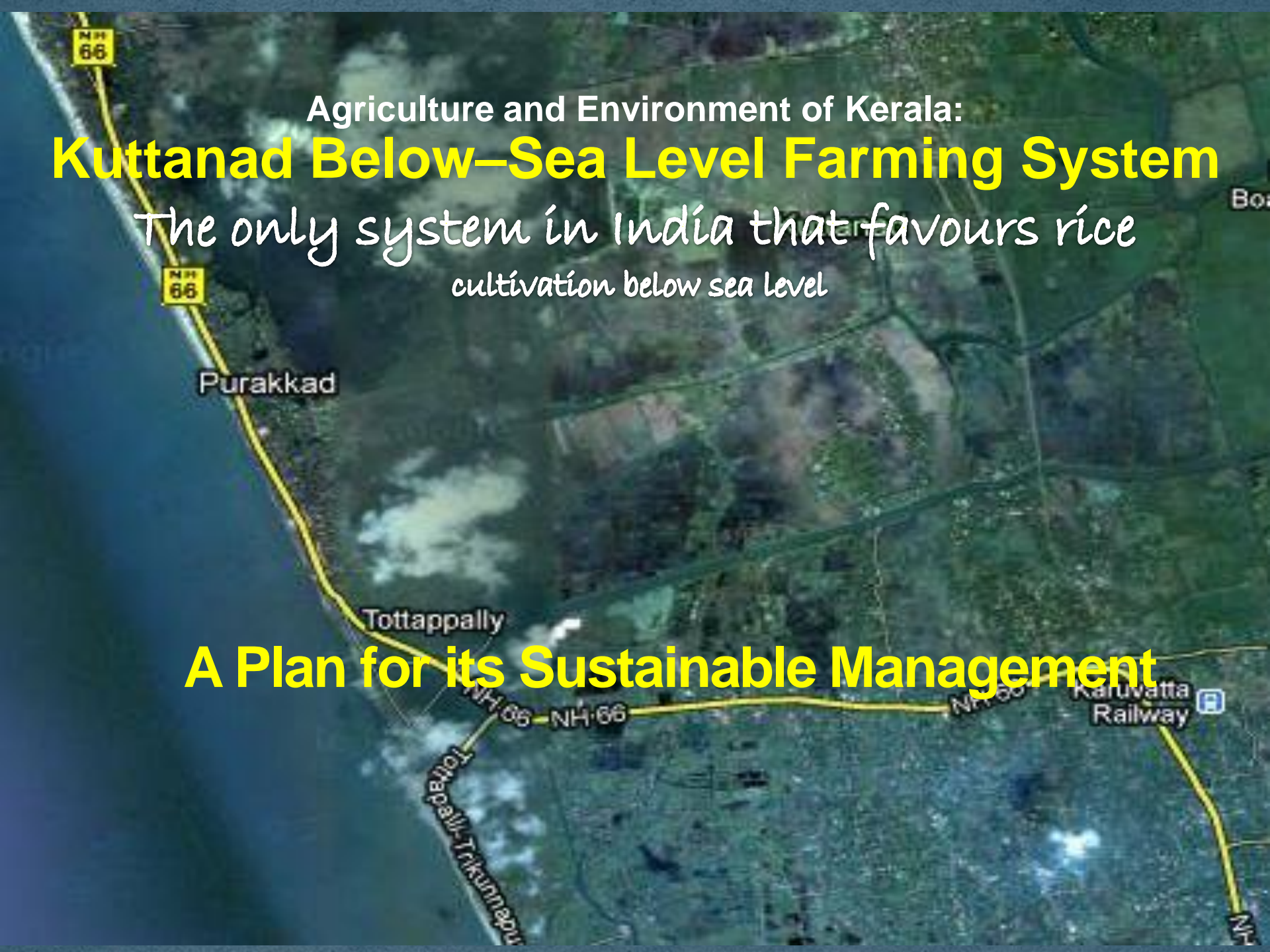


Agriculture and Environment of Kerala:

# Kuttanad Below-Sea Level Farming System

*The only system in India that favours rice cultivation below sea level*

## A Plan for its Sustainable Management



# Revitalization of Kuttanad Heritage Agriculture

**A DELTA REGION** ca 900sq. km

Ca 500 km<sup>2</sup> of the area with agricultural fields situated below sea level

- **FAO has recognized the *Kuttanad Heritage Agriculture (KHA)* as a *Globally Important Agricultural Heritage System*.**
- The recognition of the Globally important agriculture heritage status necessitates revitalization of some of the vital conservation and enhancement actions of the past that are relevant to address the concerns of sustainable food security, climate change adaptation and ecosystem services management.



# A COMPLEX MOSAIC OF FRAGMENTED AGRICULTURAL LANDSCAPE

- Coastal backwaters
- Rivers
- Paddy fields,
- Marshes
- Ponds,
- Garden lands
- Edges
- Corridors and
- WATER WAYS  
(remarkably networked)



# THE LAND/WATER USE

- the largest wetland use system in the west coast of Indian peninsula and **perhaps the largest below sea level cultivation of Paddy in the world!**



**Major Land/Water Use**  
Agriculture and Inland Fisheries

The complex mosaic of landscape elements can be grouped into three **Landscape structures** :

1. **GARDEN LAND**: Raised lands of ca.31,000ha and 0.50 to 2.5 m above MSL with coconut as the major crop



2. **WATER AREAS:** Large expanse comprising the rivers and lake system, in which roughly 13000 ha: **VEMBANAD Lake** – A Ramsar Site is the major Area



**3. WETLANDS:** A landscape with levels ranging from 0.60m to 2.00m below MSL, part of which are reclaimed lands and form the traditional paddy cultivation areas

- *Karapadam, Kayal padam and Kari padam* according to the structure, function and land use.
- **Karapadam** of ca. 16280 ha with over 600 reclaimed stretches of rice paddies
- **Kayal Land** is about 9,464 ha area at elevations 1.0 m to 2.0 m below MSL
- **Kari Lands**, the Purakkad kari is an area of 3,500 ha with 43 *padasekharams*



# *Kayal*

- PUNCHA VAYALS  
/PADASEKHARAMS/

RECLAIMED LANDS FOR  
PADDY CULTIVATION



## History of Reclamation

- Local level efforts since long time
- Became a trend by 1870s
- Its full potential by later part of 19<sup>th</sup> century
- By early 20<sup>th</sup> Century about 2226 ha and by 1930s 5261 ha reclaimed
- Reclamation stopped by 1980's

Ca. 15000 ha of reclaimed land

Ca 40,000 ha of natural land

One of the huge sized *padasekharams* is about 2500 acres



# LANDSCAPE MANAGEMENT PRACTICES

## *Construction of Polders and Land reclamation*

- Identification of the shallow regions in the vast stretches of Vembanad Lake
- Marking the boundaries
- **The bund construction and maintenance are the most skilful tasks, for which an array of long and stout coconut poles would be hammered deep enough into the lake bed in two rows, normally in 1.5 m to 2-5 m width enveloping the entire area and fenced with bamboo mats on either side.**
- The channels of the bund then would be filled to the desired height, first with sand, followed by twigs, sedges interspersed with high quality clay that dug from 20-25 m deep bottom of lakes.





# Maintenance of Bunds

- The *padasekhara* committees are made responsible for the annual maintenance of bunds.
- Normally bunds would breach during high flood and high tides.
- Since last 20-30 years some of the *padasekharams* are protected with permanent outer bunds with granite pitching.



# CLAY DIGGING (Katta Kuthu)



# *De watering of the polder areas: Traditional Method*

- Traditionally, huge and strong water wheels of about 12 feet diameter with blade width of 1 to 1.5 feet were used, which pedaled by 12-14 men who would sit on and work from a gallery erected for this purpose.



# DEWATERING: Modern Method

- Modern Method of dewatering 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.



## **Agricultural Biodiversity** and Associated Biodiversity

- **Mixed agro-ecosystems** such as backwaters, rivers, vast stretches of paddy fields, marshes, ponds, garden lands, edges, corridors and water ways-the characteristic feature of Kuttanad Wetland Agricultural Landscape.
- **Plant and animal germplasm** (of food and medicinal value like several edible wild greens and healing herbs) The delicacy like meat of turtle, frogs and different species of birds is still available though it is legally controlled)
- **Insects, pests and fungi** (Enormous diversity available now after the practice of high intensive farming!)
- **Soil biodiversity, microbes** (not much known)



# Livestock

- A traditional breed of Buffalo still thrive



# Crop species and varieties

- Largely of Rice (Now only the released varieties- *Jyothi* and *Uma*. In the past puthari champavu and jeeraka champavu)



# Plant and animal germplasm

- **Plant and animal germplasm** (of food and medicinal value like several edible wild greens and healing herbs) **The delicacy like meat of turtle, frogs and different species of birds is still available** though it is legally controlled)

- **Insects, pests and fungi**

**Insects, pests and fungi** (Enormous diversity available now after the practice of high intensive farming!)

- **Soil biodiversity, microbes** (not much known)

## Agrobiodiversity Value

- The plant and animal diversity present in the bushes in isolated patches and water are employed in various ways for their food and agricultural needs- **Food, drink and for healing purpose, livelihood and cultural needs.**
- Traditional diet included primarily **rice, fish, prawns, crabs, mussels, duck meat, coconut and cassava.**



# Various Uses

Habit of using deep mined clay for healing their small wounds and cuts and

Herbal medicine was known for poisonous bites. Abundantly grown screw pines and a sedge

Screw pine, Typha in the region offered enough raw material

Mat weaving – a livelihood option for the women



# The wild biodiversity

- The wild biodiversity of the region is rich! It ranges from mixed wetland ecosystems to the associated above ground and below ground flora, fauna and microbial diversity.
- The 11 km long stretch of mangrove vegetation still found close to **Kumarakom** supports a diverse array of mangrove and mangrove associates.
- **Pathiramanal** is a large repository of migratory fishes and birds and several species of mangroves, birds and fish species.
- A bird count in 2009 listed out **27942 birds belonging to 56 wetland and wetland associated bird species.**
- The *Kayal* is home to the third largest population of more than 20,000 waterfowls that visit India



# Endangered Birds

- Endangered species of waterfowl that have been identified from the region are:
- **spot billed pelican,**
- **oriental darter,**
- **water cock**
- **black billed tern.**



BRAHMINI KITE  
photo- shibu bhaskar

## Fish Diversity

- The region is an ideal habitat for variety of finfish, shellfish, and several varieties of prawns, black clams, white clams and shrimps. Many fish species are reported to be depended upon the wetland for food, spawning and nursery.



the esteemed golden catfish of Kuttanad



# Plant Diversity

- The aquatic species include:
- 24 spp of green algae,
- 10 blue green algae,
- one species of yellow brown algae,
- 13 desmids and 19 diatoms
- 202 angiosperm species, which include 14 mangroves and 30 mangrove associates.
- 8 species of pteridophyta



# Goods and Services provide by the System

## *Kuttanadan Rice*

- The rice cultivation area of Kuttanad shares about 25 % of the State's total rice production area and contributes nearly 37 % of the rice production of the state. Owing to its primacy in rice area and production, Kuttanad had been long time referred as "**The Rice Bowl**" of Kerala.



# *Kuttanadan Fish wealth*

- The Kuttanadan Agricultural Landscape, including the Punja Rice System that surrounded with estuaries, flood plains, Kayals, ponds and canal networks known for its diverse fish wealth.
- Vembanad Fish Count 2009 identified 65 species of fin fish and 14 species of shell fish from the region (ATREE 2009).
- The fresh water environment closer to rice fields and the canals provide abundance of Pearl spots, perchlets, fresh water giant prawns or *attukonju* and freshwater catfishes



# Giant freshwater prawn



- Giant freshwater prawn *Macrobrachium rosenbergii*, which grows up to the size of 40 cm and locally known as *Kuttanadan konchu* is a highly valuable species
- The total annual production of this species in 80's was reported as 100 tons per annum. There are now successful attempts to increase spawning of this species by scientists.

# *Karimeen*, the Pearl spot



*Karimeen*, the Pearl spot is another major delicacy of Kuttanad and now it is Kerala's state fish. The Kuttanad region is considered the *tharavad* (family home) of the fish. Kerala now produces only 2,000 tons of *Karimeen*.

# Endangered Fish Diversity

Some of the endangered fish species of the region are the endemic carp of Central Travancore, *Labeo dussumieri* (Toolli/Pullan), the esteemed golden catfish of Kuttanad,

- *Horobagrus brachysoma* (Manjakoori),
- the riverine coldwater fish,
- *Gonoproktopterus curmuca* (Kooral),
- *Wallago attu* (Attuvaala), the glass perch,
- *Parambassis dayi* (Nandan),
- *Macropodus cupanus*, and
- *Nandus nandus* (Andikalli).

# Endangered Fish Diversity

- The highly Endangered endemic species in the fresh water reaches include
- *Channa micropeltes* (Manal waaha), *C. leucopunctatus* (Puliwaaha) *Pristolepis malabaricus* (Pannakarimeen), *Ompok bimaculatus* and *Clarias dussumie* (Mushi).

# *Rice-fish Rotation farming*

- Rice –fish rotation is now popular in the region as double cropping of rice turned to be less lucrative and more damaging to environment. The second crop (March to October) is now taken for rearing of fish (various carps)





## Kuttanadan Clam :

Four species of Clams:

- *Villoritta cyprinoids*,
- *Meretrix casta*,
- *Paphia malabarica* and
- *Sunetta scripta*) are reported from the region, in which Black clam (*Villoritta cyprinoids*)
- Its production was estimated about 31430 ton in 2000.



# *Kuttanadan Duck Farming*

The ideal condition of the system allows Duck farming in a promising way. Famous local breeds Kuttanadan duck are:

**Chara** and **Chempalli** and the introduced breeds are Kuttanadan White, White Pecking and White Muscovi.



# Kuttanadan Coconut Gardens



- In garden lands Coconut agroforestry is also followed where coconut is grown with fruit trees like mango, jack and roots and tubers like yams and taros. The palm is also used for tapping toddy, which is another attraction of the region. Apart it contributes to profound scenic beauty

# TRADITIONAL FOOD BASKET

Traditional Food basket of people of Kuttanad included four major items-

1. **Kizhangu** (tuber, mainly cassava),
2. **Karimeen** (pearl spot),
3. **Konju** (Giant freshwater prawn),
4. **Kakka** (clams), and
5. **Kallu** (toddy- An alcoholic beverage).



# Environmental services

Transportation, recreation apart from crucial regulating service the system plays is the control of the hydrology of the entire region.



**Paddy fields**  
**Breeding sites of**  
**frogs**

*Euphlyctis*  
*hexadactylus*



# Threats and Challenges

*Kuttanad – A ‘Water Desert’*

Fresh water supply is hugely defective:

- Pollution,
- Urban encroachment,
- Land reclamation for agriculture and tourism,
- Fragmentation by transportation routes, untreated human sewage from dense settlements, and
- Intensive agricultural run-offs including fertilizers and pesticides.

Almost all areas in Kuttanad are reeling under severe shortage of potable water. The people of this water logged area virtually starve for quality potable water.



# *Kuttanad – A ‘Den of Distress’*

- A barrage commissioned in 1975 and construction of an adjoining earthen bund in the vembanad lake with a view to regulate salt water intrusion into inland for enabling cultivation of a second crop of paddy and construction of canals, roads, culverts and bridges and development of waterways in an unscientific manner have significantly affected the dynamic nature of this wetland and reduced the natural tidal flow considerably.







**Death in breeding sites**

**Impact of pesticide**

# The Revitalisation Challenges

The major challenges identified by MSSRF about a few years back to bring back the KHA are :

- (i) Declining surface area of waterways including the Vembanad Lake**
- (ii) Flood management,**
- (iii) Control and regulation of saline water intrusion,**
- (iv) Choked waterways and the 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) Degrading ecosystem services and goods like water recharge, pollution control, fishery and loss of biodiversity.**

# Special Agricultural Zone

- M.S. Swaminathan Research Foundation three years ago recommended promotion of this region as a Special Agricultural Zone for strengthening location specific research and extension system for the prosperity of the Kuttanad region

# The Intervention Objectives

- to educate the farmers and fisher communities to enhance their knowledge- base and capacity in integrated land and water management particularly in (i) polder system of landscape building and management of sea water intrusion; (ii) below sea level farming, and (iii) sustainable garden-land agriculture and fisheries through participatory research and communication approaches

**(Education and Training oriented);**

- to develop sustainable livelihood options by maximizing the production of rice cultivation and fisheries and bringing back the *rice- bowl* of Kerala status of this region by finding opportunities for utilization of modern technologies for the community members, particularly youth in processing and value addition in rice, fishery and other agricultural produces.

**(Livelihoods and Development oriented);**

- to undertake scientific research and bringing out high quality results on the issues and problems related to three high priority topics (i) below sea level farming and the related area of water resource management pertain to both inland and sea waterscapes; (ii) *integrated fisheries inclusive of prawn culture* and (iii) specially focused research on Climate Change scenario analysis in relation with the hydrology of the region, biodiversity, water and landscape management & agriculture.

**(Research, Documentation and Policy oriented);**

# Objective 1: Education and Training

The major intervention to achieve this objective is establishment of a fully functional world class Training Institute for bringing a critical mass of scholars from different disciplines to undertake training and capacity building initiatives in the focal areas of ReKHA Council.

## Objective II: Sustainable Livelihoods

Creating an economic stake in conservation is an important strategy to promote sustainable income generation in villages and revitalize the heritage. Applied Research into this direction supported with new bio-chemical explorations to value-chain studies and policy initiatives will be explored.

# Sustainable Livelihoods through 3 goals

- Revitalization of the ecological foundations essential for sustainable agriculture in Kuttanad,
- Enhancement in productivity and reduction in the cost of production through higher factor productivity in rice cultivation, coconut gardening, roots and vegetable cultivation and fisheries.
- Introduction of agro-processing and value addition initiatives primarily to rice, coconut and fish.

## Some of the priority activities to achieve the Sustainable Livelihoods objective:

- Launching of ***Bio-Enterprises Initiative*** by establishing Demonstration Villages, Aqua Parks and Bio Parks for sustainable utilization of targeted resource such as rice, coconut and fish (including prawn) in cooperation with appropriate government, non-government and academic institutions.
- These could be spread out in strategic locations of the region- one at Lower Kuttanad (Monkombu), One at Middle Kuttanad (Kumarakom) and one at Upper Kuttanad (Haripad) which as the Hub of the Initiative\*



# Some of the priority activities

- Enlarging the markets for traditional foods and herbal products through Cooperatives/ SHGs and by finding niche markets, by promoting brand names where appropriate.
- Traditional Food basket of people of Kuttanad included six major items- Kizhangu (tuber, mainly cassava that cultivated locally is far superior in cooking quality and taste), Karimeen (pearl spot), Konju (Giant freshwater prawn), Kakka (clams), Karikku (tender coconut) and Kallu (toddy);

## Some of the priority activities (contd..)

- Promoting organic farming methods of cultivation and linking the organic rice, coconut, fish/prawn and medicinal plants with value-added marketing techniques such as adoption of market-accepted certification procedures.

## Objective III:

# Research, Documentation and Policy

Undertaking scientific research and bringing out high quality results on the issues and problems related to three high priority topics

- (i) below sea level farming and the related area of water resource management pertain to both inland and sea waterscapes;
- (ii) *integrated fisheries inclusive of prawn culture and one rice –one fish cultivation;*
- (iii) Climate Change scenario analysis in relation with the hydrology of the region, biodiversity, water and landscape management & agriculture.

# Some of the required activities to achieve the Objective III

- Facilitate establishment of a Heritage Museum for Kuttanad Agriculture by exhibiting all the known tools and equipment and demonstration of the earlier agricultural practices. Producing technical and popular multi-media publications related to the activities of KHA for example the Kuttanadan folk songs and arts for public reference will also be a major activity component;
- Extending Consultations and Policy advocacy to public organizations and community institutions and policy makers respectively in the operational process of coastal area sustainable agriculture with focal themes of coastal agriculture/fisheries and climate risk management.
- Facilitating formation of networks and collaborations with organizations and departments of public and private sector and community institutions for discussions, meetings and policy dialogue etc;

# Conclusions

- It is urgent and important to bring back the vibrancy of Kuttanad Wetland Agriculture System by addressing the issues listed out in this paper and to contribute the national development goal of food and nutrition security, and the state objective of reinstating the top one *rice- bowl* status of this region.
- The existing major Institutions in sustainable agriculture and waterscape management need to be strengthened and supported in funding, human resources and research directions.;
- Once the activities listed out are implemented with appropriate administrative and monitoring mechanisms it would be possible to bring back the KHA to its past glory..
- The Implementation Council should strongly advocate for promoting 'sustainable wetland agriculture development' through active involvement of youth and adults in on-farm and non-farm livelihood interventions including community centered water tourism and suitable bio-resource and water based enterprises.

THANK YOU