	14:00 – 16:00	Farmers of Upper Kuttanad	Maharaja Palace, Store Junction, Mannar in Upper Kuttanad	192
8	11-04-07	10:00-12:30	Farmers in North Kuttanad	Aattamangalam Church Hall, Kumarakom, Kottayam	150
9	11-04-07	14:00 – 16:00	Tourism operators	Houseboat terminal, Punnamada	57
10	12-04-07	10:00-12:30	Coconut farmers and Coir workers	Govt. L.P.School Trikkunnappuzha, Alappuzha	116
11	17-04-07	14:00 – 16:00	Technical meeting with government officials and the Academia	Collectorate Office, Alappuzha	37
12	18-04-07	10:00-12:30	Ecology experts and concerned public	Collectorate Office, Alappuzha	38
13	18-04-07	14:00 – 16:00	Panchayat members	Collectorate, Alappuzha	31
14	19-04-07	10:00-12:30	Media persons	Collectorate, Alappuzha	19
15	10-05-07	10:00-17:00	Focus group discussion with selected farmers, Government officials, senior scientists	Hotel Royal Park, Alappuzha	28
16	23-05-07	10:00-17:00	Expert Committee Meeting	Coconut Development Board, Ernakulam	9
17	22-06-07	10:00-12:30	Meeting with Govt of Kerala presided by Hon'ble Chief Minister	State Guest House, Trivandrum	

Interaction with the Government of Kerala on the draft report



Consultation session with farmers



Consultation session with MPs and MLAs



Consultation session with women farmers



Post harvest grain damage due to rain



## Annexure 4

### RESPONSE TO THE COMMENTS RAISED BY THE STATE GOVERNMENT

1	Suitable measures for augmenting water flow of the other three rivers, other than Pampa River, flowing to Kuttanad – Meenachil, Achenkovil, Manimala	Augmenting water flow of rivers within the study mandate area is attended and recommendations made. Study did not examine augmentation of water flow of these rivers outside the mandated area. Study details and recommendations on this subject are available in the Indo-Dutch study report (1989).
2	Specific recommendations for restoration and conservation of the Vembanad Lake	Preparation of estuarine profiles all along the Vembanad Kayal identifying critical areas, including eroded segments, physical processes, development patterns, user conflicts and setting priorities for action and management <ol style="list-style-type: none"> <li>1. Halt reclamation and remove encroachments on backwaters, lakefront, canals, drains and public ponds</li> <li>2. Demarcate boundaries of Vembanad Lake and all waterways</li> <li>3. Boundary mapping and zonation into critical, dark, grey and white areas based on increasing levels of degradation and encroachment for prioritisation of restoration activities.</li> <li>4. Creation of 4-6 m wide ecotone along the Lake boundary to check further encroachment.</li> <li>5. Bring law to prevent paddy field reclamation</li> <li>6. Dredging of lake bottom south of coffer dam of the TMB along with construction of 3<sup>rd</sup> phase of TMB</li> <li>7. Fix depth gauges to monitor water level changes during tides, floods and summer.</li> </ol>
3	The Special Agricultural Zone	Please see in the following page. Also dealt in the final report.
4	Water tourism and resorts to be based on an inclusive model of development involving local population in these activities so as to sustain the ecology of the region	Farm tourism, Culture tourism, Water tourism, and houseboat wayside shopping places, etc recommended would enlarged participation of local. More investment and action is required from state to strengthen tourism and enforce eco-friendly practices.
5	Mills to be need based; producer owned with equity participation from Government. Rural go downs are a basic necessity of rice farmers to be set up under the auspices of the State Warehousing Corporation	Mills cannot be viable, when they are not need based. One can assess the required number of mills based on marketable paddy and capacity of the mill. The report argues that go-down option is not viable in Kuttanad. However, it is recommended. Thus a two-pronged approach is recommended- for establishing more mills and few go-downs.
6	Integrated and coordinated functioning of several agencies under the State Government. A project-	The implementation mechanism recommended provides for a statutory special purpose vehicle under the Kuttanad & Alappuzha Prosperity Council chaired by the CM and Task Implementation Committee chaired by the CS.

	specific <u>special purpose vehicle</u> to implement the recommendations	
7	Detailed account for mitigating the problem of drinking water shortage	The thrust on ecological revival also aims to improve the water quality. It is important adequate measures are taken by the State to prevent avoidable pollution of river waters upstream, so that people in Kuttanad can drink water seen around them all the time with minimal purification. The lack of drinking water to people of Kuttanad is created by the practices in the upstream of rivers. State should give high priority to clean the river systems from man-made pollution. While supply of drinking water is an important issue, it does not come under the mandate on improving farming conditions and mitigating farmers' distress.
8	Upper Kuttanad and Onattukara to be included	These regions are included as much as they are in the mandated area.
9	Immediate relief	A provision is recommended for immediate relief based on Central Govt norms on the matter.

### Special Agricultural Zone

**Aim:** To mitigate the ecological decay and economic distress prevailing in the area.

**Goals of the Action Plan**

- To achieve holistic attention to conservation, cultivation, consumption and commerce.
- To promote a scientific water salinity management and flood control strategy in the Vembanad Lake which will help to harnessing the needs of both paddy and fish cultivation.
- To improve the productivity and profitability of rice – fish farming systems and to promote multiple livelihood opportunities in garden lands through crop-livestock integration and biomass utilization.
- To achieve a small farm management revolution through the spatial reorganization of *Padasekharams* and the provision of essential centralized services like farm equipment, threshing, drying and storage facilities, agri-clinics, agri-business centres and computer-aided knowledge centres to support decentralized small scale production.
- To develop the six agronomic zones of Kuttanad, namely *Kayal Lands*, Lower Kuttanad, Upper Kuttanad, North Kuttanad, Purakkadu *Kari* and Vaikom *Kari*, in an integrated manner based on principles of ecology, economics, gender equity and employment generation.
- To introduce credit and insurance systems which will help to minimize risks from floods and other natural calamities and ensure income and work security.
- To improve marketing infrastructure in order to help in avoiding distress sales, particularly of perishable commodities, and to add value to primary products through agro-processing.

- To develop a brand name for the farm products of Kuttanad based on strict quality control and observance of *Codex alimentarius* standards of food safety.
- To strengthen the research and training infrastructure.
- To achieve convergence and synergy among numerous ongoing programmes.

## Annexure 5

### Revitalization of the ecology and economy of Alappuzha District: Suggestions for Immediate Action

#### I. Introduction

Kuttanad, the land of glorious heritage, the land of legends and legends, the land revered for the indomitable adventure and achievements of its people, the land that gave birth to the movement for social justice and equity of the working class, is in a state of ecological and economic decay. The vigour and pristineness of Kuttanad is wilting and the strong will of its people for defying hardship is getting eroded. The breathtaking natural charm of the backwaters and lush greeneries of Kuttanadan *punja* paddy fields splashed with the majestic coconut palms are living on borrowed time. A natural disaster with devastating ecological impact on human livelihood and habitation is brewing in the Kuttanad waters. Over last few decades, this is being fueled by unsustainable development projects, misuse of technologies, self-centered resource mining, inadequate policy and investment response and public apathy and pessimism. The impact is already there, particularly on the economically and socially vulnerable- farmers, fishermen and daily wage earners, who are struggling and suffering under serious ecological degradation, intense environmental pollution, loss of bio-resources, mounting threat to public health, declining economic and livelihood opportunities and escalating threat to life and property from increasing incidences of floods. What is more disturbing is that a vicious circle has emerged with the integration of negative eco-economic forces and unsustainable exploitation of natural resources of this fragile ecosystem. Kerala has a huge stake for immediate intervention and scientifically calibrated and socially harmonized action to save this “land where nature has spent up her richest bounties” and make it a true paradise in the “God’s own country”.

#### II. Economy of Kuttanad: Maladies

The mainstay of Kuttanad economy is rice cultivation, particularly the *punja* rice. Over the last fifty years the *punja* rice area has declined from about 55,000 ha to current estimates of 35,000-39,000 ha. The decline in the case of second season rice crop is much more drastic, from 24,000 ha to about 5,000-10,000 ha. Nevertheless, rice cultivation at various levels supports about 6 lakh farmers and farm labourers, providing about 40-50 lakh man-days employment.-It is estimated that a major share of income from rice is disbursed as farm wages. There is acute labour shortage

on the one side, and opposition to mechanization from organized labour, on the other. It is pertinent to mention here that women constitute nearly 80% of the labour force. For more reasons, which will be discussed in a subsequent report, rice farming has become economically unattractive or even a big burden. This, in turn is encouraging large-scale conversion of rice fields into garden lands (notwithstanding the law prohibiting such conversion) and fallowing of large rice areas. The silver lining in the dark clouds is that the hard working and enterprising Kuttanad farming community is willing to continue with rice farming and take the Kuttanad back to its past glory as the 'Granary of the State', provided their problems and tribulations are addressed by appropriate action and consistent policies by the government. Apart from farmers and farm labourers inhabiting the wetland, about 25,000 fishermen and a few thousands of shell collectors are directly depending on Kuttanad for their livelihoods. Severe water pollution, lack of natural water flow, large quantities of sediment deposition, reclamation for different purposes and unsustainable capture of diminishing fish stock have become major challenge to the livelihood of these people.

All in Kuttanad commonly share one major threat- the flood during the monsoon months, which is increasing in recent years in terms of frequency, intensity and damages inflicted. Prior to 1970's major floods used to be rare and there were only two recorded major floods. The impact of these floods used to last about 7-12 days during June-July (*Karkadakam*) and about 3-5 days during October November (*Thulam*). During such floods the water used to rise about 3-4 feet above the normal level, often entering houses in many areas. During the past 30 years the Government, the panchayats and groups of persons have been undertaking hectic uncontrolled or unplanned road building criss-crossing the region, with no regard to the direction of the water flow. These have seriously blocked floodwater ingress and egress leading to at least 4-5 or even more flash floods in a year, each lasting for 7-10 days, depending on the rains in the hills and in the Kuttanad plains. While flood as a natural phenomenon is an event essential to the Kuttanad ecology as a natural cleanser and replenisher, the adverse impacts of the flood on human health and livelihoods are amenable for remedial action.

During the last 50 years, many teams of experts from different institutions have studied the environmental, ecological, economic and livelihood issues arising from the unique situations and predilections of Kuttanad. These studies have not only adequately focused on many problems and



issues, but also prescribed several solutions, preventive and precautionary, to mitigate or counter these problems. Only a very few of these solutions seem to have received attention of the concerned authorities and implemented. Some of these solutions, either by their very nature or the manner in which they were implemented, have opened up new problems, while not totally addressing the issues they were intended to. These along with increasing multi-dimensional anthropogenic pressures on the sensitive Kuttanad ecology, changing socio-economic paradigms and continuing ad-hocism and neglect in addressing issues have compounded the problems of Kuttanad over the years, while recommendations to reverse this trend are yet to be acted up on. *Now, there is no more room for complacency and there is no time left for waiting for the opportune time, when the Kuttanad ecosystem is on fire.* Recognizing this urgency, this Committee submits this interim report with the hope that the recommendations provided herein will immediately be acted up on and for which required financial provision will be made in the 2007-08 Budget.

### **III. Remedies:**

#### **A. Ecosystem restoration**

Kuttanad is an integral part of the Vembanad-Kol wetland system, which was declared as a Ramsar site in 2002. The future development in Kuttanad has to fall in line with the Ramsar Convention. Over the years, activities which are either complementary or conflicting to the principles of Ramsar Convention, have been in practice. In all policies and actions by the government and communities related to the use of this aquatic ecosystem, a well integrated holistic view of the Vembanad Lake and the adjoining basins constituted by the five river systems draining into the lake, consistent with Ramsar Convention have to be kept in mind. This committee proposes to deal this matter in greater detail in its final report.

The present recommendations are largely based on a careful desk study and assessment of conclusions and recommendations available in all major studies undertaken earlier as well as the ground validation conducted by this Committee. This assessment revealed both converging as well as diverging conclusions from different studies. Only the converging conclusions were further examined and prioritized to develop these recommendations. A group of subject matter

experts also extended their erudition and experience on Kuttanad in making the following recommendations.

**1. Restoration of natural drainage systems of Kuttanad:**

Restoration to facilitate free water flow along the main waterways and all networked channels, from the river estuaries to the exit points at the Arabian sea to achieve reduction in flood intensity and duration and effective purging out of polluted water. This should address the cumulative silt-deposition in main waterways facilitating the flow, many road constructions causing obstruction to natural drainage, and the alignment of a few *padasekharam* bunds in the *kayal* area. Major road constructions like AC Road have created serious problems in the quick drainage of floodwaters with the AC Canal left disjointed at a number of points, narrow width at several points, and partially or totally blocked by the branching roads. The restoration should immediately involve mechanical de-silting of main waterways and all networked channels, connecting disjointed canals, and removal of all blocks across waterways created by natural silting, major and minor road constructions, waterweeds, etc. The de-silting has to be to the desired depth and the silt saved used to widen and strengthen the existing bunds or to erect new bunds, wherever required. These bunds should have adequate width to move small machinery, plant a row of coconut, banana or tapioca. This has to be done with care not to impact adversely the aquatic ecosystem. For deciding the quantity of de-silting required in different locations, we recommend the use of bathymetric maps prepared by the Indo-Dutch team on the Kuttanad Water Balance study and the hydrographic survey data available with the Kerala Engineering Research Institute. *There is urgency to start these restoration operations, preferably from 2007-08, and complete the whole work in a few phases within a time frame, with priority to important waterways and channels.*

**2. Minimising the ecological damage caused by the Thanneermukkom barrage:**

The crucial role of Thanneermukkom barrage in preventing saline water intrusion during summer season and increasing the concentration of pollutants in water bodies south of the bund is well recognized by all studies conducted after its construction. The consequent influence of this bund in substantially modifying the Kuttanad ecology including fish and shell breeding is universally emphasized by all studies. There is, however, divergence on whether the bund should be kept

open round the year or how long its shutters be kept down in a year. While we would like to go into details of this matter in our final report, as an interim measure we recommend two major steps. First, the barrage is in poor state with a number of its shutters corroded and some of the operating locks in a non-functional state, leading the barrage system partly and inefficiently functional. The system needs to be restored and maintained in a total functional state for efficient operation. Second, the duration of closure of the barrage should not exceed a three-month period, as recommended earlier by the Centre for Water Resources Development and Management (CWRDM), Kozhikode. Advance action may be taken to implement this recommendation during the coming *punja* season along with putting in place a plan to influence the *punja* crop calendar in conjunction with the barrage operation. A preferable crop calendar may require completion of sowing before November and harvesting before mid-February in all *kayal* and adjacent *padasekharams* vulnerable to saltwater intrusion. Such a crop calendar essentially demands farmers' cooperation for strict adherence as well as support to them with timely de-watering, supply of seeds and other agricultural inputs, mechanized ploughing and other preparatory operations. An early and synchronised cultivation may also substantially reduce the incidence of pests and diseases, leading to reduced pesticide application and better realization of price to paddy.

### **3. Functional restoration of the Thottapally spillway system:**

This spillway built in 1955 is in a poor state. This has to be repaired to restore its intended role along with restoration of channels leading to the spillway and periodic removal of sand bar at the sea-mouth for enhancing the drainage of the flood waters during the monsoon. It has to be ensured that the spillway is operated on a scientific basis, under the guidance of a multi-stakeholder team.

### **4. Reducing pollution of Kuttanad waters:**

The major sources of pollution in Kuttanad region, particularly the water bodies, are the solid wastes and sewage, coir retting, excessive use of chemical fertilizers and pesticides, and fuel contamination from mechanized boats. Among rivers, the Pampa is the major contributor of solid pollutants. Hanging latrines, which are very common along the banks of the canals are also

contributing a share to water pollution. This, together with decreased water flow and reduced ingress of salt water are helping the breeding of water borne pathogens such as *Leptospirae*, *Vibrio cholerae*, organisms causing gastroenteritis and disease-carrying mosquitoes. During the last two decades, leptospirosis, Japanese encephalitis (Culex mosquito transmitted), and gastroenteritis are almost endemic in all parts of Kuttanad. The poor and those who are directly depending on water for livelihood, such as fishing community, are more vulnerable to such health problems. While this Committee sees the need for a comprehensive plan for total sanitation of Kuttanad, the immediate measures recommended are better water flow with restored natural drainages and immediate time-bound and expedited implementation of an ***Integrated Pampa Action Plan***, which has already been approved with budget. This will help to reduce contamination of solid wastes and other major pollutants in the river.

## **B. Strengthening Livelihoods**

### **5. Improving the logistics of *padasekharams*:**

An estimate made in 2002 states that the Kuttanad paddy fields exist in more than 1,000 clusters (*padasekharams*), with about 32 of them measuring about 9,500 ha in *kayal* lands. Many of these *padasekharams*, (for example, E-Block, J-Block, H-Block, Mangalam Manickamangalam, Rajaramapuram, etc) are very large in size, measuring up to 985 ha. With the change in ownership and management of these *padasekharams* from one family to multiple farm families, the logistics of farming these fields, particularly those located in the interior part of *padasekharams* has become an important issue. Farmers owning such interior fields face serious problems and additional cost in taking farm inputs and labourers to these fields and carrying the farm produce from the field to the nearest bund for transportation by boat. Farm labourers are also reported to be less enthusiastic to work in such interior fields. Another major disadvantage is the common destiny for the entire crop of such huge *padasekharam*, whenever a loss happens with floodwater induced breach in any part of the bund embanking them. In view of these, this Committee recommends division of such large *padasekharams* in to smaller units, each not exceeding 200 ha in size, with the partitioning bunds having adequate width and height to facilitate movement of machineries like tractor, etc. and to save the field from floodwaters in situations of a breach in the adjacent embankment. These embankments may be built with due consideration to the hydraulic characteristics of the flow in the water body and drainage issues.

The existing old bunds are weak in many places and their strength is continuously getting eroded with the draft generated by speeding motorboats. It is recommended the silt de-silted could be used to strengthen the existing external bunds along the major waterways.

#### **6. Efficient input and information services to farmers:**

A major reason for low profitability from rice cultivation is the increasing expenditure on inputs such as fertilizer, pesticides and herbicides. Among these three input components, the Committee could gather adequate information to offer interim recommendation only on the application of fertilizers. The current application of fertilizers is not on a scientifically determined need basis. Soil test based fertilizer application may significantly cut down the fertilizer applied and consequent pollution problem. The soil test service appears to be dysfunctional and with poor reach and response. In view of the special situation existing in Kuttanad rice cultivation, this Committee recommends that the Department of Agriculture in liaison with the *Punchakrishi* Special Office to undertake regular soil testing of the area on its own and periodically (once in two years) publish the soil nutrient and acidity status as well as liming and manuring prescription for each distinct area, covering one or more *padasekharams*, by August-September. The Department should also prescribe appropriate low cost fertilizer options, including non-synthetic forms, and soil ameliorants (lime or dolomite) and ensure that the recommended inputs are made available to farmers at the right time and in adequate quantity. In view of the constraints being faced by farmers for getting quality seed on time, it is important that the Department of Agriculture should ensure the adequate availability of quality paddy seeds of varieties preferred by farmers. This Committee would like to deal with the seed supply system in detail in its final report. Another major gap readily visible is on the transfer of right information at the right time to farmers. There is vast scope to bridge the information gap with the disaggregated [Village Knowledge Centers](#) (VKCs) or aggregated *e-krishi* models as well as through the Farmers Field School (FFS) system, which were successfully tested in Kerala. Along with these information/technology transfer system, the Out Reach Programme (ORP) could be introduced to train selected Self Help Groups of farmwomen and men to produce and supply bioagents at a reasonable cost. All these may be integrated with participatory approach and cluster farming concept.

Deleted: village

Deleted: knowledge

Deleted: centers

## **7. Farm labour:**

One of the major constraints in paddy cultivation in Kuttanad region is the non-availability of farm labour at the right time and in required quantity. This is severe during peak farm operations like sowing and harvesting. The availability of farm labourers is steadily decreasing and many among the younger generation, men and women, are not keen to agricultural work, even if they remain jobless. A multi-pronged approach is required to provide timely support to agricultural operations with care to optimize the man-days of employment for the local farm labour. This may include creation of panchayat level labour banks by enlisting persons willing to take agriculture related works, developing *padasekharam*-wise labour demand planner for paddy crop, mobilizing labour from adjacent regions to meet the labour deficit during peak operations, selective mechanization of farm operations without displacing labour, empowering unemployed youth for operation of agricultural machineries, providing financial assistance to trained group of youths to own farm machineries, and determination of competitive rates for mechanized operations. ***Educated youth can start Agri-clinics and agri-business centers and provide the necessary implements on a custom hiring basis.*** The bottom line should be the concurrent welfare of farm labour and farmer.

## **8. Promote group farming**

A group farming approach built around one or few *padasekharams* to synchronize all farming operations from de-watering, liming, field preparation, sowing through harvesting may benefit farmers and farm labourers. Such approach to be successful has to be leveraged with the support of Department of Electricity, *Punchakrishi* Office, Department of Agriculture, input suppliers, and the respective *padasekhara* committee. The idea of group farming is to promote decentralized production using eco-technologies, supported by a few key centralized services such as pest-proofing on an area basis by an Agri-clinic operated by farm graduates.

## **9. Enhancing income from coconut farming systems:**

Coconut is the crop next in importance to rice in Alappuzha district including the Kuttanad region. Alappuzha is the severely affected area of root wilt disease of coconut. Apart from this,

the productivity of palm is further crippled by the mite epidemics and the red palm weevil, particularly in Kuttanad. The farmers with small and marginal holdings bear the brunt of this economic loss. Palms with early and middle stages of root wilt disease respond well to management. An integrated coconut management method developed at the Kayamkulam center of the Kerala Agricultural University involving selection of healthy mother palms from areas severely infested by root wilt and selective propagation of seedling derived from such mother palms along with other cultural methods may help to restore palm health and productivity. Inter-mixed or multi-storey cropping, including vegetable cultivation and honeybee rearing, and organic recycling through vermicomposting are more beneficial to coconut and provide better income to farmers with small holding. For example, the remunerative potential of honeybee rearing by women self help groups has been proved in Kollam district. Integration of these activities with Farmers' Field Schools would facilitate faster technology transfer and wider capacity building. Thus an integrated coconut production revival along with a massive effort to identify the good mother palms, production and supply of quality planting material to replace the severely root wilt affected as well as older low yielding palms, under a subsidy component is recommended. *This re-plantation may be linked with the National Horticultural Mission for leveraging funds.*

#### **10. Revitalization of Fisheries in Kuttanad:**

Since the mid-seventies, the economics of rice cultivation has been becoming less and less attractive. This along with other problems associated with rice farming has resulted in a steep decline in rice area and production. Wherever feasible, rice fields are being converted for other crops or for non-agricultural activities. This irreversible trend on staple food production will not augur well for Kerala in the long run. However, in large areas in Kuttanad where rice is the traditional crop, there is little alternative to the farmers. Apart from rice, Kuttanad wetland ecosystem offers a fishery wealth, comprising several unique species of fishes (eg. *Karimeen*), prawns (eg. the famous tiger prawn) and mollusks. The harvests of prawns, shrimps and fishes are rapidly declining due to the interference in natural water flows, increasing water pollution and unacceptable eutrophication. Prior to the regulation of water flow by the *Thanneermukkom* barrage, the annual catch was of the order of about 400 t prawn and about 16,000 t fishes, which have declined in recent time to about 74 t and 507 t, respectively. The impact of this decline on

the population depending on fishing for livelihood is serious. Kuttanad has potential not only as a Granary of rice, but also as bountiful bowl of fish. The restoration of both is vital to the local economy. When cultured and processed under hygienic conditions these fishes command high export value. This important topic will be dealt with in more detail in the final report.

#### **11. Promoting environmentally sustainable water tourism:**

Water tourism is a major economic activity of recent origin in Kuttanad. This is reported to be providing employment to about 5,000 persons from Alappuzha and Kottayam districts and earning annually about Rs 250 million. Regulations are in place regarding the boat standards and management of pollution from water tourism. There are about 300 houseboats of different specifications and standards of luxury approved by the Department of Tourism. These boats are expected to maintain scientifically designed septic tanks and bio-chemical toilets as alternative arrangements for discharging solid wastes and sewage. They are also required to have battery or solar sourced energy supply. More eco-friendly stipulations are insisted for boats for optional 'Green Palm' certificate. An equal or more number of houseboats and speedboats are operating with the license issued by the State Pollution Control Board under relaxed norms. Most of them lack scientifically designed septic tanks and bio-chemical toilets and have high propensity to pollute water with their out board low fuel efficient engines. Laxity in enforcement of existing regulations on motorboat is causing increasing contribution of pollution by tourism, largely by direct discharge of human waste into waters and water contamination by engine fuels. Increasing fossil fuel contamination is retarding reproduction of water biota and making the fish inedible. There is also very little integration of houseboat tourism with local culinary and cultural ethos of the local community. It is hence recommended that the water tourism be made eco-friendly with very strict regulations and their enforcement to prevent direct disposal of any kind of waste from houseboats and plying of boat having engines not conforming the green emission standard and then allowing boats having only in-board engines of approved standard after a year. Necessary financial assistance may be provided to all boats to conform to these standards within the said timeline. Tourism also has to be integrated with the local community to provide them opportunity to earn from their culinary and cultural skills by promoting approved shops en-route the *kayal* area. Systematic monitoring of water quality of rivers and the lake by the State Pollution Control Board is also recommended. The houseboat owners may be encouraged to form a Kuttanad Water



Tourism Society for Health and Happiness. This Society could impose a code of conduct on the sanitary and pollution prevention methods to be adopted by the members. A Green and Health Audit procedure may be developed by such a Society with the help of the Centre for Science and Environment, New Delhi.

To sum up, the following are the immediate measures needed:

**A. Strengthening ecological security**

- Restoration of natural drainage system
- Minimising the damage caused to the ecosystem by *Thanneermukkam* barrage
- Restoration of the Thottapally spillway system
- Pollution control in Kuttanad waters
- Improving the logistics of *padashekharams*

**B. Strengthening livelihoods through work and income security**

- Improving the productivity and profitability of rice farming system
- Revitalization of fisheries
- Labour security – integrated manual and mechanized operations
- Group cooperation in certain farm operations with the support of Agri-clinics and Agri-business centers operated by the Farm graduates
- Enhancing income from coconut farming system

**C. Promoting environmentally sustainable water tourism and formation of a Kuttanad Water Tourism Society for Health and Happiness**

**M.S. Swaminathan**  
Chairman,  
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13-Feb-07

**SUMMARY OF INTERIM RECOMMENATIONS TO IMPROVE THE ECOLOGICAL  
AND LIVELIHOODS SECURITY OF ALAPPUZHA DISTRICT WITH SPECIAL  
REFERENCE TO THE KUTTANAD ECOSYSTEM**

<i>Major assigned objectives</i>	<i>Recommended Actions</i>	<i>Indicative budget provision</i>
<i>Measures for strengthening the ecological security of the Kuttanad wetland ecosystem</i>	<b>1. Improve natural drainage in the Kuttanad delta</b> 1.1 : Mechanical de-silting of waterways and network channels 1.2 : Removal of all blocks due to silt, road building across the waterways, water-weeds, etc	Rs 80 crores
	<b>2. Improve natural water flow in Vembanad kayal along Thanneermukkom barrage</b> 2.1 : Keep the barrage closed for period not more than 3 months a year, during the <i>punja</i> crop 2.2 : Improve the operational efficiency of shutters	
	<b>3. Reduce and remove pollution</b> 3.1 : Expedite implementation of the Integrated Pampa Action Plan 3.2 : Systematic monitoring for water quality status in rivers and Vembanad <i>kayal</i>	
	<b>4. Ensure sanitation and health</b> 4.1 : Total sanitation to all houses. Discourage habitation in places where adequate sanitation cannot be achieved	
<i>Measures for expanding sustainable livelihood opportunities for the people of the area</i>	<b>5. Strengthen paddy based livelihoods</b> 5.1 : Bund construction and strengthening- in conjunction with de-silting operation 5.2 : Re-adjust <i>Punja</i> crop calendar of <i>kayal</i> and adjoining <i>padashekharams</i> , which are vulnerable to saline water intrusion to suit the shut down of <i>Thanneermukkom</i> barrage only for three months during November to February 5.3 : Divide large <i>padashekharams</i> to smaller units with partitioning bunds of adequate width and height 5.4 : Introduce centralized cluster-based soil health service for periodic analysis of acidity and nutrient status and to provide prescription on low cost ameliorants and fertilizers including bio-fertilizers 5.5 : Ensure timely supply of quality seeds and other inputs in adequate quantities 5.6 : Establish panchayat labour banks to gauge availability of farm labour and ensure timely supply 5.7 : Promote group farming built around one or few <i>padashekharams</i>	Rs 40 crores

	<p><b>6. Promote Fisheries and livelihoods</b> 6.1 : Promote enhanced fresh and brackish water fish (includes prawn) production through improved water flow and other ecological measures</p>	Rs. 30 crores
	<p><b>7. Coconut based livelihoods</b> 7.1 :Adopt better management using bio-fertilizers, organized use of traps to control red palm weevil, multi-storey cropping with focus on vegetable 7.2 :Selective re-planting of aged and severely disease/pest-affected trees with quality seedlings locally raised from healthy mother palms</p>	
	<p><b>8. Promote Eco-tourism</b> 8.1 : Promote farm-based tourism along with local community managed services and local cuisine, costumes, herbal products, handicraft products, etc. 8.2 :Enforce eco-friendly practices and pollution emission norms for house/motor boat engines 8.3 :Promote in-board fossil fuel based engines or battery/solar power based engines 8.4 : Introduce a code of conduct on pollution and sanitation measures under the aegis of Kuttanad Water Tourism Society for Health and Happiness</p>	
	<p><b>9. Encourage integrated farming</b> 9.1 :Promote dairying, goat, duck and honey bee rearing, bio-fertilizer production 9.2 Promote Agri-clinics and Agri-business centres</p>	
	<p><b>10. Introduce knowledge and information hubs</b> 10.1 :Village information systems (eg. VKC, <i>e-krishi</i> and <i>e-akshaya</i>) to provide quick access to appropriate information related to crop options, production, schedule of government /padasekhara committee coordinated services like de-watering, input price and supply, commodity price, government and panchayat schemes, etc 10.2 :Bridge VKC or <i>e-krishi</i> with Farmer field schools and facilitate farmer- to- farmer training, knowledge dissemination and technology transfer.</p>	

Total indicative and immediate additional allocation of Rs. 150 crores during 2007-08 is recommended.

**M.S. Swaminathan**  
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13-Feb-07

## LIST OF PARTICIPANTS

Annexure 6

### 1. Consultations with MPs and MLAs of Kuttanad region in Alappuzha District, State Guest House, Alappuzha on 11-03-07.

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2. Smt. C S Sujatha, M.P. Mavelikara
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13. Shri. P P Chitharanjan, Municipal Chairman, Alappuzha
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15. Shri. K R Viswambharan, IAS, Dist. Collector, Alappuzha
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### 2. Consultation with Kuttanad farmers, Vidyadhiraja Auditorium, Nedumudi on 13-03-07

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### **3. Consultations with Kuttanad fishermen community, N.S. Auditorium, Collectorate compound, Alappuzha on 14-03-07**

- 175.Dr. D D Namboothri Pad, Prof.Fisheries College, Panangad
- 176.K G Padmakumar, Kerala Agri. University, RARS, Kumarakom
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- 178.N K Sanujan, Secretary, All India Kisan Sabha, Kottayam
- 179.P G Padmanabhan, Kissan Sabha Taluk Committee, Kumarakom
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- 182.V N Vishwanathan, Dheeware Sabha
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### 4. Consultations with Farm labourers, Block Panchayat Hall, Mankombu, Chambakulam on 15-03-07

- 217.M Vijayan, K S K T U, Alappuzha DC
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- 255.Jacob Cherian, Member
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- 273.K R Viswabharan, DC, Alappuzha
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277. Pushpavalli, C.D.S.M.
- 278.Shyler G Kaimal, Women in Agricultural, Nedumudy
- 279.Indira P, Women in Agricultural, Nedumudy
- 280.Subha S Pillai, Women in Agricultural, Nedumudy
- 281.C P Vijaya Kumari, Women in Agricultural, Nedumudy
- 282.Annamma Thomas, Women in Agricultural, Nedumudy
- 283.Usha Devi, Women in Agricultural, Nedumudy
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- 295.Susamma Zacharia, Anganwadi Helper, C.No: 11, Kainakary
- 296.P N Ramani, Anganwadi Worker C.No: 98, Edathua, Prabha, Vezhapra
- 297.P Thankamma, Suresj Bjavaan, Vezhapra
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- 299.Shobha Mohan, E.D.S. Chairperson, Thakazhy Panchayat
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- 302.Renuka Rajan, Ambalapuzha
- 303.Sheela G, Ambalapuzha
- 304.Sathy K, Ambalapuzha
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338. Poornam Sudhajayan
339. Indulekha
340. Elsamma Lonappar
341. Kunjamma Mathew
342. Usha K K
343. Sudha
344. Maniamma
345. Tessy Thomas
346. Sujatha Shaj
347. Indumanali
348. Asha
349. Geetha Laya
350. Valsamma Gopinath
351. Mahimma Jacob, Mariyam S.H.G.
352. Kunjumol Vijayam
353. Jinsi James
354. Thankamma Sathish
355. Mallika Anil Kumar
356. Rekha Balakrishnan
357. Molly Purushothaman
358. Rathnakaran
359. Sheebabali Kumar
360. Bindumol Monsi
361. Swapna Saji
362. Vinija
363. Chellamma Parameswaran
364. Krishnamma Vijaya
365. Lisamma Thomas
366. Vatsamma Ajaynker, K V S

## LIST OF PARTICIPANTS

367. Laila Mani, Charge Officer, Kudambasu, Ramankary
368. Valoala Kumari G, L.V.E.O. Mancompu
369. T V Omana, L.V.E.O. Muttar
370. Bina Suresh, Welfare Chair Person, Veelam purores. G.P.
371. Prasonna Mohan, Neelamperoor Grama Panchayat President
372. Quenojose, Agrl. Officer, KCPM, Moncompu
373. K Kusumam, Project Director, KCPM, Moncompu
374. M G Prasanna Kumar, Deputy Director of Agrl. (YP) PAO's Office, Alaphey
375. Siby. T Neemoisstry, AO (AEZ), PAO, ALPY.
376. A K Shamsuden
377. Rosamma Mathew, Navajyothi Ayalkoottam, Ramankary
378. Vijayama Nadarajan, Lankara, Ramankary
379. L Sreelakha, Asst. Director of Agriculture, Ramankary
380. Vrinda T S, A O Muttar
381. Dr. S Kulavathi, Sr. Scientist, CPCRI, Kayamkulam
382. Linma Skaria
383. K M Nalini, C.D.S.
384. Gowri Kutty Rajappan, C.D.S.
385. P Thankamani, Thriveni Vanitha Karshika SHG, Krishibhavan
386. Lalitha Vidyadharan, Thriveni Vanitha Karshika SHG, Krishibhavan
387. Radhamany K, Hari Sree Vanitha Karshika SHG, Krishibhavan
388. Sarala U K, Hari Sree Vanitha Karshika SHG, Krishibhavan
389. Sindu Baiju, Nedumudy Panchayat IX Ward C.D.S. Member
390. Madhev Kutty, Nedumudy Panchayat VII Ward C.D.S.
391. Geetha Raju, President, Nedumudy Grama Panchayat, C.D.S.
392. Valsala Nataraj, GSK Sub Centre Secretary, Kuttanad
393. Raamma Appu Kutton AC Animator
394. Smethy, K Champakkulam IV Ward
395. K N Sasikala, Vayalar
396. Shamshad, Vayalar
397. Valsana Sivadasan, C.D.S. President, Muttar
398. Sridevi, C.D.S
399. Omunakarunakaran
400. Ammini Gangachewan
401. Shilaja Salilan, Gandhi Smaraka Grama Seva Kendra, S L Puram
402. Renuka Shaji, Kayamkulam
403. Podichi, Kayamkulam
404. Mary, Kayamkulam
405. Sudharma Babu, Gandhi Smaraka Grama Seva Kendram, Karthicapally

### **6. Consultations with Women in Upper Kuttanad, Maharaja Palace, Store Junction, Mannar in Upper Kuttanad on 10-04-07**

406. R Prasanna, ICDS, Trikunnappuzha
407. Shoshamma Thomas, ICDS, Pallippad
408. Geetha Kumari, ICDS, Pallippad
409. K Lalitha, ICDS, Thottapally
410. Beena Kumari, ICDS, Ambalappuzha
411. C Nagamma, ICDS, Ambalappuzha
412. B Padmini Amma, ICDS, Ambalappuzha
413. K Shantha Kumari, ICDS, Ambalappuzha
414. P Laila, ICDS, Punnappa
415. R Sudhamani, ICDS, Kakkazham
416. Leelamma Jayaram, Fishermen, Pappad

## LIST OF PARTICIPANTS

- 417.Kochu Rai Mathew, Director, Socio Economic Unit
- 418.K Kusumom, A W Worker, Karivaka
- 419.V K Shyamala, A.W.Worker, Mannar
- 420.K Leelamma, A.W.Worker, Bijuville, Cheruthana
- 421.R Sulochanamani Amma, A.W.Worker, Veliyathu, Cheruthana
- 422.S Suvarna, Thrikkunapuzha, Krishi Bhavan
- 423.D Solehana
- 424.Sumathi
- 425.Beena Krishi Bhavan, Trikkunnapuzha
- 426.K Kavitha, Pallanu Krishi Bhavan
- 427.Saroja, Pallanu Krishi Bhavan
- 428.Sulekha Ous, Kandaloor
- 429.Lakshmi Kuttiamma, Kandaloor Krishi Bhavan
- 430.P Ambika, Kandaloor Krishi Bhavan
- 431.Sudharamma, Women in Agriculture, Kandaloor
- 432.Subhara, Women in Agriculture, Kandaloor
- 433.Sumangala, Women in Agriculture, Kandaloor
- 434.Sathamma, Women in Agriculture, Kandallor
- 435.Bhasker Shyam Nivas, Women in Agriculture, Kandaloor
- 436.Droupathy Amma, Women in Agriculture, CheriyanadK J Omana, Women in Agriculture, Cheriyanad
- 437.Indira, Women in Agriculture, Cheriyanad
- 438.Thankamoney, Women in Agriculture, Cheriyanad
- 439.Suma Vijayan, Women in Agriculture, Cheriyanad
- 440.Geetha Nair, Women in Agriculture, Cheriyanad
- 441.Chandramaniamma, I.C.D.S., Haripad
- 442.V Umayamma, I.C.D.S., Haripad
- 443.Rajalekshmi Radhakrishnan, Krishi Bhavan, Mankamkuzhi
- 444.R Mahilamani, I.C.D.S. Karuvatta
- 445.T S Vasantha Kumari, I.C.D.S. Karuvatta
- 446.S Sabeedabevi, Agrl. Assistant, I.C.D.S. Karuvatta
- 447.K Sujatha, MNR Panchayat
- 448.Lolly. L. Vasughee, ICDS, Tiruvanvadoor
- 449.K Lalitha, I.C.D.S. Budhanoor
- 450.Gracy Thobiyas, President
- 451.Omana Baby, Karichal
- 452.Retnamma Shaji, President, Purakkad Grama Panchayat
- 453.K Jyotheeswaran, Chairman, Purakkadu Grama Panchayat
- 454.P K Vasudevan Nair, R.D.S., Alu
- 455.V S Gopalakrishnan, President, Rural Development & Cultural Society, Alu.
- 456.C Ranjunathan, Social Welfare Department, Alappuzha
- 457.V S Ranganathan, Social Welfare Department, Alappuzha
- 458.N Viswanathan, Programme Officer, Dist. Level ICDS, Alappuzha
- 459.V V Ramachandra Nayar, NCP Block Committee, Karshaka Congress President
- 460.Shaji Kochu Thandathil, GSGSK Convenor, Karthikappally Sub Center
- 461.P Usha Kumari, Women in Agriculture, Krishi Bhavan, Cheriyanad
- 462.V M Joshnakumari, Cheriyanad Krishi Bhavan
- 463.Saraswathy Soman, Cheriyanad Krishi Bhavan
- 464.Maheswari Anantha Krishnan, Amrutham Food Supplement Unit Convener
- 465.Geetha Devi, Joint Convener
- 466.Saraswathy Sanjeev, Cheriyanad
- 467.Rekha Bhaskar, Agrl. Officer, Pandanad
- 468.Mini Tom, Agrl. Officer, Chennithala
- 469.Mini M Pillai, Agrl. Officer, Yughakar
470. Lekha Mohan, Agrl.Officer, Chettikulangars
- 471.Penja K Nair, Agrl. Officer, Thekkekara
- 472.S Geetha, Agrl. Officer, Mannar

## LIST OF PARTICIPANTS

- 473.P Sarojini Amma, Mannar
- 474.Anni Samuel, ADA, Chenganur
- 475.Shaila Joseph, ADA, Mavelikara
- 476.B Chandrika, ICDS, Mannar
- 477.Rejani, ICDS, Mannar
- 478.T R Thankamma, K B Mannar
- 479.Jossey Thomas, Krishi Bhavan, Puliyoov
- 480.P J Thankamma, Budanoor K B
- 481.Vijayamma, Mannar
- 482.T G Radhamony, Mannar Member
- 483.Suseela Somarajan, CDS Member
- 484.N Sreedharan, Member Block Panchayat, Chenganur
- 485.S Jayalal, Chairman, Padithara Development, Mannar Grama Panchayat
- 486.Rama Raveendran, Krishi Bhavan, Thazhakkara
- 487.Sridevi Gopinath, Krishi Bhavan, Thazhakkara
- 488.Omana Mani Kuttan, Krishi Bhavan, Thazhakkara
- 489.Jagadamma Narayanan, Krishi Bhavan, Thazhakkara
- 490.T Radhamani, Krishi Bhavan, Thazhakkara
- 491.Sashi Kumari, Krishi Bhavan, Thazhakkara
- 492.Elsi Thomas, Krishi Bhavan, Thazhakkara
- 493.Kanakamma Krishna Kumar, Krishi Bhavan, Thazhakkara
- 494.Saraswathi Srirajan, Krishi Bhavan, Thazhakkara
- 495.Vimala Murali, Krishi Bhavan, Thazhakkara
- 496.Mani Divakaran, Krishi Bhavan, Thazhakkara
- 497.Mani Sadanandan, Krishi Bhavan, Thazhakkara
- 498.S Rama Devi, Krishi Bhavan, Thazhakkara
- 499.Kala Devarajan, Krishi Bhavan, Thazhakkara
- 500.Latha Bhaghavan, Krishi Bhavan, Thazhakkara
- 501.Indira Vishwanathan, Krishi Bhavan, Thazhakkara
- 502.Rama Vishwambharan, Krishi Bhavan, Thazhakkara
- 503.P Sushama, Krishi Bhavan, Thazhakkara
- 504.S Thangamani, Krishi Bhavan, Thazhakkara
- 505.Prasanna Kumari, Krishi Bhavan, Cheriyanadu
- 506.V S Sunitha, Krishi Bhavan, Cheriyanadu
- 507.Susheela A K Nair, Krishi Bhavan, Puliur
- 508.Bindhu Jayabalan, Krishi Bhavan, Puliur
- 509.Leela Gokul, Women in Agriculture, Puliur
- 510.J Rani, Women in Agriculture, Puliur
- 511.Latha Ravi, Women in Agriculture, Puliur
- 512.Vishwa Kumari, Women in Agriculture, Puliur
- 513.Rani Raghu, Women in Agriculture, Puliur
- 514.Saraswathy Sasi, Women in Agriculture, Puliur
- 515.Mini Babu, Women in Agriculture, Puliur
- 516.Sheela George, Women in Agriculture, Puliur
- 517.Saroja Keshavan, Women in Agriculture, Puliur
- 518.K Radhamany, Women in Agriculture, Chettikulangara
- 519.C Radhamani, Women in Agriculture, Chettikulangara
- 520.K Vijayalakshmi, Women in Agriculture, Chettikulangara
- 521.Sobha S Nair, Women in Agriculture, Chettikulangara
- 522.Sudha S Pillai, Women in Agriculture, Chettikulangara
- 523.Sree K Radhakrishnan, Women in Agriculture, Chettikulangara
- 524.J Sasi kala, Women in Agriculture, Chettikulangara
- 525.P G Geetha, Punnapra South
- 526.M Radha, Punnapra South
- 527.R Ramadevi, Punnapra North
- 528.S Vasantha Kumari, Agrl.Asst. Krishi Bhavan, Mannar

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- 529.Mary Thomas, Agrl.Officer,K B, Cherrianad  
530.Jincy Thomas, Agrl.Prog.Officer, Gandhi Smaraka Grama Seva Kendram  
531.S Anitha, Sector Organisor, Gandhi Smaraka Grama Seva Kendram  
532.G Rojam, Punnapra North, ICDS, Ambalapuzha  
533.Chandramathi, Chattikulangara Panchayat  
534.M C Ponnama, Cheriyanadu Panchayat  
535.K J Sebastian, Cheruthana  
536.Jacob Jose, Cheruthana Panchayat Krishi Bhavan  
537.Shantham Divakaran, Pathanamthitta  
538.K S Anantha chandran, Kandaloore Grama Panchayat  
539.Adeesh Kumar, Reporter, ACV News  
540.S Kanakamma, President, Trikunapuzha  
541.Shartaja, CDS Cairman, Trikunnapuzha  
542.Prassana Sajeev, CDS Vice President, Mannar  
543.Thankamma, Krishi Bhavan, Chettikulangara  
544.Ani Amma Chacko, Chengannoor  
545.P K Radhamani Amma, Kshemakarya Standing Committee, Chengannur  
546.G Hari Kumar, Krishi Bhavan, Mannar  
547.Pradeep, CD NET News, Kayamkulam  
548.Sasikumar, Cameraman, A.C.V. News Thiruvalla  
549.Saju Bhaskar, Mathrubhumi, Mannar  
550.M B Sawalkumara Panicker, Correspondent, Madhyamam Daily  
551.Jeena Radhakrishnan, XI Ward Member, Mannar  
552.Ponnamma Raghavan, Thazahakara Panchayat  
553.Rajamma Bhaskara, Chattikulangara  
554.P V Hari Kumar, RYF, Chengannur  
555.Sreedeviamma  
556.T J Santhamma, Mannar, CDS, Chairperson  
557.M G Prasanna Kumar, Deputy Director of Agrl. (YP) PAO's Office, Alappee  
558.Abraham Jbadryar  
559.P K Sree Kumar  
560.T Geetha, SIUF, Alappuzha  
561.P Viswanbhar Panickar, President, Changannur Panchayat  
562.B Krishna Kumar, President, Mandalam Con. (I) Committee, Mannar, Janmabumi  
563.Satish Shantinivas, Mnnar  
564.James Chakkalyil, Journalist, Malayala Manorama, Mannar  
565.Anish, Chennithala, Journalist, Mangalam Mannar  
566.Abdul Latheef, KPCC Secretary, Mannar  
567.Charli Abraham, Jilla Panchayat Member  
568.G Geetha, ICDS Supervisor  
569.S Sathan, Changannur  
570.Mariamamma Mathew, Chengannur  
571.I Priya, Agrl.Officer, Krishi Bhavan, Puhyoo  
572.Thankamany, Ambalapuzha North  
573.Usha Babu, Gandhi Smaraka Grama Seva Kendram, S L Puram  
574.K P Lernelt, President  
575.N Rajeev,  
576.G Rajamma, Women in Agriculture, Puliyoore  
577.P R Sreelatha, Kudambasree C.D.S. Mannar  
578.T N Subha, Kudambasree C.D.S. Mannar  
579.Latha Prasad, President, Niranam  
580.Raji Sreekumar, Bodhini Kala Samskarika Vedi, Chengannur  
581.Sree latha Vidhukrishnan, Bodhini Kala Samskarika Vedi, Chengannur  
582.S Bindu Kumari, Bodhini Kala Samskarika Vedi, Chengannur  
583.Padmini Thulasi, Puliyoore Thrippadini SHG, Chengannur  
584.Omana Kuttyam, Puliyoore Thrippadini SHG, Chengannur

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585.P C Vishnunath, M.L.A

### 7. Consultations with Farmers of Upper Kuttanad, Maharaja Palace, Store Junction, Mannar in Upper Kuttanad on 10-04-07

- 586.M Vargheese  
587.N Raveendran  
588.Adv. Elizabeth Mannu Mathai, Ex.MLA. Thiruvalla  
589.Sridharan  
590.Varadarajan Nair  
591.Devarajan Nair  
592.P Viswamthara Panickar, President, Chengannur  
593.V K Vasudava Cheriyan  
594.Adv. Thomas  
595.Bhaskaran  
596.Samuel M Mathunni  
597.Abraham Kosi  
598.Appu Kuttan Nair  
599.N Narayanan  
600.N P Daniel  
601.T K G Unnithan  
602.K Mathew  
603.John Kosi  
604.V N Ramachandran  
605.M R Nair, Mannar  
606.Chappachan  
607.John  
608.Vargheese  
609.Adv. Roy Philip, Chengannur  
610.Raveendranath Kaimal  
611.Kicherin Srekuna  
612.Venmony Sudhakaran, President, Venmony Grama Panchayat  
613.T K Jyothiraj, Prof. Memorial Training College, Mavelikara  
614.T V George, Convener, Thiruvella  
615.Sridharan  
616.Jayalal  
617.M K Vijayan  
618.Dr.P K Janaidhara Kuruppu  
619.Thomas M Varghese Chengannur  
620.P S Shamsuden  
621.Koshy C Check, Mannar  
622.Jayam Mathews, Perungara  
623.Kerala Karshaka Sangha, Chennithala Trippuliur Village Committee  
624.M M Thomas, Vice President, Chennithala Grama Panchayat  
625.K M Sasi Kumar, Member, Chennithala Grama Panchayat  
626.Gopalakrishnan  
627.V R Tinu, Chennithala  
628.T Prasad, Pathpad  
629.T G Ramakrishna Pillay, Member, Kerala Karshaka Sangam, Mannar  
630.Kuttappan  
631.T K Thankamani, K B Mannar  
632.Varghese Mathew  
633.K Gopi  
634.S ChandraKumar

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635. Menon
636. Gopalakrishnan Nair
637. K Madhu
638. T K Hari Kumar
639. K C Mathews
640. Kicherin Sree Kumar
641. Devadas
642. Ponnappan
643. K Gopi
644. Jose Joseph
645. Geetha Manoharan Pillai, Vettiye
646. S Vasanthakumary, Agrl. Assistant, K B Mannar
647. C Ragul Chander
648. Komala Vally, Let. In Economics, Maharaja College,
649. Sudharma Babu, Farmer, Karuvatta
650. Usha Peter, Punnapra (South) Panchayat
651. Thankamani, Ambalapuzha (North) Panchayat
652. Varghese, Mannar
653. Raghunath
654. Madan Menon
655. K K Balan
656. Jacde Cheriyan, Mannar Grama Panchayat
657. K M Shamsuddin
658. P K Nanda Kumar
659. Thangappan
660. P D Sasidharan
661. Raveendranath Kaimal
662. Mohana Chandran
663. Mathew Thomas
664. Baby Mathews
665. Kumbampuzha Babu
666. Vijaya Kumar
667. Jacob, District Panchayat Member, Chettikulam
668. S Karunakara Kuruppu
669. Karunakaran Nair
670. Joji Cheriyan
671. V Sivadasan
672. P Shampallil
673. R Gopalakrishna Pilla
674. Rajan
675. Karunakaran
676. M G Varghese
677. K Gopalakrishna Kuruppu
678. Mohanan
679. Rajappa
680. Omallur Sankara
681. George V Thomas
682. G Varghese P D Abraham, Mavelikara
683. Mathew Abraham
684. K Gopi
685. T G Gopalakrishna Pillai
686. K S Gopi
687. Sam Eappen
688. Janardhana Kurup
689. R Madhu Kumar
690. Ambika Mohan



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- 691.G Soman Nair
- 692.John Abraham
- 693.Radha Kumar
- 694.Eappen Kurian, Vice President, Pulikkeezhu
- 695.P Uthaman
- 696.Divakaran
- 697.V K Thangappan
- 698.P K Sree Kumar
- 699.B Anil Kumar
- 700.Surendra
- 701.K Venu
- 702.Jinu George
- 703.Kuriakose
- 704.Vasudevan Nair
- 705.T K Purushothaman thumpi
- 706.Peethambara
- 707.K P C Kurup
- 708.K Chandrasekharan
- 709.Karakkattu Rajasekhar
- 710.V S Gopalakrishnan
- 711.K Daniel John
- 712.C T Philips
- 713.P O Thomas
- 714.S Radhakrishnan
- 715.Chakko Kuriyathren
- 716.Ramachandra pilla
- 717.Binu K Alex
- 718.P N Selvarajan
- 719.P V Hari Kumar
- 720.P Gopalan
- 721.K Krishnan Kutty
- 722.Madhavan
- 723.K V Prabhakaran
- 724.Thomas P Abraham
- 725.Kuriakose
- 726.P S Janardhanan
- 727.Saji Alex
- 728.Charlie Abraham, Jilla Panchayat Member, Alappuzha
- 729.K N Biji Rajan, Ala. Grama Panchayat
- 730.James Makkalayil, Malayala Manorama, Mannar
- 731.K K Chandran, Principal Agrl. Officer, Pathanamthitta
- 732.M G Prasanna Kumar, Deputy Director of Agrl. PAO's Office, Alpy
- 733.K V Koshy, Mavelidara
- 734.P S Soman, Dy. Director of Agriculture, Kollam
- 735.K G Mahadevan, Mathrubhumi, Kayamkulam
- 736.Anish Chennithala, Mangalam, Mannar
- 737.A R Prasanth, Mannar
- 738.Unni Krishnan Kunnath, Asst. Dist. Information Officer Collect-rate, Alappuzha
- 739.San Mathew, Agrl. Office
- 740.Jose P Vayakal, Agrl. Department
- 741.K S Rajan, B J P Dist. President, Alappuzha
- 742.P C Thankachan
- 743.K Mathew, Thiruvalla
- 744.Raveendranathan
- 745.A Gopunathan Nair, Budhanoor Grama Panchayat
- 746.K Bhaskaran, Chennithala

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- 747.C Sreedharan  
748.V K Joseph  
749.N Sreedhara Kurup, President, Chettikulangara Development Society  
750.T D Mohanan, President  
751.V Raman Pillai, Mannar Grama Panchayat  
752.B Krishna Kumar, Janmabhumi Correspondent  
753.Dominic Joseph Deepika, Correspondent  
754.Sajeev Kumar, Nedumbrom Grama Panchayat  
755.Chandrasenon nair, Secretary, Pathiyoor  
756.Mary Thomas, Agrl.Office, K B Cherrianad  
757.Annie Samuel, ADA, Chengannur  
758.P Jaya Kumar, Member, Chettikulangara Grama Panchayat  
759.P C Vishnunath MLA  
760.Mathew Thomas  
761.C Sujatha  
762.G Hari Kumar, Agrl.Asst. K B Mannar  
763.Sasidharan  
764.V Anil Kumar, Agrl.Officer, Venmony  
765.Madhava Kurup, Vettiye  
766.Susamma P George, Asst. Professor, Kerala Agrl. Univesity, ORARS Kayamkulam  
767.Dr. M R Bindu, Asst. Professor, Kerala Agrl. Univesity, ORARS, Kayamkulam  
768.L M Kuliakose, Mannar  
769.Kurian Zacharia, Neeranom K S Anandachandran, Farmer, Vice President, Kandallloor Grama Panchayat, Kayamkulam

### **8. Consultations with Tourism operators, Houseboat terminal, Punnamada on 11-04-07**

- 770.Unni P T  
771.P Mahadevan  
772.Surendran Nair  
773.Moni Kuncherri  
774.Devagi Iype, Pulickathil  
775.Raju Joseph, Kerala Tour Company  
776.Babu Raj, Splash Tour  
777.Suresh S  
778.Varghese Antony, House Boat Samithi  
779.Biju kallincal, Savy Tours, Cochin  
780.R Sasidhar  
781.Babichas, Ramankary  
782.C J Joseph, Nedumudy  
783.Biju Kurian, Convenor, Muttar  
784.P A Thomas, Secretary, Muttar  
785.Jokkullin Joseph S  
786.Chacko P M, White Water  
787.Alex George, President, All Kerala House Boat Owners Association  
788.Tomy Joseph, Secretary, All Kerala House Boat Owners Association  
789.Soma Sundaram  
790.K K Pankajakshan  
791.Alex Mathew, President, Rajiv Gandhi Trophy Boat Race Club  
792.T G Raghu, Secretary, ATDC  
793.Dr. Kavalam Joseph Jacob, Chirayil, Kavalam  
794.Adv. P A Aslam, President, Kerala House Boat Resort Working Union (CITU)  
795.Antony P Paul, Chirayil, Kavalam

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- 796.Suresh Babu G, Alleppey  
797.G Sudha dev, Marvel Cruise, Alappuzha  
798.C C Joseph, Kottayam  
799.R Kiran, Kattamouch  
800.Anson Antony Elamataayrc, Blue Lagoon Tour & Travels, Mullackal  
801.Joseph Chittady, Venu Geetham House Boat, Alappuzha  
802.Joyce Manuel, Jainivas, Thakazhy  
803.Joy Jawardhanam, Asst.Engr, Canal Secretary, Alappuzha  
804.K P PadmaKumar, Komalas Hotel  
805.Santhosh M, Mayoore Cruise  
806.Abraham Kulup  
807.Santhosh Kumar R, Alappey  
808.Raji George, Happy Tours, Alleppey-13  
809.Amith House Boat  
**810.Tomy Philips, Alleppey**  
**811.Joseph Antony, Lake Lands Cruise, Pllathuruthy, Alleppey**

### **9. Consultations with coconut farmers and coir workers, Govt. L.P.School Trikkunnappuzha, Alappuzha on 12-04-07**

- 812.Dr. K S Sasikala,  
813.T K Deva Kumar, Ex.MLA, President of Coir Workers Union, Ciru  
814.Lalitha Bai, Secretary, Thirukkumanpuzha Group  
815.A M Kanakan, Retd. Grama Panchayat Secretary  
816.Sindhul Ajel, Officer, K B, Thirikkunapuzha  
817.P Komala Vally, Prof. of Economics, Ernakulam  
818.V Rama chandran, CPI (M), Trikkunnappuzha  
819.Nakulan Mandil, Trikkunapuzha  
820.C Sree Kumar Unithan, Secretary, Kerala Farmers Union  
821.P Prakasan, Kizhakkekara South, Coir Union  
822.Thampi, Kizhakkekara South  
823.B Sindhu, Kizhakkekara South  
824.N C Anil Kumar, Farmers Union, Trikkunnappuzha  
825.Suni Chellappan, Ward Member (12), Trikkunnappuzha  
826.P M Vicky, Secretary, CPI  
827.D Sasidharan 3 Ward Member, Trikkunnappuzha  
828.Nazar, Kizhakkekara South, Trikkunnappuzha  
829.P Thambichayan, President, Congress (I), Harippad  
830.B Prakasham, Grama Panchayat President  
831.T V John, Village Officer, Trikkunnappuzha  
832.C Ratna Kumar, Secretary, Matsya Thozhilali Union AC  
833.Sudharna Babu, Social worker and Farmer  
834.S Kanakamma, President Grama Panchayat, Trikkunnappuzha  
835.K Ashokan, Sribhavanam, Trikkunnappuzha  
836.K Madan, Arangil  
837.G Narayanan Pillai, Lakshmi Bhavan  
838.K Sudhakaran Nair, Srikalam  
839.K V Rajan, Vivekananda Youth self help group, Trikkunnappuzha  
840.P Subramanian, Health Inspector, Trikkunnappuzha  
841.N Satyan, Business Manager, CVCS Ltd.  
842.S Gulam, Secretary, Mahatma SHG  
843.E J Sam, Deputy Labour Officer, Alappuzha  
844.G Radhakrishna Nair, Asst.Labour Officer  
845.Bichu Balan, Asst.Labour Officer, Harippad  
846.D Saniganon, Staff Asst. Labour Office, Harippad  
847.Thangappan Nallamangalaveedu

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- 848.Ramadasappan AKDS, Trikkunnappuzha
- 849.K Ravi, Farmer
- 850.Radhamani, WIAS
- 851.M Sajini, WIAS, Thrukkunnappuzha Krishi Bhavan
- 852.Latha, WIAS, Thrukkunnappuzha Krishi Bhavan
- 853.Thankamoney, WIAS, Thrukkunnappuzha Krishi Bhavan
- 854.Sandhya, WIAS, Thrukkunnappuzha Krishi Bhavan
- 855.Lalitha, WIAS, Thrukkunnappuzha Krishi Bhavan
- 856.Ramani, WIAS, Thrukkunnappuzha Krishi Bhavan
- 857.S Suvarna, WIAS, Thrukkunnappuzha Krishi Bhavan
- 858.C Chandra prabha, WIAS, Thrukkunnappuzha Krishi Bhavan
- 859.N Mani Amma, WIAS, Thrukkunnappuzha Krishi Bhavan
- 860.S Valsala, WIAS, Thrukkunnappuzha Krishi Bhavan
- 861.S Seema, WIAS, Thrukkunnappuzha Krishi Bhavan
- 862.D Sobhana, WIAS, Thrukkunnappuzha Krishi Bhavan
- 863.Saroja, WIAS, Thrukkunnappuzha Krishi Bhavan
- 864.Sathi, WIAS, Thrukkunnappuzha Krishi Bhavan
- 865.K Suma, WIAS, Thrukkunnappuzha Krishi Bhavan
- 866.Kavitha, WIAS, Thrukkunnappuzha Krishi Bhavan
- 867.Chandran, WIAS, Thrukkunnappuzha Krishi Bhavan
- 868.K Rama Krishnan, WIAS, Thrukkunnappuzha Krishi Bhavan
- 869.G Remesan Nair, WIAS, Thrukkunnappuzha Krishi Bhavan
- 870.K Gopalan, WIAS, Thrukkunnappuzha Krishi Bhavan
- 871.Gopi Somarajan
- 872.Raghavan
- 873.Beena
- 874.K A Latheef, WIAS, Thrukkunnappuzha Krishi Bhavan
- 875.N Mohanan Ward Member, Trikkunnappuzha
- 876.T K Balan
- 877.Dr. N Ratna Kumar,
- 878.A Shajahan, Member, Thrikkunnappuzha
- 879.P R Sasidharan, INTUC, Harippad
- 880.K Sreekumar, Vice President, Chengoli Grama Panchayat
- 881.Munjinathan Ramachandran, Karshaka Congress (I) Dist.President
- 882.K A Hameed
- 883.T Pancharam, Chairman, Tsunami Action Council
- 884.T Bhakthavatsalam
- 885.V Rajendran
- 886.K K Gopi, Managing Director, S.C.D.C. P
- 887.Abdul Jabbar, Kizhi south
- 888.D Sivanandan, Ummapampil
- 889.J Achankunju
- 890.Mini, Perumpally
- 891.Omana, Perumpally
- 892.Sareswathy, Perumpally
- 893.Sathy, Perumpally
- 894.U AsokaKumar, Gen. Secretary, INTUC, Harippad
- 895.S Kishore, Pandyalatharayil
- 896.Kochu Kunju
- 897.J Sree Kumari, Asst. Manager, Matsyafed
- 898.P Pradeep, B M S Secretary, Karthikapally
- 899.Shirly Jose, Agricultural Officer, Krishi Bhavan, Harippad
- 900.Biji Joy, Agricultural Officer, Karthikapally
- 901.Ramlath, 6 Ward Member
- 902.Sudha, Perumpally
- 903.Thilakam, Perumpally

## LIST OF PARTICIPANTS

- 904.Omana, Perumpally
- 905.Sathi, Perumpally
- 906.Saraswathy
- 907.Mini, Perumpally
- 908.V Mukundan
- 909.V Damien R S P
- 910.Adv. N Shivan Kunju, Arattupuzha Grama Panchayat
- 911.R Chandran, Chairman, Arattupuzha Grama Panchayat
- 912.V Bhasurangan, Secretary, Fishermen Union, Kumrapuram
- 913.Keshavan Nedujapparas, Trikunnappuzha
- 914.S Shylaja, CDS Chair person
- 915.K Viswambharan, C.V.C.S.Ltd.
- 916.G Vikramon, C.V.C.S. Ltd.
- 917.Das L Panantharayil
- 918.C V Rajeev, Member ward 16
- 919.G Balan
- 920.K Suhura Beevi, Govt. L.P.S. Thrikkannappuzh
- 921.Retnamma C, Govt. L.P.S
- 922.Kalesh K
- 923.A Kassim Palappillil
- 924.Mala T Chirayil
- 925.Sheeba Palathiparamil
- 926.S Laila Beevi
- 927.G Karthikeyan, Member, Trikunnappuzha
- 928.P Babu, Pulayan
- 929.Shamsudheen Ali Ahamed C.I.

### **10. Consultations Technical meeting with Government Officials and the Academia, Collectorate Office, Alappuzha on 17-04-07**

- 930.Sudha Soni, Gandhi Smaraka Grama Seva Kendra, Alleppey
- 931.George Thomas, President
- 932.D Ranjit, AGM, NABARD, (DD) Alappuzha
- 933.N Sreedhara Kurup, President, Mavelikkara
- 934.Dr. Abraham Varghese
- 935.Dr. Leena Kumary S Assoc. Prof. RRS, Moncompu
- 936.N V Nair, Dy.General Manger, NTPC, Kayamkulam
- 937.Dr. A V Mathew, Assoc. Director, RARS, Kumarakom
- 938.K Bheekaran, Project Engineer, K.W.D.C. Alappey
- 939.A Abdul Galeel, Land Dist. Manager
- 940.A Farook Sait, E.E. KSPCB,
- 941.K Sajeevan, Senior Environmental Engineer, Kerala State Pollution Control Board,Thiruvananthapuram
- 942.M Y Gousjan, Chief Manager, State Bank of Travancore
- 943.K Renganathan, Chief Manager, State Bank of Travancore
- 944.Sabira Beevi P M, Agriculture Officer, State Bank of Travancore
- 945.G Jayachandran, Asst.Exc.Engineer(Agri.), Alappuzha
- 946.K Surendran, Asst.Exc.Engineer(Agri.), Alappuzha
- 947.A Nila, Asst.Exc. Engineer, M 1 Sub. Division; Chartala
- 948.A Cynil, Asst.Exc. Engineer, M 1 Sub. Division; Moncompu
- 949.Sunil George AEE (I), Kuttanad
- 950.Joy Janardhanan AE, Canal Section, Alappuzha
- 951.P S Ganesh, Asst.Executive Engineer, Alleppey
- 952.G Geetha, Asst.Engineer, Irrigation, Elathua
- 953.Dr. Joseph Scaria, Dy. Director (A.H), Kottayam

## LIST OF PARTICIPANTS

954. Dr. R T Pillai, DAHO, Kottayam  
955. K Mohanan, Asst. Engr. M.I. Section, Ambalapuzha  
956. B RadhaKrishnan, Asst. Exc. Engr. M.I. Section, Harippad  
957. Jose Zacharah, Asst. Director, Kottayam  
958. R Hari Kumar, Asst. Labour Officer, Charthala (North)  
959. Dr. P Anil Kumar, Deputy Director (AH), Alappuzha  
960. Dr. K B Devadas Thaupri, Dist. Animal Husbandry Officer, Alappuzha  
961. Usha S, 'Thanal', H-3, Jawahar Nagar, Trivandrum – 3  
962. Joseph Francis, Chief Manage, Travancore Cements Ltd  
963. Krishna Kumar, EE, KWA, PH Division, Alappuzha  
964. Sree Kumar, C.A.E.E. Mech. Division, Alapppy  
965. K Babu, Deputy Director of Agriculture, Alappuzha  
966. V Pradesh, PDA, Alappuzha  
967. Sunny Kutty, Dy. Director of Agriculture, Kottayam  
968. Sasidharan, Extension Officer, Fisheries  
969. Ramani Cheeriyam, D D Fisheries, Alappuzha  
970. S Jalaja, Extension Officer, Fisheries  
971. Asha Chandran, Technical Asst. O/o PAO, Alapppy

### **11. Consultations with Ecology Security of Kuttanad, Collectorate Office, Alappuzha on 18-04-07**

972. Sudha Soni, Alleppey  
973. P S Sasidharan, Changanacherry  
974. Fr. Thomas, Exc. Director, Kuttanad Vikasana Samithy  
975. Dr. K John Mathai, KSSP, Melpadom  
976. K C Mathews Koodarathil, Melpadom  
977. Deepak D, Atree (Field Office), Alappuzha  
978. Joy T D, Atree (Field Office), Alappuzha  
979. S Dipu, Kumarakom Nature Club, Kumarakom  
980. A Favook Saib, EE. KSPCB, Alappuzha  
981. Fr. Philip, Society of SNEHA, Alleppey  
982. Suresh Babu, Project Officer, Tola  
983. K Babu, Deputy Diorector of Agriculture, Alappuzha  
984. P N Devadas, Kuttanad Foundation  
985. P D Sasi Kumar, Kuttanad Foundation  
986. Kaladharan P V, Kuttanad Foundation  
987. Jojikoottummel, Kerala Sasthra Sahithya Parishathum, Kottayam  
988. Asokan  
989. K M Poovu  
990. P G Abraham, General Manager, The Travancore Cements, Kottayam  
991. Bobby Bose, Civil Organiser  
992. R Gopakumar, Scientist E1, Surface Water Division, CWRDM, Kozhikode – 673 571, Kerala  
993. Dr. P Natarajan, Professor, Rajiv Gandhi Chair School of Environmental Studies, Cochin University of Science & Technology, Cochin.  
994. Florence M A, Lecturer, St. Michael's College, Charthala  
995. George Varghese, Dy. Conservator, Social Forestry, Alappuzha  
996. N K Sukumaran Nair, General Secretary, Pampa Parivarthana Samithy, Thiruvalla  
997. Dr. Unni Krishnan, Secretary, Kottayam Nature Society, Kottayam  
998. Dr. K M Nair, Farmer Director, CESS  
999. Dr. K S Manoj, Member of Parliament

### **12. Consultations with Panchayat members, Collectorate, Alappuzha, on 18-04-07**

## LIST OF PARTICIPANTS

1000. Viswambhara Paniker, President, Chengannur
1001. NK Sukumaran Nair, Gen. Secretary, Pathanamthitta
1002. K K KrishnanKutty, President, Muttar Grama Panchayath
1003. Joseph K Nelluvely, Vice President, Block Panchayath, Veliyamadu
1004. M K Animohan, President,
1005. K K Sukumaran, Mulakuzha Grama Panchayat
1006. K R Sree Kumar, Vice-President, Ramankary Grama Panchayat, Kalathil
1007. K K Chellappan, President, Thanneermukkom Grama Panchayat
1008. K Vijaya Kumar, President, Muthukulam Block Panchayat
1009. K Unni Krishnan, Punnappa
1010. George Mathew, President, Champakkulam Grama Panchayat
1011. S Radhakrishnan Nair, Member, Grama Panchayat, Ambalappuzha South
1012. G Venulal Cherian, Development Ambalappuzha South Grama Panchayat
1013. Amitha John, President, Ala. Grama Panchayat
1014. Lakha Santhosh, President, Puliyur Grama Panchayat
1015. K Ashokan President, Purakkad Grama Panchayat
1016. M Azhathakumar, Nedumudi Panchayat
1017. K Mohanan Punnappa Grama Panchayat
1018. P S Valsala, President, Kainakari Grama Panchayat
1019. K P Zeenath, President, Mannar Grama Panchayat
1020. Adv. Prathibha Jain, President, Grama Panchayat, Thekazhy
1021. Dr. N P Kurup, Eduthura GramaPanchayat President
1022. Meena Suresh, Nelamperur Grama Panchayat
1023. K R Pushpamma, Kovalam Grama Panchayat
1024. M Raghu, Punnappa Grama Panchayat

### 13. Consultations with Media, Collectorate, Alappuzha on 19-04-07

1025. Thomas Gregory, Editor, Kerala Sree Daily
1026. T P Reghuvaran, Thaminiam Daily
1027. R C Rajeev, Amrita T.V.
1028. A Showkath, Southern Star & Siraj Daily
1029. R Ajaya Kumar, Janmabhumi Daily
1030. E S Subhash, Deshabhimani
1031. Kavalam Gopal Kumar, Mathrubhumi Reporter, Kuttanadu
1032. Dennis Marcus Mathew, Senior Reporter, The Hindu
1033. Umesh Kannankara, Reporter, Kerala Kaumudi
1034. Rasheed S, Thejas Daily
1035. G Anil Kumar, Deshabhimani Newspaper
1036. C Prasad Ramankari, Mangalam News paper
1037. C Krishna Kumar, K C V Media channel
1038. Krishna Das V, Mangalam

### 14. Consultations with selected Government Officials, farmers, senior scientists, Hotel Royale Park, Alappuzha on 10-05-07

1039. B Rajapandian, Kuttanad
1040. M K Purushothama Das, Mangalapalle
1041. S Sree Kumar, General Manager, Alappuzha Dist. Co-op Bank
1042. Dr. Abraham Verghese, Assoc. Prof., R R S Moncompu

## LIST OF PARTICIPANTS

1043. P J Abraham, Kainady
1044. Titto Abraham Puthon Parayil, Kainady
1045. Antony Arayil Anthonikayal
1046. P K Mathew, Joint Director of Agrl. Pathil, Pulinannu
1047. P Manoj Kumar, Ramankary
1048. Dr. K G Padmakumar, Kumarakom
1049. Joyoltoop Mandiralttil, Kumarakom
1050. Jincy Thomas, Agriculture Programme Officer
1051. Dr. Leena Kumary S, Associate Professor, Rice Research Station, Moncompu
1052. R Dinesh Kumar, Alappuzha
1053. George Thomas, Alappuzha
1054. Stephen Thomas
1055. P C Varghese, Agrl.Consultant, Gandhi Smaraka Kendram, S LPuram
1056. T C Sivan, Changanakary
1057. Jose Joseph, Thokazhy
1058. P C Alexander, Edathua
1059. Joseph Kora
1060. K Santhosh
1061. Jose Joseph, Deputy & Principal Agricultural Officer, Alappuzha
1062. T N Elhana
1063. S Umash
1064. Dr. SushmaKumar, Associate Professor, ORARS
1065. Dr. T N Willams, Associate Professor, ORARS, Kayamkulam

### **15. Consultations with Expert Committee Meeting, Coconut Development Board, Ernakulam on 23-05-07**

- Mr. R Hali, Former Director of Agriculture, Kerala
- Dr. Babu Ambat, Director, Centre for Environment and Development, Thiruvananthapuram
- Mr. Joseph Alex, Retd.CE, Kerala
- Mr. S Sreekumar, General Manager, Alappuzha Dist. Cooperative Bank
- Dr. K G Padmakumar, Associate Professor, Regional Agricultural Research Station, Kerala Agricultural University, Kumarakom
- Dr. E J James, Executive Director, Centre for Water Resources Development and Management, Kozhikode
- Dr. P Rethinam, Former Chairman of the Coconut Development Board
- Smt. Mini Mathew, IAS, Chairperson, Coconut Development Board, Cochin, Kerala
- Dr. Bala Ravi S, Advisor, M S Swamination Research Foundation
- Dr. Sudha Nair, Programme Director, M S Swamination Research Foundation
- Ms. Deepa Varma, Project Associate, M S Swamination Research Foundation

### **16. \*\*\* Participants list of the consultation with farmers in North Kuttanad held at Aattamangalam Church Hall, Kumarakom, Kottayam on 11-04-07 is not available.**



## LIST OF MEMORANDA RECEIVED

### Annexure 7

1. V.V. Vazhatra, Kuttanad Aadyakala Paurasamiti president
2. N Mohan ward Member, Trikkunnapuzha gram panchayat, 0479-2482039
3. KC Joseph, Kaithaparambil, Ramankari, Alappuzha
4. Pathiyur Karippuzha Ullittapuncha – pathiyurpanchayat Nel Ulpathaka samithi,
5. Keerikkadu, Alappuzha
6. Joseph Kunju, Rice-fish integrated farming in kayals of Kuttanad, H-Block kayal, Neelamperoor Panchayat, Kuttanad Taluk, Alappuzha
7. Jose Chemperi, President, Kerala Karshaka Union State Committee, Kottayam
8. VK Vasudeva, President, Cheriyanad Grama Panchayat, 0479-2360149
9. N. Sreekumaran Thampi, Secretary, Karinila Vikasana Action Council, Purakkad,
10. Thomas Abraham, TP Namboothiri, Farmers
11. KRamakrishnan, All-India Kisan sabha – Harippad mandalam committee Ph2296086
12. Karthikapally grama panchayat
13. K Radhakrishnan, Coconut Farmer, Trikunnappuzha
14. Sreekumar Unnithan, Secretary, Kerala Karshaka Sangham, Harippad
15. TS Thaha, President Block Panchayat, Harippad 0479-2413890
16. Thomas Zacharia, Farmer and Village Tourism Activist
17. PK chandrasekaran, Farmer
18. BR Sunil Kumar, Secretary, Aarupanku Padasekara Nel Ulpadaka Samiti, Kainakari
19. M Rajkumar, Secretary, Parappil Padasekara Nel Ulpadaka Samiti, Punnapra, Alappuzha, 0477-2286449
20. Sosamma Iype, Vechur Conservation trust
21. Thekke mathi kayal Paasekara Nel Ulpadaka samiti
22. Vellyanadu Mathachan, President, Kissan Janata Alappuzha; 0477-2239529
23. Farmers of Champakkulam Panchayat
24. Zacharia Joseph, President, Kuttanadu citizen forum
25. Memorandum for sustained paddy cultivation in Chittira, Rani kayals
26. All India Kisan Sabha, Kottayam
27. Janadhipatya Karshaka samiti, Alappuzha
28. K Kamala Devi
29. Macheri Vakka Padasekara Nel Ulpadaka Samete
30. E-Block Kayal Nel Ulpadaka Samate
31. Onattukara Vikasna Agency, Kayamkulam
32. The Kerala Karshaka Sangam, Alappuzha Dist.Committee, Alappuzha, Kerala
33. DCC General Secretary, Alex Matheww
34. Kerala Congress (I), State General Secretary, A C Mathew Edayadi
35. Neeranom Grama Panchayat, Thiruvalla
36. Nationalist Farmers Congress, Alleppey Jilla Committee
37. Alleppy Corporation – Krishi Bhavan United Nel Ulpadaka Sameti
38. D-Block North 6000 Padasakaram Nel Ulpadaka Samithi, Pulinkumru
39. Secretary D Block Vdakke Arayirm Kayal Samathi Pulincunnu
40. Develop allied industries and employment
41. George Punnakunnam, Polayil Thekedom Amara P.O., Changanacherry
42. Mercy Fellowship & Charitable Trust, Alappuzha
43. Nel – Kera Karshalka Samyukta Samathi, Talavady, Allappey
44. Federation of Edathu Nel Ulpadaka Samathi
45. Karalacom Padasekara Nel Ulpadaka Samathi, Avalookanna, Allappey
46. Mannar Grama Panchayat
47. Indian National Congress (I), Block Committee, Vaikom
48. Narionalist Farmers Congress, Alleppey jilla Committee
49. All India Kissan Sabha – Aroor, Chertala
50. K C Joseph, MLA District Congress Committee, Kottayam
51. The Cardamom Growers' Association Vandanmedu P.O., Idukki District, Kerala

## LIST OF MEMORANDA RECEIVED

52. Thomas Chazhikadan MLA Deputy Leader Parliamentary Party, Kerala Congress(I)
53. All India Kisan Sabha, District Committee, Kottayam, Kerala
54. The President, Vazhappally Grama Panchayat, Changanacherry, Kottayam
55. Thanal, Kowdiar, Thiruvananthapuram – Preventing Farmer Indebtness and Suicides through Reviving and Supporting Paddy Cultivation in Alleppey.
56. Jose John Venganthra, President, Mary Matha Plantation Society, Mampuzhakkary P.O. Alappuzha District, Kerala.
57. “Upper Kuttanadu Padasekharam” Presidents and Secretaries
58. Joseph Kunju, Mangalappally, Pulincunnoo
59. Munjinattu Ramachandran, Kerala Pradesh Karshaka Congress (I), Alappuzha
60. Sam Eapen, President, Upper Kuttanadu Karshaka Samithy, Vengal, Thiruvalla, Kerala
61. Babu Joseph Karshaka Congress (I) Kottayam District Committee, Kottayam
62. Babu Joseph, Kerala Pradesh Karshaka Congress (I), District Committee, Kottayam
63. Ayyanadu Padasekara Nel Ulpadaka Samithi Chathurthakari
64. Kari Nila Karshaka Samrakshana Samithi, Purakkadu
65. Ponvelipakkal Padasekharam
66. Devinder Sharma, Farmers Need as Income Commission
67. Mangalam Manikya mangalam, Kayal Nel Ulpadaka Samithi
68. Vettikkara Padasekara Nel Ulpadaka Samithi, Punnapra
69. Ponnakari Kumbala thakkal kari Padasekaram, Punnapra, Alappuzha
70. Farmers Congress, Kerala State Committee
71. Joy Kuriyakose
72. Sahaiji, Kuttanad.
73. A D Kamalahasan, President, Punthuram, Padasekharam
74. Keri Krishi Conservation – Kera Vyavasaya Self help group
75. Irumbanam Padasekara Nel Ulpadaka Samithi, Kainakari
76. All India Kisan Sabha, Ramankari
77. Kerala Congress Secular State Organizing Secretary – Baby Parakkadan
78. Mary Matha Plantations Trust, Ramankary P.O. Alappuzha Dist., Kerala
79. Kuttanad Vikasana Samithy, Ramankary P.O. Alappuzha Dist. Kerala
80. Karingalichal Puncta, By Elias nagar Agricultural Farmers and Fishermen
81. Ambalapuzha South Grama Panchayat Office, Ambalapuzha, P.O. Alappuzha
82. Chettikulangara Development Society, Chettikulangara, Mavelikara
83. Kerala state karshaka thozhilali Union, UTUC, Alappuzha Jilla Committee
84. Thiruvithankur Karshaka Thozhilali Union, Mankompu
85. P.S. Sasidharan, Puthanchirayil Veedu, Kidangara
86. Kuttanad duckery workers from Joseph Savier.
87. Kuttanad Thaaravu karshakar
88. BR Kaimal karumadi, President, National Farm workers federation, Jilla Committee Alappuzha
89. KD Mohan, Kerala state Farm Labourer Federation, BMKU-AITUC Jilla Committee, Alappuzha
90. CG Kamalahasan, Kuttanad Taluk Farm Workers Union, BMKU-AITUC, mancompu
91. TN. Muralidharan, National Farm Labourer Federation, Kuttanad Block
92. S. Kamalamma, Welfare Standing Committee Chairperson, Veliyanadu Grama Panchayat, 0477-2753251
93. N Sadashivan Nair, Kerala state Farm Labourer Federation, DKTF, Jilla Committee Alappuzha
94. Alappuzha Jilla Karshaka thozhilali sangham (BMS) Mancompu
95. Gandhi smaraka gramaseva kendram
96. Trikunnappuzha lock workers
97. Coir workers Union, CITU, Trikunnappuzha
98. Kairali Agriculture Development Trust, Thanneermukkom, P.O. Alappuzha
99. Primary Dairy Co-operatives, Veliyanadu Block, Kuttanadu
100. D Lakshmanan, Secretary, Kerala State Karchaka Thozhilali Union, Alappuzha
101. G Gangadharan, Duck Rearing Fasrmers Union, Kutrtanad
102. Akhila Kerala Dheevera Sabha, Thanneermukkom
103. Matsya Thozhilali cooperative society, Thanneermukkom

## LIST OF MEMORANDA RECEIVED

104. Retnakumar, Gen. Secretary, Harippad Mekhala Malsya Thozhilali Union CITU
105. Alappuzha Roopatha Charitable Trust and Social Welfare Society
106. Fishermen welfare Association, Chembu village, Vaikom
107. Vaikom Taluk Matsya Tozhilali Federation CITU Area committee
108. ER Asokan, Secretary, Akhila Kerala Dheevara Sabha, Kuttanad Taluk samiti, Pulinkunnu, Alleppey
109. Akhila Kerala Dheevara Sabha, Punnappara Alappuzha
110. Kerala Pradesh Matsya thozhilali congress I State Committee Trivandrum
111. Kadalora Kayalora Matsya Thozhilali Union, AITUC, Mullackal
112. Kerala Mathya Thozhilali Federation, CITU Karunagarapalli, Kollam
113. Mathya Thozhilali Union, CITU, Kottayam
114. All Kerala Dheevara Sabha, Chertala Taluk Committee
115. Fisheries Cooperatives and Livelihood Security of Fisher folk of Kerala: Challenges and Prospects
116. Kerala State Mathya Thozhilali Federation (CITU) Alleppey Jilla Committee.
117. MA Florence, Lecturer, St. Michael's college, Chertala, Alappuzha
118. Block panchayat, Champakkulam
119. Jacob cherian, member, Peringara Grama panchayat, Thiruvalla, 09447694209
120. Common Interests Memorandum by Farm development and environmental Conservation Committee – "Progressive Pourasamiti", Karakkal, Thiruvalla,
121. Ramsay JT, Vikasana karya standing committee member, champakkulam block panchayat Mannar grama panchayat office, Mannar, Alappuzha, 047923122387.
122. Dr. Baby kamalam, Ward member, Thanner mukkom grama panchayat, 9847797979
123. Radhakrishnan Nair, South Grama Panchayat Office, 9446022948
124. Veliyanad Block Panchayat, Mampuzhakary, Ramankari 0477 2705542
125. Proposals for Purakkad Kari Area
126. Purakkadu Gandhi-Smriti Vanam Project, Tharangam, Kala-Kayika Samskarika Sanghatana
127. K. Maheswari amma, Former vice president, Jilla Panchayat, Alappuzha
128. Sankaranarayanan Onni samrakshana samiti, Thanner mukkom
129. S Vasavan Convener, Thanner mukkom Vikasana Samiti, Thanner mukkom 582184
130. R Gopi, President Chingoli grama panchayat, Chingoli-690532 Ph:2486156
131. S Sudheesh, Ward member Trikkunnapuzha gram panchayat
132. TJ Anchalos, AITUC District Council, Alappuzha
133. Dr. TP Zacharia, Media Epidemic Control cell, Moncompu, Thekkekara
134. Karshaka Congress (I) Kottayam District Committee, Indira Bhavan, Kottayam
135. Kayal Passengers Association, Kuttanad
136. Spark, Puthamangadi, Mukamma P.O. Allappuzha
137. Jelji Verghese, Chairman, Vikasana Standing Committee, Thalayazhom Grama Panchayat, Thalayazhom, Vaikom
138. L Karthikeyan, Panchayat President Vechoor, Vaikom
139. INTUC (I) Mandalam Committee, Thanneermukkom
140. R Nazar, President District Panchayat, Alappuzha
141. M J Sivasdas, President, Vembanad Kayal Samrakshana Samithi, Kacherikadavu, Kottayam
142. Malayala Manorama
143. Kuttanad Floods and Rainfall: Suggestions for Management
144. Kuttanad Democratic Samithi, Ramankari
145. P Retnamma, Vice President, Nedumudy Grama Panchayat, Chempakulam P O
146. Integrated Development of Kuttanad, Kuttanad Development Agency, Jilla Collector, Alappuzha
147. N K Sukumaran Nair, Pampa Parirakshana Samithi, Maramon P.O, Tiruvalla, Kerala
148. N K Sukumaran Nair, Pampa Parirakshana Samithi, Maramon P O, Tiruvalla, Kerala
149. The President, Vazhappally Grama Panchayat, Changanacherry, Kottayam
150. Pollution & Environmental Conservation
151. PVN Namboodiri
152. K D Mohan, Kuttanad Vikasana Agency
153. NABARD

## LIST OF MEMORANDA RECEIVED

154. Development of Kuttanadu, Minor Irrigation Division, Chengannur
155. SBT, Poojappura, Thiruvananthapuram – 695 012
156. Mullakkara Retnakaran, Minister for Agri., Govt. of Kerala, Thiruvananthapuram
157. A.C. JOSE, Chairman Coir Board, Kochi, Kerala
158. Kuttanad Ecology: Ravi Varma Thampuran
159. Bobby Bose, Ezhapasa, Kanjippadam P.O. Alappuzha – 5
160. Kuttanadu Foundation, Punnakunnam, Pulincunnu P.O. Alappuzha – 688 504
161. Kottayam Nature Society, From Dr. B. Sreekumar, President,
162. K K Chellappan, President, Chenneermukkom Grama Panchayat
163. K K Krishnan Kutty President, Muttar Grama Panchayath, Alappuzha Dist.
164. Chettikumangara Development Society, Chettikulangara, Mavelikara
165. Ambalapuzha South Grama Panchayat Office, Ambalapuzha P.O. Alappuzha
166. Kuttanad – A Man made Disaster?? By Dr. P. T. Zacharia, M.B.B.S., M.D., DTM&H Farmer  
Director KSIV & ID, Alappuzha.
167. R. Nazar, President – District Panchayat, Alappuzha
168. Rice Research Station, Moncompu
169. Gandhi Smaraka Grama Seva Kendram
170. Aloysian study centre on Kuttanad
171. Chief Engineer (Mechanical), Irrigation Department, Kuttanad
172. Kuttanad Vikasana Project: on the basis of Padasekharams
173. Kerala Land Development Corporation, Detailed Project report on Integrated Development Project for  
Kuttanad Area
174. Chathurthyakari Service Sahakarana Bank
175. Travancore Cements Limited
176. Kovalom Grama Panchayat
177. Librated Fishermen Federation of Puthuyakaru
178. Anganwadi Workers
179. Ramankary Panchayat
180. Nilomperur Grama Panchayat
181. Vayalur Paddy
182. Pathujur Paddy
183. Secretary, Farm Club Vayalur, Chertallay.
184. The Moolam Jalolsava Samithi, Champakulam Moolam Boat Race
185. Upper Kuttanad – Matham Mangad Chirayil Nel Ulpadaka Samithi, Mavelikkara
186. Sreelatha PR, Kudumbasgree, CDS Member, Mannar Grama Panchayat
187. Mathrubhumi Karma Padhoti,
188. Women Fisher Folk, Viyapuram, Karichal Inland fisher Development
189. Karuvatha Panchayat, Member Sudharma Babu
190. Thousand Padavu Padasekara Nel Ulpadaka Samithi, Naduvattom, Pallipadu
191. One Lakh Yuva Karshaka Samithi Muhamma, Alleppey
192. Swaraj Paper Mr. Shoukad
193. Tagore Smaraka Nel Ulpadaka Samithi Tattarambalam, Mavelikkara
194. Peruvlichal Pancha Padasekara Samithi
195. Varanikkal Nel Ulpadaka Samithi
196. V Baskarn Nair, Secretary, Vadakke Mankuzhi Kere Karshaka Samithi.
197. R Unnikrishnan, Keral Farmers Sanghom, Tekekara Easr.
198. M G Soman, President, Democratic Farmers Sasnghom, Noornadu Village
199. Noornadu Village, Mavelikkara
200. Tekekara Grama Panchayat, Mavelikkara
201. Komma Padasekara Nel Ulpadana Samithi, Vettiyyar
202. Cherukunnam-Vadakemankuzhi Padasekara Nel Ulpadna Samithi, Mavelikkara
203. K R Pushpamma, President, Kavalom, Grama Panchayat
204. K N Kururp, Edathua Grama Panchayat
205. Kainakari Grama Panchayat Office
206. Kerala Pradesh Farmers Congress (I) Tazhakara - (1)

## LIST OF MEMORANDA RECEIVED

- 207.Kerala Pradesh Farmers Congress (I) Tazhakara - (2)
- 208.Kerala Pradesh Farmers Congress (I) Tazhakara - (3)
- 209.Kerala Pradesh Farmers Congress (I) Tazhakara - (4)
- 210.Sree kumar, NSS College, Chertalai
- 211.Kuttanad Development Trusr, Alleppey
- 212.Champakkulom Bridge Engineering Samithi.
- 213.Pathanamthitta Jilla Panchayat President Memorandum
- 214.27 (1) Ayirathum Padavu Padasekara Nel Ulpadaka Samithi - List of Canals
- 215.27 (2) Kannimel Narayanan, Kanna mangalam Kerala Karshaka Sangham
- 216.27 (3) Nedumudi Grama Panchayat - AC Canal open
- 217.27 (4) Nedumudi Panchayat president
- 218.Karshaka Congress (I) Kottayam District Committee, Babu Joseph, President
- 219.Mannar Puthan Karipadasekara Samithi, Kottayam
- 220.All India Kisan Sabha- Talayola Panchayat Committee, Vaikom
- 221.Manakkari Padasekara Nel Ulpadaka Samithi
- 222.Pannurukkam padasekaram, Vadayar, Vaikkom
- 223.Thomas Chazhikadan(ETTUMANOOR),Member, KLA, Kottayam-686 006
- 224.Tekkekari Padasekarram Samithi
- 225.Ponmathuruthu, Chetti Koduppu, Vaikkathara Padasekara Nel UlpadakaSamithi
- 226.Gramasevini Library, Karingalilchal Puncta
- 227.Vanom Vadakke Block Nel Ulpadaka Samithi, Vaikkom
- 228.Kottayam Jilla Nel Karshaka Samrakshana Samithi
- 229.Thiruvaikary-Turkey Padasekaram, Killoor, Thiruvapur
- 230.Changanassery Kattakuzhi Padasekara Samithi
- 231.Changanassery Kattapuram paddy Land Secretary.
- 232.People's Representatives living on Banks of Meenachil River, Kottayam
- 233.Alangery Padasekara Nel Ulpadaka Samithi, Thalayola Parambu.
- 234.C M Venugopal, President, Manjoor Grama Panchayat, Kottayam
- 235.V N Vasavan, MLA, Kottayam Constituency, North Kuttanad
- 236.P S Shashidharan, Environmental Activist, Changanasseri.
- 237.QST Kayal Sustained Paddy Cultivation Proposal
- 238.Trikinnapuzha Kizhakckara
- 239.N Mohanan, Tripuzha
- 240.N Mohan, Trikunnapuzha Grama Panchayat
- 241.Chanpakkulam Farmers
- 242.Parappil Padasekara Nel Ulpadaka Samithi
- 243.Arupanku {adasekara Nel Ulpadaka Samithi, Kainakari
244. School of Environmental Sciences, Mahatma Gandhi University, Kottayam
- 245.Lower Kuttanad Citizens Forum President, Zacharis Joseph
- 246.Karthikapally Grama Panchayat
247. Scaria James, Nedumparambil, Kavalam
- 248.Kalady Rice Milers Consortium Pvt.Ltd., Kalady, Eranakulam Dist.
- 249.Florirea. M.A. Lecturer, Research Scholar, St.Maicharel's College, Kerala
- 250.Maveli Padasekara Nel Ulpadaka Samithi, Thakazhi
- 251.Bharanmickvu Panchayathu Farmers's Club, Pallickal P.O.690 503 Kerala
- 252.Sri Joseph Mathew, President, Clove Growers' Association of India, Nagaercoil.
- 253.Pampa Parirakshnana Samithi,(A Voluntary Environmental Organisation) Tuiruvalla. Kerala
- 254.Kuttanad Farmers Cooperative Union: Kuttanad Taluk.
- 255.Kainakari Village R-Blkock Kayal Committee
- 256.P .J Abraham, Pathenpurayil, Kainaday P.O. Convenor, R.Block kayal, KuttanadTaluk, Alleppey District.
- 257.Kerala Karshaka Sangham Chennithala ThriPPERunthura Village Committee
- 258.Advocate T S Thaha, President, Block Panchayat, Harippadu, Thondiayyath, Chingold P.O. Alappuzha Dist., Pin: 690 532
- 259.Tarangam Cultural Sports Development Council, Ambalapuzha. Ward of Trikunnapuzha Panchayat

## LIST OF MEMORANDA RECEIVED

260. 'T' Ward of of Trikunnappuzha Panchayat
261. Salim Cherthal, Journalist, Navelist & Script Writer. Thuravoor, Alappuzha Dist.
262. Advocate Mans Joseph, M.L.A. Quarters, New Block, 50-51 Kaduthuruthi, Kottayam.
263. Can Kuttanad be saved, K.S.Narayana Iyer, Kaitharam, Vechoor,
264. K Ajit Anjanam, West gate Vaikom, Kottayam, Pin: 686 141
265. K C Pappacherri
266. Vasanthy Sudasivan, Kumarakom P.O.
267. P V Prasad Secretary, Puthiyad Poonkasseri, Karithra-Mankuzhy, Padasekharam, Nellulpadaka Samithy, Kumarakom
268. P K. Sivasatna Pillai, Vadakkekannattu Kuliroor, Kajinnar P.O. Kottayam
269. President, Kozhipuncha Padasekara Nel Ulpadaka Samithi, Reg.No: 221/93 Olassu, P.O Kottayam-686 014
270. Mr. T J Thomas, Kathezhathukari Nel Ulpadaka Samithi, Reg.No: 372/91, Kumarakom South P.O. Kottayam - 686 563
271. J Mani, President, Alleppey House Boat Owners Association, Finishing Point, Thathompalli P.O. Alleppey - 13
272. Mr. Alex Mathew, Rajiv Gandhi Trophy Boat Race Club, Reg. No: 401/91, Pulincunnoo P.O. Pulincunnoo
273. Shija John, AIJF – Kumarakom Panchayat, Kumarakom, Kottayam
274. Anthony Arayil, Anthonikayal Padasekaram, Kumarakom, Kottayam.
275. Sajimon P.S. Pudukaparambil (H) Kanjiram P.O., Kottayam – 30
276. K M Mathew, Kalamkukattussery, Pulikkuttissery P.O. Kottayam Baiju
277. V S Baiju, malarikkal Men Self Help Group, Kanjirom P.O. kottayam, Kerala
278. Muralidharan Nair Archana Nivas Kallara Karayil, Vaikom
279. Taryan John, Tazhathu Kotavara P.O., Vaikom, Kottayam – 686 607
280. K K Sreenivasan, President, Chozhipara Padasekara Nel Ulpadaka Samithi, Neendoor, Kottayam.
281. M K Gopi, Secretary, Menonkary Padasekharam, Nel Ulpadaka Samithy, Kottayam
282. Agusti Joseph, Ererathara Injanthururtha Nel Ulpadaka Samithi, Thuruthi Kottayam
283. E N Muuraleedharan Nai, Prisdent, Arpookara Grama Panchayat, Villoonni P.O.
284. Jacob C. Kusumalayam, Kumarakom
285. Island Padasekaram Kumarakom
286. Smt. Ammini Gopalan, President, Kallara Grama Panchayat, Vaikom, Kottayam
287. Anthoni Kayal Padasekhara Nell Ulpadaka Samithy, Cheepunkal P.O. Kottayam
288. Mr. K K Mahadevan, President, Kattikunnu Puthan Kari Group Farming Nel Ulpadaka Samithi, Vaikom
289. M T Joseph Jilla Secretary, Kerala Karshaka Sangam, Kottayam
290. Aryathoozhm padasekara Samithi, Arpookara Village.
291. Kerala Karshaka Sangam, Kottayam
292. K N Parameswaran Namboothiri, Karakkattu Illam, Kudamaloor P.O. Kottayam
293. Babu Joseph, President, Karshaka Congress (1) Kottayam District Committee, Indira Bhavan, Kottayam
294. Anthony Arayil, Anthony Kayal Padasekaram
295. Anthony Arayil, Cheepkungal, Kumarakom, Kottayam
296. Parochal Padasekaram, Kottayam Municipality.
297. M K Balan, Secretary, Kottayam
298. Mr. P C Kurian, President, Anchalasserry-Vaikathukizhy-Naguda Padasekaram Kurichy, Kottayam
299. K C John, Kallumkathra, Pulikkuttissery. P.O. Kottayam – 686 015
300. J Block 9000 Padasekara Farmers
301. Memorandum by Kumarakom Swaminathan
302. Secretary, Ayamanam Grama Panchayat Karyalayam, Ayamanam, Kottayam-686 015
303. Suresh Kurup, Member of arliament, Kottayam
304. N K Sanujan, Vice Chairman, Vaikom Karinila Vikasana Agency, (A Development Agency Promotted By Govr. Of Kerala) Sanju Nivas, Kottayam – 1.
305. Adv. P K. Chetrabhanu, All India Kisan Sabha, Kottayam Jilla Committee, P P George Smarakam, Chelli – Ozhukkom Raod, Kottayam – 1.

## LIST OF MEMORANDA RECEIVED

306. The Convenor, North Pudussery Padasekara Nel Ulpadaka Samithi, Vadayar P.O. Kottayam
307. The Kavalachathankary Padasekhara Nellulpathaka Samithy, Reg.No: K. 550/98 Malakunnam P.O. Changanacherry
308. Mr. K S Narayanan Nair, Krishnan Karikathakuzhi Padasekara Samithi, Malakunnam P.O. Kottayam.
309. Krishnankari Kattakkuzhi Padassekham – map
310. The Kumarakom Lime Sheli Co-op: Society Ltd. No: 1782, Kumarakom – 686 563 Kottayam, Kerala
311. Eera ponganam Padasekaram Farmers Changanassery
312. K J Mathew, Kochuchira, Kumarakom P O Kottayam District, Kerala
313. Kannadichal, Konnakari Padasekara Samithi, Kottayam
314. Mr. Girish M Thekkepudussery Nel Ulpadaka Samithi, Vadayar P.O. Talayola Pramba, Vaikom, Kottayam, Kerala
315. President, Kadathuruthy Grama Panchayat, Kadathuruthy P.O. Kottayam – 686 604
316. C J Jiju, Secretary, Nature Club, Kumarakom P.O. Kottayam – 686 563 Kerala
317. Tekkrmthuruthy Padasekara Samithi, Changanassery.
318. V G Shivadas, Secretary, South Local Committee, Communist Party of India (M). Kumarakom P.O. Kottayam
319. K George Thomas, Secretary, M.N. Block Kara Padasekhara Group Farming Samithy, Thiruvappu, Kottayam.
320. Mr. V K Sukumaran, President, Varikkadu, Puthan Kari Padasekaram Nel Ulpadaka Samithi, Kumarakom, Kottayam.
321. Joji Cheriyan, Vice President, Puliayar Grama Panchayat, Puliayar P.O. Chengannur, Alappuzha, Kerala
322. P D Thomas, Vice President, Kadapra Grama Panchayat
323. Prof. Varghese Mathew, Principal, B A M College Thuruthicad, Pin: 689 597
324. Pampa Raksha Sena, Sree Budha Ayurvedic Building, Market Road, Edathur P.O. Alappuzha
325. Social Science Department, Peet Memorial Training College, Mavelikara (Affiliated to the University of Kerala)
326. President, Chettikulangara Grama Panchayath (Special Grade) Chettikulangara P.O, Mavelikara – 690 106 Alappuzha District.
327. Mr. Venmoney Sudhakaran, President, Venmoney Grama Panchayat, Venmoney P.O., Chengannur, Alappuzha District.
328. Mr. T V George, Convenor, Thalalachalil Veedu, Paliyakkam, Thiruvalla, Pathanamthitta – 689 101
329. Kerala Farmers Association (AIKS), Pathanamthutta
330. Saji Alex, Member, District Panchayat, Pathanamthitta, Ittiyampampil, Valanjavattom East P.O. Thiruvalla
331. Mr. R Gopi, President, Chingoli Grama Panchayath Office, Chingoli P.O., Alappuzha District, Pin: 690 532
332. Fish Labourers Union (CITU), Harippad
333. C Sreekumar Unnithan, Secretary, Kerala Karshaka Sangham, Harippad Area Committee
334. C Prasad, Secretary, K S K T U, Harippad, Ayaparambu P.O. Cherutana, Alleppey
335. Sujatha, Palakuhngara, Palana, Trikunnappuzha, Alappuzha
336. P Mukundan, President, Indian National Trade Union Congress (INTUC) Harippad Regional Committee, Devaki Nivas, Karuvatta, P.O.
337. C Prasad, Jilla Panchayat Member, Mangalathu Vadathil Ayaparambu P.O. Cheruthan, Alappuzha – 690 517
338. Ecological and Livelihoods securities of Kuttanad Wetland Ecosystem
339. Secretary, Vivekananda Yuvajana Swashraya Sangham (Reg.No.GSK/YSS/TPZHA/36/07) Thrikkannappuzha – 690 515
340. Dr. N Ratna Kumar B A M Retired. Senior Medical Officer, 'Navarasmy' Thrikkunnappuzha P.O. Alappuzha, Kerala – 690 515
341. Adv. T S Taha, President, Block Panchayat, Harippad, Alleppey.
342. T Panchaman, Tsunami Action Council, Arathupuzha South, Valiyazhukkal P.O. Alleppey – 690 535
343. K A Latheef, Vice President, Kerala Pradesh Matsys Thozhilali Congress (I) State Committee, K.P.C.C.(I) Office, Indira Bhavan, Palace Garden, Thrikkunnappuzha P.O. Alappuzha District, Trivandrum

## LIST OF MEMORANDA RECEIVED

344. Pulikeezha Block Panchayat
345. Establishment of center of Excellence in duck production at Niranam, Pathanamthitta District, Kerala
346. Venmani Grama Panchayat, Alappuzha
347. Balakrishnan Nair, Puliyoor, Changanoor
348. V R Vasudevan Pillai, Karshika Vikasana Samithi Mamber, Puliur, P.O. Changanoor, Alleppey.
349. President, Pandanadu Grama Panchayat, Pandanadu P.O, Chengannoor 689 506, Kerala
350. Adv. N S Sreekumar, President, Vallikunnom Grama Panchayat, Elippakulom P.O. Pin: 690 501
351. Kayamkulam Branch Canal under Kallada Irrigation Project – Paper Reports
352. Bharanickavu Grama Panchayat, Pallicjal P.O. Alappuzha (Dist.) – 690503
353. Integrated approach in cultivation in Onattukara region by Adv. George Thomas
354. Shankaranarayanan Oonni Samrakshana Samithi, Thanneermukkom P.O.
355. V E Ittyavirab, President, V M K Padasekaram
356. Revival of Kuttanad Development Project by Zachariah James, Kavalam
357. Shri Jacob Verghese, Kainady
358. Sister. Anila Issac, Vaikom
359. C K Das, Kuttanad Convenor's Association, Farmer Secretary
360. M Jose on proposal for 'Kuttanadu Development '
361. Memorandum by on Comprehensive Development of Kuttanadu
362. Environmental Resources Research Centre, Thiruvananthapuram
363. Sustainable development of this problem zone of Agro climatic region of Kerala State from Dr.C J Thampi
364. Memo submitted by Dr. N K Unni for coconut products development
365. T P S Namboothiri, Takazhi, For Responsible Tourism
366. Infrastructure Development of Odenty Padasekharam by George Mathew, Vattakalam, Secretary
367. K N Parameswaran Namboodiri in Mathrubhoom
368. Salvin Kodyanthara, General Secretary, Upper Kuttanad Vikasana Samithi, Central Junction, Kottayam – 1.
369. Government of Kerala order on Local Self governance Dec.2006
370. A study on the prices of Major agricultural crops of Kerala State by Dr. P Yageen Thomas. Dept. of Statistics, University of Kerala
371. Rural Development & Cultural Society, Ala P.O. Chengannur – 689 126
372. Sudharamma, S S Bhavan, Kandallor North, Pattoli Market P.O.
373. K V Koshi, Kizhakkeveetil, Tazhakkara Panchayat, Mavelikkara
374. Crop production submitted by the Farmers of Kumarakom
375. The Kumarakom, Ksheeralpadaka Co-operative Society, Kumarakom
376. District Congress Committee
377. Ward II of Kumarakom Gramma Panchayat
378. T C Thomas BSc(Engg) M.E. (USA) Dip.Housing, Kottayam, Kerala
379. Alappuzha District Panchayath by Charly Abraham
380. P C Vishnunadh (Chengannur) Member Kerala Legislative Assembly
381. Upper Kuttanad Nel-Karshaka Samithy, Thiruvalla, Kerala
382. Niranam Grama Panchayat, Niranam P.O.
383. V V Ramachandran Nayar, President, Nationalist Karshak Congress Chengannur.
384. K Ganghadharan Nair, Action Council Convenor, Alappuzha Dist.
385. Office of the Arattupuzha Grama Panchayat, Arattupuzha South P.O.
386. Kottalil Vijayakumar, President, Muthukulam Block Panchayat
387. Secretary, Patakalkkad Nel Ulpadaka Samithi, Karichal Payippad P.O. Alappuzha
388. A K Rajan, Member KPCC Exective, Member Coir Board Advisory Committee Govt. of Indai, Member Coir Advisory Committiee Govt.of Kerala.
389. Institute for Societal Advancement ISA
390. Sonny E.C., Elaackattu House, Neendoor P.O. Kottayam, Kerala
391. Kerala Ration Wholesale Distributors Federation General Secretary, Adv. Santhosh P. Varghese, Kottayam
392. Dipu Sasi
393. Mr. Adv. George Thomas, Ex-Member, Advisory Committee, Farm Information Bureau, Govt.of



## LIST OF MEMORANDA RECEIVED

- Kerala, Kunnil Villa, Kattanam.
394. Gandhi Smaraka Gramaseva Kendram S L Puram – 688 523
395. M J M Centre, Mavelikkara, Kerala
396. The President, Anchalasserry – Vaikathukuzhy – Naguda Padasekaram, Kurichy Kottayam, Kerala
397. Jojoy Chariyan, Vice President
398. Karthikapalli Block Cheruthana Village Coconut growers, Mannar
399. President, Kareshaka Congress (I), Mannar
400. Mannar Grama Panchayat
401. Shri. V Raman Pilla, President, Mannar Nel Krishi Vikasana Samithi
402. Secretary, Tagore Smaraka Nel Ulpadaka Samithi, Thattambalam P.O
403. C O Kuriakose S Padasekara Samithi, Upper Kuttanad
404. P K Chandrasekaran Nair, Changanassery
405. Theveri Thandrapra Padasekara Samithi, Cherutana
406. George Thomas, Thevercad House, Kainakary P.O. Alappuzha
407. ennithala Samyukta Nel Ulpadaka Samithi
408. Memorandum submitted by B Rajappan Nair
409. Rajan Lassar, Jilla President, Kerala Swatanthra Matsya Thozhilali Federation
410. K Gangadharan, President, All India Kisan Sabha, Aroor Mandalam Committee, C G Smarakam, Chertaka, Aleppey
411. Santha Kumari K C D S Chair person, South Grama Panchayat, AmbalaPuzha, Alappuzha, Kerala
412. Susheela Sonearayan, Vettathathu Thekkethil, Kuttamberur, Mannar, Alappuzha, Kerala
413. Anganwadi Workers, ICDS, Ambalappuzha
414. Womens In agriculture – Kandallloor, Kandallloor Vanitha Swayam Sahaya Sangham, Muthukulam Block, - Alappuzha
415. Smt. Maheswari Ananthkrishnan, Kavungal matom, Kurathi Kadu, Mannar, Alappuzha, Kerala
416. WIAS, Trikkunnapuzha Krishi Bhavan
417. B Sridevi, Aru Villa, Kuratti Kadu, Mannar, Alappuzha, Kerala
418. Area Committee Member, Kera Karshaka Sangam, Thiruvalla
419. Sridevi Gopinath, Varya Chiratharayil, Mankomkuzhi P.O., Vettiyyar South, Mavelikkara Alappuzha, Kerala
420. Shyamala, Mannar Panchayat
421. Tazhakkara Grama Panchayat Krishi Bhavan
422. Shanthamma Divakaran, Thrikkannam Velichirayil Mempral P.O., Thiruvalla, Pathanamthitta, Kerala
423. V M Krishna Kumari, Vasudeva Sadanom, Mambra P.O., Cheriyana East, Alappuzha, Kerala
424. Leelamma Jerome, Meenathaathil, Karichal, Paippad P.O. Haripad, Alappuzha
425. Cheriyana Krishi Bhavan Women Farmers Association
426. Thonippurakkal Veetil Vasantha Kumari, Karuvatta
427. Karichal Inland Matsya Thozhilali Cooperative Veeyapuram Grama Panchayat
428. Democratic Womens Association
429. Joseph Joseph, Mapplasseriyil Parippu P.O. Kottayam.
430. T M Pappachan, Malikayil, Olassa P.O. Kottayam – 686 014
431. K D Aniyachan, Secretary, J Block 9000 Padasekara Nel Ulpadana Samithi, Kanjiram P.O. Kottayam
432. Kamalamma Jayapalan, President, Thiruvappu Grama Panchayat, Kiliroor North P.O. Kottayam – 686 020
433. Alexander Clacto Grama Panchayath Member Ward II, Kumarakom North P.O., Kottayam – 686 563
434. Mr. Peter, President, Pattammal Nalinthodu, Nellulpadaka Samithy, Parippu P.O. Kottayam – 686 024
435. Panachikari Padasekara Samithi
436. Secretary, Mangalasserikari Thollaytram Nellulpathaka Samithy, Arpookara, Reg.No: K-549
437. All India Kisan Sabha, Vaikom
438. Ambika Mohan, President, Pulikkeezha Block Panchayat, Valanja Vattom P.O. Thiruvalla – 689 104
439. Vettiyyar Tekku padasekara Nel Ulpadaka samithi, Vettiyyar
440. Parathchal Padasekara Nel Ulpataka Samithi, Kadapra, Mannar
441. Cheriyana Grama Panchayat
442. Development of Noomadu, Allappey,
443. Cooperative Padasekara Samithi, Chennithala

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