

# **PEOPLE'S COMMISSION ON VEMBANAD ECOSYSTEM**

**What future for Vembanad Ecosystem: From one crisis to another or  
crisis to sustainable management?**

**September 2017**

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## PREFACE

The rapid depletion of scarce resources through predatory encroachment, and the generation of negative externalities, are phenomena that are invariably associated with capitalist development; and even Kerala, notwithstanding its *sui generis* development trajectory, is not immune to these tendencies. The situation in Vembanad is a particular cause for concern, on account of the severe environmental degradation it has witnessed; and a succession of crises are both making the area less liveable, and also affecting adversely the livelihood of its working poor. There are clear indications too that climate change will worsen the situation.

Numerous studies have highlighted the environmental challenges confronting the Vembanad area. Though policies and legislation exist, and more environment-friendly technologies are available, we are seeing no improvement in the situation. While the extent and the depth of the Kayal are declining, poor waste management and ineffective implementation of pollution control rules ensure that there is no reversal of this process. Soaring real estate prices have led to private appropriation of public land through encroachments, and to land conversions despite the existence of legislation that prevents such conversion.

It is in this context that the Kerala Sasthra Sahithya Parishath had constituted a People's Commission to assess the issue of encroachments and environmental degradation of the Vembanad Kayal and to make recommendations to address the various problems. Though the Commission was constituted in September 2013, it took quite some time to collect, synthesize and analyze all relevant information, especially in view of the other commitments of the Commission members and also the limited resources at the disposal of the Commission.

Several individuals and organizations have helped in the work of the Commission by sharing with it their knowledge and experience, and providing inputs for the drafting of this report. It is almost impossible to list them all since it is a very long list. The Commission however would like to thank in particular all those who joined the focus group discussions and provided written submissions. These helped us to capture the diversity of views that necessarily exist on such a complex issue. The Commission is also thankful to the large number of scientists working in various organizations who shared with it their knowledge and perceptions.

Saving the Vembanad ecosystem will require fundamental changes in its mode of governance. The approach whereby a multitude of organizations are allowed to deal with it, each focusing on its own specific narrow objective, has been a major contributing factor towards the continuing degradation of this ecosystem. Besides, whatever interventions have been undertaken, have had an extremely weak scientific base. We need a governance system that enables large scale social mobilization ensuring that everyone who benefits from the Vembanad ecosystem shares the responsibility for its sustainable management. This report provides only a broad indication of what may be done to revitalize the economy and ecology of the area. I hope that our suggestions will be discussed, debated and refined so that a better way of managing this important ecosystem is devised soon.

Prabhat Patnaik  
Chairman,  
People's Commission on Vembanad Ecosystem

## **EXECUTIVE SUMMARY**

### **BACKGROUND**

The Vembanad kayal has been an integral part of Kerala's history, culture, economy and ecology. No precise estimate is available on the direct and indirect contribution of the Kayal to the economy at the local, state or national levels. From time immemorial people have been depending on the Vembanad ecosystem. However it is very clear that the supportive and assimilative capacities of the backwater have been stretched and there are clear evidences that the Kayal is undergoing fundamental changes affecting the provision of critical ecosystem services. Encroachments and other violations of various environmental regulations have significantly affected the estuary and its ecological functions negatively impacting the livelihood of people directly and indirectly.

It is in this context that the Kerala Sasthra Sahithya Parishath (KSSP) organized the Kayal Convention in September 2013 in Alappuzha. Taking note of the widespread decline of the ecosystem due to encroachments and environmental degradation, the convention constituted a People's Commission to provide an assessment of the situation particularly focusing on encroachments and other environmental issues and to recommend what needs to be done to restore the ecology, helping to improve the livelihood of people who have been traditionally dependent on the backwater. Key findings and recommendations based on the assessment made by the Commission are summarized below:

### **FINDINGS**

#### **A highly degraded environment**

The fact that Vembanad is undergoing severe environmental decline remains an undisputed fact. Every available evidence indicates a continuous degradation of the Vembanad environment, severely affecting the ecosystem services and consequently the lives of people. Almost all studies paint a picture of crisis affecting the area of the lake, its depth, biodiversity, and water quality and there are hardly anything that gives any indications to the contrary. Almost all those who participated in the FGDs confirmed the significant decline in environmental conditions. Ecosystem people in particular fisher folk, including those dependent on black clam collection are the most affected.

#### **Vembanad becoming an unliveable place?**

At the outset it became very clear that encroachment and violation of environmental regulations are just symptoms of a more fundamental problem and therefore there is a need to consider the larger changes in society-nature relationship over time and how we have reached the current situation. The collective impact of several drivers – including demographic, economic, technological and political – have brought about major changes in resource use. Overall there is a failure to reduce the negative impacts of certain drivers and to augment positive impacts. As such the quality of life of many people in the area has declined. Persistence of the present trends – the business as usual scenario –

will have far reaching consequences and the area will become an unliveable place for a much larger proportion of people.

### **From one crisis to the next**

While some of the interventions in the Vembanad kayal did have some short term positive impacts, the very nature of market driven developments have sown the seeds of one crisis after another. Large scale reclamation intended to expand rice cultivation reduced the extent of the Kayal significantly. The next round of agriculture intensification focused on productivity enhancement severely affected the hydrology and accentuated the pesticide-fertilizer linked pollution undermining the fisheries economy. Development of industries – traditional and modern - seen as a solution to the agrarian crisis worsened water pollution further undermining people's livelihood. Urbanization has further accentuated the crisis, especially as legal and illegal land conversions reduced the lake area and increased the pollution from residential and commercial establishments. Tourism development was envisaged as another way out of the crisis; however, notwithstanding all the discussions about responsible tourism, it is worsening the situation, especially as reclamation and illegal constructions spread and more pollutants are off-loaded into the lake. Further those who have been significantly affected continue to be excluded from the benefits stemming from tourism development. On the whole every effort to overcome a crisis has led to a new set of crisis.

### **The common thread of the crises**

In essence the capitalistic mode of production driven by markets fail to take into account the negative externalities. This is especially so considering that Vembanad estuary is an intensively used common property with contested/ conflicting demands. Almost all stakeholders are pursuing their narrow short term objectives which inevitably tends to ignore the impacts of their actions on other sectors and stakeholders. There are umpteen examples of how this has affected key ecological services like hydrology, water quality, biodiversity as also equity and livelihoods of people, especially those who continue to rely on the ecosystem services.

### **Decline in carrying capacity**

Undoubtedly the major challenge facing the Vembanad ecosystem is the continued decline in both the supportive and assimilative capacity, which together determines the overall carrying capacity. Technological changes have helped to increase the supportive capacity through enhancing productivity (most often short term) in some sectors (for example rice cultivation), but this has increased the dependence on external resources as also affected productivity in other sectors (for example fisheries). Of major concern now is the decline in assimilative capacity especially as the load of pollutants from diverse sources increase. This has further eroded the supportive capacity significantly. The impact of these are all there to see and manifests in several ways, including the health and vitality of the people.

### **Causes of environmental degradation**

In the ultimate analysis two most important factors responsible for environmental degradation are (a) an overall failure of governance in general and environmental governance in particular and (b) the

adoption of technologies that are economically unviable, socially inappropriate and ecologically unsustainable. As society evolves, its relationship with nature changes and this will require that governance systems and technological interventions are continuously refined and improved. In both these areas there have been significant failures and precisely the degradation we witness now is an outcome of such failures. In particular:

- The current system of governance driven by a plethora of departments/ agencies/ institutions, each focusing on their narrow domains ignoring the implications of their actions on others is the root cause of degradation of the Vembanad ecosystem. No systematic effort is made to undertake an assessment of the long term impacts of interventions. In the case of private investments, profitability remains the main consideration, encouraging circumvention of environmental rules and regulations.
- The overall commitment to pursue a path of sustainable development and to adhere to the various environmental policies and legislation is very weak. Failure to effectively implement policies and legislation is widespread.
- While most of the stakeholders are aware of the seriousness of the problem of environmental degradation, there is a strong tendency to put the responsibility on others.
- Often government departments/ agencies are themselves the major violators of environmental regulations through their acts of omissions and commissions.
- The oversight mechanism for checking violations including encroachment, unauthorized construction and discharge of pollutants is very weak and ineffective.
- Although some effort is being made to use more environment-friendly technologies – for example organic farming -, there are little incentives for their wider adoption. Narrow economic objectives determine the nature of technologies applied in all the sectors. Every key player using the Vembanad ecosystem is attempting to maximize their benefits degrading the ecosystem imposing costs on others.
- On the whole what we are witnessing is a typical “laissez-faire” approach notwithstanding the various pronouncements about sustainably managing the ecosystem.

## **RECOMMENDATIONS**

### **Reforming the governance system and social mobilisation**

Saving Vembanad ecosystem and ensuring that its economic, social and environmental functions are improved and sustained will require fundamental changes in the governance arrangements. The current system of fragmented governance (which in effect has encouraged a “laissez faire” approach) with no one taking responsibility to the totality of interventions and impacts will result in the rapid decline of the ecosystem. Key aspects that a governance system should strive to accomplish are:

1. Large scale social mobilisation ensuring that everyone takes responsibility in the upkeep and improvement of the ecosystem ensuring that they cannot continue on the “business as usual” path of using the ecosystem imposing costs on others.
2. Effective implementation of all the rules and regulations.

### **Institutional arrangements**

#### **Joint Committee of District Panchayaths**

Notwithstanding some of the draw backs of the system of governance under the Panchayathi Raj institutions, certainly it has considerable potential to provide a democratic foundation for ecological and economic revival of Vembanad ecosystem fully involving all the stakeholders. It is recommended that a Joint Committee of the Panchayaths be established as an Authority to manage the Vembanad ecosystem. All the activities that will directly and indirectly impact the Vembanad Lake should be brought under the purview of such an Authority. The Authority will be fully responsible for large scale social mobilization in support of revival of Vembanad.

#### Science and Technology Committee to enable science based interventions

Science has to play a key role in the use of a highly vulnerable ecosystem like Vembanad and the science-policy interphase needs considerable strengthening. To facilitate this a science and technology committee consisting of eminent scientists will be established. The Committee will be responsible for providing science inputs to all important decision relating to the management of the kayal.

#### A ten-year social mobilization plan for eco-restoration

The Joint Committee through a consultative process will develop a detailed plan for social mobilization for restoration of Vembanad ecosystem. This will specifically address issues like shrinkage of the lake including through encroachments, changes in hydrology, water quality decline on account of pollution/ effluent discharge and loss of biodiversity and what needs to be done to improve the livelihood of ecosystem people, in particular the fisher-folk. The action plan will provide details of how social mobilization can be accomplished.

#### Code of conduct

Restoration of the Vembanad ecosystem will require fundamental behavioural changes by all who are directly and indirectly using the lake. Certain activities will have to be totally prohibited while several others will have to be regulated. All key sectors and activities should abide by a code of conduct – Dos and Don'ts – developed through a consultative process. If required this may be formalized as Vembanad Ecosystem (Protection, Restoration and Sustainable Management) Act.

#### Identification of violations and legal action.

There is an urgent need to prevent further encroachments and to reclaim public land that has been encroached and illegally appropriated by individuals and institutions. A time-bound programme will be initiated to remove all illegal construction/ occupation in accordance with the provisions in the existing rules and all land/ water bodies that are public property will be brought to public control:

- Demarcation of the kayal boundary as per the revenue records;
- Identification of encroachments; and
- Eviction of encroachments.

#### A system for participative monitoring and reporting environmental changes/ violations

A key to the ecological and economic revival of Vembanad is an effective system for monitoring and reporting environmental quality changes. Modern technologies like satellite based monitoring to detect land use changes including encroachments and a network of sensors to assess water quality changes on a real-time basis are to be deployed. Ward and Panchayath level environment committees (which will have representation from local civil society organizations, students, teachers, etc.) will be established to encourage public participation in monitoring and reporting changes. An effective system for verifying reported changes in key environmental parameters and to take appropriate corrective action is to be put in place.

### **Adoption of an integrated approach to resource management**

Most of the problems pertaining to Vembanad relates to the fragmented approach to the management of resources ignoring the linkages between land, soil, water and biodiversity. Traditional low intensity integrated management systems have been replaced by intensive single use management aimed to increase profitability of a particular component. There is an urgent need to reinvent and improve multiple use resource management practices taking advantage of local knowledge and some of the ongoing initiatives like one rice-one fish systems. In fact the future direction of resource use should be to strengthen the integration between agriculture, fisheries, animal husbandry, small scale agro-based processing and tourism.

### **Financing ecological restoration of Vembanad**

Eco restoration of Vembanad will require efforts on the part of all stakeholders and it should not be dependent entirely on government funding. A wide array of funding arrangements needs to be deployed. In particular those who are commercially benefitting from the ecosystem services (in particular the tourism industry) and those who are polluting the environment will have to meet a major share of the ecological restoration costs. Other sources of funding ecological restoration will include:

- An annual budgetary allocation from the Kerala government;
- Project specific funding by state and central governments as also international organizations.
- Support from private industries in fulfilment of their CSR obligations;
- Voluntary contribution by individuals and organizations.

With effective social mobilization it should be possible to obtain in-kind support, including in the form of voluntary labour to undertake cleaning up degraded areas and to undertake ecological restoration. Putting in place a transparent, accountable and efficient governance system will help to mobilise most of the resources required from non-traditional sources.

### **Social control over natural resources use**

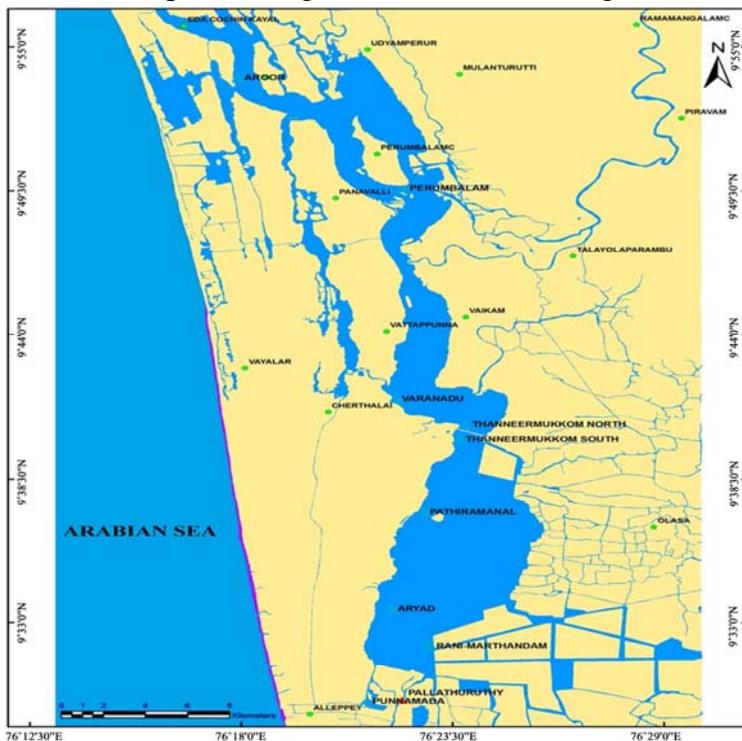
Sustainable management of an ecologically sensitive area like Vembanad would require effective social control over the use of natural resources like land, water, air and biodiversity. Market determined use by individuals will invariably generate externalities imposing significant costs affecting those who are already marginalised as also future generations. Policies, legislation and

institutions need to be reformed to ensure better social control in the larger interests of society as a whole and individual use of resources does-not impose any direct and indirect costs on society.

# 1. BACKGROUND

The Vembanad estuary or backwater is a unique ecosystem forming an integral part of Kerala's geography, history, culture, environment and socio-economic development. It forms part of the ecological continuum linking the Western Ghats and the Arabian Sea and has witnessed continuous changes in response to larger societal changes. Ecological changes in the Vembanad estuary is very much part of the transformation in society-nature relationship taking place locally, regionally, nationally and increasingly globally.

The issue of degradation of the Vembanad ecosystem and the adjoining areas has been a topic of many studies (see for example World Wildlife Fund 1987); yet a meaningful solution continues to evade and the pace of degradation is accelerating. What is happening to the Vembanad ecosystem is



a microcosm of the larger changes – especially on account of the multitude of large and small human interventions taking place in the entire Kerala. Influenced by several drivers – demographic, economic, social and environmental – complex changes have taken place altering the functions of the ecosystem. This is exacerbated by governance inadequacies. Many of the human interventions are having negative impacts making the place (and in fact Kerala) a less livable area. As elsewhere the ability of the ecosystem to support a healthy life is being undermined on account of the degradation of life support system components like water, air, soil and

biodiversity. The most affected by these changes are the ecosystem people, in particular the fisher folk whose dependence on natural resources is very high.

The Vembanad Lake is one of the most important wetlands in Kerala which fulfils vital hydrological and other environmental functions. The water body, although a revenue puramboke and thus a publically owned property, has for all practical purpose become an open access resource, subject to all kinds of unplanned uses. The social, economic and ecological functions are being severely undermined on account of encroachment and appropriation as well as severe pollution from a wide array of sources.

There is widespread concern about the ecological degradation of the Vembanad estuary and its impacts – both immediate and long term – on people’s livelihood. Human induced changes could eventually result in a scenario of accelerated ecological and economic decline of Vembanad. . The development path currently being pursued will worsen the environmental decline affecting livelihood of a large number of people and foreclose the options to provide a better and sustainable livelihood. . Of key concern is that the livelihood of the very poor – primarily the ecosystem people, in particular the fisher-folk (including traditional clam collectors), – who are dependent on the kayal are at the receiving end of the negative impacts.

Governments, both Central and State, have enacted a number of policies and legislation to protect the coastal areas, including the backwaters and wetlands. The CRZ notification of 1991 and its 2011 revision promulgated under the Environment Protection Act 1986 stipulate a zoning of the

coastal areas to regulate construction and other activities. In view of the intense human pressure and declining state of environment, Vembanad has been identified to be declared as a critically vulnerable coastal area (CVCA) as per the 2011 CRZ notification. (See Box1) Vembanad is already declared as an internationally important wetland under the Ramsar Convention. Vembanad also comes under the purview of the Kerala Paddy and Wetland Conservation Act 2008.

**Box 1: Coastal Regulations Zone Notification 2011.**

The CRZ Notification 2011 has listed Vembanad to be declared as critically vulnerable coastal area (CVCA). The 2011 notification stipulates that such declaration will be done through a process of consultation with local fisher and other communities inhabiting the area and who depend on its resources for livelihood. The purpose of declaring an area as CVCA is to ensure its conservation and sustainable management. The CRZ notification also stipulates the preparation of integrated management plans for sustainable management, again fully involving the local communities.

Further the CRZ notification makes a specific reference to the back water islands in the state. All islands in the backwater come under the purview of the CRZ notification and what are permitted and what are not have been specified in the notification.

Yet in practice environmental governance seems to be dysfunctional and violations of rules and regulations are rampant. Often government departments who should be abiding by the various regulations have become the

violators. Even judicial intervention at the highest level seems to be ineffective in stopping such violations. There are several examples of government complicity and omissions and commissions. Continued degradation of the estuary is a clear indication that there is something fundamentally wrongwith the present arrangements for environmental governance.

## 2. PEOPLE'S COMMISSION ON VEMBANAD ECOSYSTEM

### Composition and terms of reference of the Commission

Widespread violations of existing regulations, appropriation of resources for short term gains ignoring the long term costs to society, worsening pollution, deteriorating living conditions of people and the failure of governance to address these prompted KSSP to undertake an in-depth assessment of the situation giving particular attention to what needs to be done to reverse the environmental decline. On 8 September 2013 KSSP organized the "Kayal Convention" to assess the situation and to raise awareness about the deterioration of the ecosystem. One of the resolutions in the Convention was to constitute a People's

#### **BOX 2: Composition of the People's Commission**

1. Prof. Prabhat Patnaik, Chairman
2. Dr. Anna Mercy
3. Dr. P. Leelakrishnan
4. Dr. Srikumar Chattopadhyay
5. Dr. KG Padmakumar
6. Sri MG Radhakrishnan
7. Dr CTS Nair – Member Secretary

Commission to provide an objective assessment of the situation and to indicate the options to arrest degradation and to manage the ecosystem sustainably. (See Box 2 for the composition of the Commission). The Commission was requested to address the following aspects:

- Identify the nature of violations of the coastal zone regulations and other laws for protection of environment and biodiversity, in the Vembanad wet land ecosystem, and elaborate the purpose of violations, the beneficiaries of violations as well as those who are adversely affected.
- What could be the adverse long term impact of these violations on the economy and ecology of the region, as well as on the life of the people living there?
- Critically assess the impact of various on-going as well as proposed development activities being implemented by various government departments, including that of the local self-governments in the region, taking in to consideration the carrying capacity of Vembanad Ecosystem.
- Propose short term and long term measures for the eco restoration of the Vembanad wet land ecosystem and give suggestions and guidelines on how further development plans in various sectors may be conceived, taking into consideration the long term sustainability, equity environmental protection and carrying capacity of the Vembanad ecosystem.

### Approach adopted

The Commission pursued a broad-based consultative process seeking views and inputs from all key stakeholders. Innumerable studies have been undertaken on a wide array of issues relating to Vembanad and the Commission reviewed many of the important studies undertaken hitherto. These, though fragmented, provided a glimpse of the issues on diverse aspects in different locations at different times. In addition the Commission also ascertained the views of different stakeholders through a series of focus group discussions (FGDs). The FGDs helped to ascertain the views of farmers, fisher-folk, resort owners, house-boat operators, industries, women's groups, etc. A

summary of the FGDs is provided as ANNEX II. Several individuals and organizations provided written submissions outlining their views on the situation and suggesting what needs to be done for the ecological and economic revival of the Vembanad ecosystem (see ANNEX III for a summary of the written submissions). A survey of about 1250 households was conducted to assess key socio-economic variables that impact the state of environment of the Vembanad estuary. Brain-storming sessions with scientists working on different aspects gave an indication of the state of knowledge on environmental and other issues relating to long term changes taking place in the estuary and adjoining areas.

### 3. THE VEMBANAD ESTUARY

As pointed out earlier Vembanad is an ecological continuum and an open system (see Box 3). The water spread area changes seasonally depending on the volume of discharge from the rivers that feed

#### **Box 3: Defining Vembanad estuary**

Vembanad estuary forms part of the Vembanad-Kol-Wetland system, one of the Ramsar sites in Kerala. It is a complex aquatic system of 96km long coastal backwaters, lagoons, marshes, mangroves and reclaimed lands with an intricate network of natural and man-made channels extending from Kuttanad in the south to the kol lands of Thrissur district. Total area of the wetland system is 1521.5 km<sup>2</sup>.

There is considerable ambiguity as regards the area of the Vembanad Lake considering the changes it has undergone over many decades. As per a report on the wetlands of Kerala (KSCSTE 2007) the original area of Vembanad lake was 363.29 km<sup>2</sup>. A wide array of human interventions over more than a century has led to its reduction to about 37 percent of its original area and currently the extent of the lake is estimated at about 132.24 km<sup>2</sup>. The study on the carrying capacity of Greater Kochi Region gives a different set of figures: At the beginning of the 19<sup>th</sup> century the area of the Vembanad Lake was 440km<sup>2</sup> which declined to 210km<sup>2</sup> about a decade ago.

Evidently inconsistency in data, partly stemming from differences in the criteria used to define what constitutes the Vembanad estuary remains an important challenge. Clear demarcation of the lake based on revenue records would have helped to some extent while management would require giving due consideration to seasonal changes which depends on the volume of discharge from the rivers feeding the system.

Notwithstanding the difficulties in clearly identifying the lake boundary and its extent, there is wide acceptance of the fact that the lake area is shrinking due to various factors.

the system. What happens to the water body – both in terms of its area and the quality of water – is primarily determined by what happens in the area that drains into the estuary. One can draw a series of contours around the Vembanad estuary based on physical nearness, slope and possibly the degree of impact of differing intensity of human interventions. Physical nearness need not necessarily mean that such areas have the greatest impact on the estuary. People have lived and used the resources in and around the estuary for centuries without leaving any significant ecological foot-print. Recent decades have however witnessed changes in the nature of use and an acceleration of the pace of change. Some of the major ecological consequences of the change are:

- Shrinkage of the lake;
- Increasing frequency and severity of floods affecting the livelihood of people in many ways;

- Pollution and eutrophication;
- Loss of biodiversity; and
- Public health concerns especially as water logging and clogging of drains create favourable conditions for breeding of disease causing vectors (Ajayakumar Varma 2015).

All the above have a direct bearing on the nature and intensity of human interventions, especially bringing about fundamental changes in hydrology. Coupled with higher levels of pollution and loss of biodiversity – especially of fishes – all aspects of life have been impacted directly and indirectly.

## Hydrology of Vembanad

The unique features of the hydrology of Vembanad have been brought out in detail through several studies (a good overview of hydrology is provided by Gopakumar, CWRDM). As in the case of all wetland systems, the seasonality, duration and frequency of flooding are all the sum total of all the hydrologic inputs and outputs and these impact the wetland’s chemical and biotic processes. In the case of Vembanad the water system consists of the discharge from five major rivers – Achencoil,

### **Box 4: Deteriorating hydrological environment of rivers flowing into Vembanad**

The Central Water Commission Data for the five inflowing rivers to the Lake (Muvattupuzha, Meenachil, Manimala, Pamba and Achankovil) for 20 years from 1989-90 indicates that the river flow is declining both in the monsoon and non-monsoon seasons. Meenachil, Manimala and Pamba experiences declining rainfall and all the river basins indicate significant change in the land use pattern as well as water use practices reducing the conservation impacts. In general, the forested area got reduced from 59% to 30% whereas the extent of plantations increased from 27% to 40% and settlement increased from 13% to 34% over 30 years up to 2010. These basins combined have an area of 8394 km<sup>2</sup> and divided into 328 sub-watersheds and 634 micro-watersheds. In order to improve the hydrological regime, integrated watershed interventions are essential which is estimated to cost Rs.1200 Crore for the five basins

Source: Ajayakumar Varma, 2016. Eco-restoration of Vembanad Lake & connected river systems

Pamba, Manimala, Meenachil and Muvattupuzha - and the semi-diurnal tides from the Arabian Sea through the Cochin sea mouth. Some of the key hydrological features that have an impact on Vembanad ecosystem are:

- Almost 90 percent of the annual discharge from the rivers takes place during the monsoon months – June to November – and the remaining 10 percent during December to April. This enormous seasonal variation in flow is a major factor that impacts the entire wetland system, including the efforts to alter the flow pattern. During the low-flow period brackish water intrudes to the upper reaches, while during the rainy season this gets flushed through the high level of fresh water discharge from the rivers.
- Available studies indicate that interventions in the catchments of rivers that feed into the Vembanad Lake have reduced the inflow, with the largest reduction during the summer months (see Box 4).

The key parameters that determine the hydrology and thus the ecology of Vembanad backwater are:

- Long term climatic changes, especially in the rainfall pattern, including the number of rainy days, their distribution, intensity and so on;
- The changes in the inflow into the Vembanad lake which is influenced by changes in land use and other human interventions in the catchment; and
- In-situ interventions in the lake and adjoining area that affects the water-spread area, depth of water and a whole range of changes in water quality.

Without going too much into the details, there are clear indications that significant changes are taking place in the Vembanad estuary as indicated below:

### Changes in the extent and depth of the lake

Society nature interaction leads to the creation of very diverse land uses with varying direct and

Table 1: Area reclaimed for various purposes from Vembanad Estuary (Source KSSP 2013 )		
Period	Area Reclaimed (ha)	
	Agriculture, Shrimp farms, housing, etc.	Harbour and urban development
1883-1903	2226.72	
1912-1931	5253.15	
1920 - 1936		364.37
1941-1950	1325.00	
Till 1970s	5100.00	
1970-1984	800.00	
1900-1984	1500.00	
1978		10.78
1981-1985		319.04
2000		25.00
<b>Total</b>	<b>16204.87</b>	<b>719.19</b>

indirect impacts on human well-being, of both the present and future generations. Use of land and water in the Vembanad area is extremely diverse – rather it is a mosaic of uses – and is undergoing continuous changes altering the flow of goods and services. Almost two centuries ago, it was a large expanse of water body and associated lands which remained largely undisturbed. Human interventions – large and small as well as organized and less organized – have created a different land use mosaic that continues to change, affecting the livelihood of people directly and indirectly. Table 1 provides an indication of the area that has been reclaimed since 1893 and up to 2000. In 1912 the extent of Vembanad estuary was 315 km<sup>2</sup>, and by the 1980s it has shrunk to 179 km<sup>2</sup> (Gopalan

2002).

As such no updated information on the exact area of the Vembanad Lake is available. The post-2000 period has witnessed considerable changes, most of which is “unorganized” especially in the context of accelerating pace of urbanization. Most of the lake shore has become high value prime land, encouraging encroachment and reclamation for residential and commercial purposes.

There has also been a significant decline in the depth of the lake, largely due to siltation. Average depth in the Vembanad Lake south of Thanneermukkam bund is 3metres while the maximum depth being 8.5metres. Accelerated siltation of the lake bed is attributed to erosion in the provenance

zones of the river catchments accentuated by land use changes including deforestation, changes in crop composition and land use practices, destruction of hills through removal of soil and stones, etc. Dredging in the Cochin harbour to clear the shipping channel also impacted the siltation pattern. Consequent to the reduction in area and depth, the total volume of the backwater lying between Alappuzha and Azhikkode has been reduced from 2.45 km<sup>3</sup> in the beginning of 20<sup>th</sup> century to 0.56 km<sup>3</sup> in 1985 (Gopalan, 2002), a decline of almost 77 percent. Various estimates of sedimentation are available and all suggest a decline in the water holding capacity of the lake, which increases the frequency and severity of floods.

### Changing resource use pattern

Vembanad backwater has been the backbone of the region's socio-economic and cultural development and has played very diverse roles in the State's history. Long back it was a swampy area rich with mangrove vegetation brimming with biodiversity and forming the feeding and breeding grounds for several aquatic organisms, enriching the marine life even far beyond its boundaries. People have been largely relying on the area for small scale agriculture, and fishing typically adopting a "hunter gatherer" production mode. Towards the end of the 19<sup>th</sup> century and mid-20<sup>th</sup> century Vembanad area witnessed one of the largest land reclamation programme, encouraged and aided by the then government to address the acute food shortage. Kuttanad thus became the rice-bowl of the erstwhile Travancore state and later of Kerala on account of the large scale reclamation of the Vembanad estuary. The Thanneermukkam bund and Thottappilly spillway were constructed to regulate water flow and salinity to intensify rice cultivation.

Agriculture has not been the only activity that led to the drastic modification of the Vembanad estuary. Infrastructure development, initially in the form of building the Cochin port and subsequently a series of bridges brought about important changes in hydrology. Vembanad backwater also witnessed the impact of industrial development, with both small scale and large industries being established on the shores impacting the ecology of the backwater and the surrounding areas. With the abundance of coconut, coir production became a major industry in the area with its consequences on water quality, though this has declined considerably in recent years on account of technological changes. The portion of Vembanad backwater north Cochin became a centre of large scale industries with all the associated impacts of pollution.

As part of the coastal ecosystem the surroundings of Vembanad have become a centre of urbanization – rather rurbanization –making it one of the most densely populated areas in the country. Several large and small cities have grown and Kochi, Alappuzha and Kottayam along with several towns are expanding and coalescing creating a very large "rurban" belt surrounding the Vembanad Lake. This had a tremendous impact on the backwater ecosystem, especially on account of land reclamation – reducing the lake area with all the consequences on the hydrological processes - and the use of the backwater as a dumping place for all kinds of waste.

Almost all the above developments – agriculture, tourism, fisheries, industries, infrastructure, etc. - involved the alteration of the use of land and water. The most recent of such intervention is the

emergence of backwater tourism taking advantage of the scenic value of the area which attracted both domestic and international travelers. Backwater cruising has a long history, starting from early 1980s when modified “Kettuvallams” were used by tourists to leisurely cruise through the estuary. However, the nature of tourism underwent very significant changes in the post 2000 period with a string of resorts, hotels and home stays springing up on the shores of the backwater as also an increase in the number of houseboats, some providing high end luxury to visitors. If regulated effectively, nature based tourism is a sustainable activity as it is dependent on maintaining the natural assets – in this case the scenic value – in-tact. However, if unregulated, nature based tourism could rapidly overshoot the carrying capacity, undermining the quality of assets that form the very basis of tourism. There are early indications that this is already happening in the case of Vembanad backwater.

Impact of environmental change varies across different sections in society depending on the nature and degree of their direct and indirect dependence on the Vembanad ecosystem. Notwithstanding various socio-economic changes, there are still people who rely on ecosystem goods and services. Their life has been affected due to:

- Decline in fish catch affecting the livelihood of those who are traditionally dependent on fishing. Several factors including overfishing using fishing gears that virtually sweep the waters, accumulation of waste including residues of fertilizers and chemicals, changes in hydrology, etc. have collectively resulted in the decline of fish wealth.
- Impact on health of people on account of increased levels of pollution from diverse sources – including from far-away sources and urban centers (including pilgrimage centers) on the banks of rivers. In fact poor waste management is a widespread problem and Vembanad tends to accumulate a huge quantity of wastes from different sources. Accumulation of plastics is of particular concern. The quality of water has declined enormously during the recent years and there are no signs of improvement in view of the continued discharge of domestic, municipal and industrial waste.
- With the decline in water-holding capacity of the lake, the frequency, intensity and duration of flooding have increased, particularly affecting the marginalized people. Living in houses surrounded by highly polluted water most of the year has made life miserable for many people, who have no options. This is especially for the clam collectors. While the better off are able to safeguard their property through building bunds and filling up with soil, those who are unable to do so bear the brunt of flooding and in many areas flooding has changed from a seasonal event to a more regular phenomenon.

A major challenge facing the Vembanad backwater is that very divergent resource uses exist competing for the diminishing space and thus paving the way for severe conflicts. Environmental degradation is an outcome of the deficiencies – or total failure – of governance as diverse players compete for the limited resources in the pursuit of their narrow interests. Compartmentalized approach pursued by different players ignoring the impact of their action beyond their limited domains, has increased the conflicts between diverse uses. It is in this context that an attempt was made to examine what could be done to arrest the decline and to reverse the environmental

degradation of the Vembanad backwater. Certainly this is not an isolated problem and is rather widespread with its severity becoming intense in situations like Vembanad. In this regard let us examine how key economic activities are impacting the ecosystem and what options are being pursued to address the challenges.

#### **4. KEY ECONOMIC ACTIVITIES AND THEIR IMPACTS**

##### **Agriculture**

The Vembanad and its adjoining areas are characterized by diverse land uses of which agriculture still remain the most important. Broadly there are two farming systems – rice cultivation in wetlands and mixed tree cropping systems in the adjoining garden lands or homesteads. A wide range of agro ecosystems exist, shaped by specific social, economic and ecological conditions. Without going into the details of the different farming systems this report focuses on giving an indication of how the different systems have impacted the environment directly and indirectly.

Within the rice cultivation system there are two broad types – small scale cultivation taking advantage of the natural flow of water including in the inflow of brackish water and large scale cultivation requiring substantial investments to manage water, especially to prevent the inflow of brackish water during the summer months and pumping out water from the flooded farms during the rainy season when discharge levels in the rivers are very high. Much of the thrust of agriculture has been on rice, largely on account of the ease of management. However, there have been efforts to diversify and there is better understanding of the potential of integrated management, as in the case of the “one-rice-one-fish” system.

##### **Rice cultivation in Kuttanad and impacts on the Vembanad kayal**

One of the most important interventions in the Vembanad area is the reclamation of low lying land for rice cultivation. A major consequence of the rice-centric development of Kuttanad has been the physical loss of sizeable area of backwaters due to reclamation (Padmakumar et al 2007) The state has directly and indirectly aided such reclamation largely to overcome the severe food shortage facing the erstwhile Travancore. The environmental implications of land reclamation were not an issue at all at that time. A capitalistic/ feudal mode of rice cultivation evolved and flourished in Kuttanad making it an important area of rice production in Kerala.

Rice cultivation in the Kuttanad was highly labour intensive, especially in the context of erecting and maintaining polders and dewatering the fields. This encouraged the emergence of a system of bonded labour, ensuring that there is no shortage of workers during periods of peak labour demand. Several factors – political and technological – have contributed to changes in agricultural practices and there has been a shift towards less labour intensive practices and increased use of inputs like fertilizers and pesticides (see ANNEX IV). Construction of permanent polders and mechanized dewatering led to a reduction in labour requirements. Yet intensive rice cultivation in Kuttanad

continues to face a number of challenges (see Box 5), especially in the context of un-remunerative prices (largely decided by lower cost of production in other states) and a host problems such as:

1. High input prices and increase in labour costs made rice cultivation uneconomical. Emerging economic opportunities led to a large number of people moving out of agriculture and the severe labour shortage led to the abandonment of cultivation and fallowing the land.
2. Overall decline in soil quality.
3. Poor water management and environmental problems stemming from pollution.

Declining economic viability has led to fallowing of land as also a shift away from rice cultivation.

**Box 5: Intensification of agriculture and its impacts**

“The current condition of Kuttanad requires a serious examination of ecological and economic viability of intensification of wetland agriculture. The extent of infrastructure developed in the region is way beyond what a wetland can sustain. The trade-offs in terms of impacts on biodiversity and foregone wetland functions as ability of regulating floods are apparent”.

Source: Wetlands International 2013 (page 24)

However there are some recent trends as regards revival of agriculture, especially on the following lines:

- Mechanization is helping to overcome labour shortages and there seems to be a general trend towards an increase in the extent of rice cultivation especially as land preparation, planting and harvesting are being mechanized.

- Increased awareness about the adverse impacts of intensive use of

fertilizers and pesticides has encouraged a shift towards a reduction in their use and some early beginning of organic farming.

- Contract farming through leasing land from owners who for various reasons are unable to cultivate the land.
- Enhancing economic viability and ecological sustainability through more integrated approaches: Systems like “one- paddy-one fish” offers immense potential and finding wider acceptance (see Padmakumar 2001).

A key issue being debated is the impact of large water management structures like Thanneermukkam bund and the Thottappally spillway. Both have been major public investments aimed to boost rice cultivation in Kuttanad. However, there is increasing concern about their role in enhancing agricultural production, and the negative impacts, especially on fisheries, are becoming more evident. Assessment of the trends in the use of insecticides/ herbicides/ fungicides suggest some positive trends. However the use of integrated pest management practices remains very limited. By altering the natural hydrology, the flushing process has been disrupted leading to a multitude of problems. Accumulation of fertilizers and pesticides in the area south of the Thanneermukkam bund and the reduction in fishery resources are major problems. During the focus group discussions many, especially fishermen, emphasized the importance of keeping the shutter opened throughout the year to restore the natural salinity gradient and thus to enhance the fish stock. This is an issue that requires more in-depth studies, including ecological modeling to assess the

probable scenarios of keeping the bund open for extended periods and its economic, environmental and social implications.

### Pokkali rice cultivation

Another important land use in certain areas adjoining the Vembanad Lake is the seasonal rice

#### **Box 6: Pokkali rice cultivation**

The coastal lands comprising the river mouths and deltaic formation for unique lands often up to 1.5 metres below sea level subject to saline water intrusion, especially during the summer months. While the base is acidic, salinity caused by brackish water creates a unique ecosystem, which has led to the development of salinity tolerant cultivation of rice known as pokkali. The unique cultivation practice involves natural leaching of salinity and the use of salinity tolerant rice variety taking advantage of flushing of the soil by rains. . The extent of Pokkali lands is estimated as about 24,000 ha of which about 7,000 ha is under cultivation. Pokkali lands are distributed in Ernakulam (Kanavannur and Paravur taluks), Thrissur (Thrissur and Kodungallur taluks) and Alappuzha (Sherthalai Taluk) districts. The unique system of rice cultivation using salt and flood tolerant variety involves very little inputs of fertilizers and pesticides and for all practical purposes can be regarded as a natural organic cultivation. The huge quantity of organic matter forms the basis of shrimp farming after the rice crop is harvested.

cultivation primarily taking advantage of the seasonal changes in salinity. Pokkali rice is salt and flood tolerant and has immense potential in the coastal areas especially in the context of the anticipated sea level rise due to climate change. There are many examples of successful ecologically viable pokkali cultivation in the Vembanad area, especially towards the northern part. Salinity tolerant rice in combination with shrimp farming is found to be an appropriate option (see Box 6).

As in the case of all labour intensive activities, Pokkali cultivation is also facing challenges on account of labour shortages and increasing wages. Also considering the limited area available for cultivation, Pokkali cultivation is unlikely to form an important means of livelihood for any significant proportion of the population. There is however a need to sustain Pokkali rice cultivation in the limited area available as a unique farming system keeping in mind its potential to provide an ecologically viable alternative in the context of sea level rise and to preserve the genetic material of salt tolerant rice. Technological options for sustaining Pokkali cultivation needs further studies.

### Garden land cultivation

Homestead cultivation mostly consisting of mixed tree cropping with coconut and other horticultural crops forms another important component of agriculture in the area. Within this broad type, enormous variations are found reflecting the divergent environmental conditions (mainly related to soil and moisture variations), but more due to the differences in the socio-economic conditions of the land owners. Coconut has been one of the dominant crops in the home gardens in and around the Vembanad backwater and there are also intensively managed multiple cropping farms producing

several products. Some of the important issues relating to the use of these dry lands that impact the Vembanad backwater are outlined below:

Conversion of the garden lands into residential and commercial areas is one of the most important change taking place, especially as urbanization advances. Almost all the garden lands are under

#### **Box 7: The rise and fall of the R Block**

In the centre of Vembanad lake was a group of dyked paddy fields, where they cultivated summer paddy after dewatering the area. During the monsoon season flood waters will go above the dykes and fill the fields. When the flood recedes below the dyke level, the area is dewatered and cultivated with paddy. The operation was risky as often the dykes made of mud fail and the crop is lost. The ground level is 1 to 1.5 metres below the sea level. A group of land owners from one such dyked area came up with an ambitious plan and decided to raise the bunds above the maximum flood level, strengthen it by increasing the width to 3 metres and more and protecting it with granite retaining wall at places. The idea was to continuously pump the water from inside and keep the land dry forming canals and ridges. This was done with substantial government support. A wide array of horticultural crops – coconut, arecanut, banana, cocoa, mango, etc. - were planted and within a few years the scenery changed beyond recognition. R block became a symbol of prosperity on account of the high yield of various products. The area could support over 3000 toddy tappers and more than one thousand families of workers settled in the area. The income from the area created a vibrant economy making R block a model to be emulated.

A number of drivers however brought about fundamental changes in the R block economy. Most of the children of the farmers in the area got educated and moved out in the pursuit of other professions. At the same time the ageing farmers were unable to pay the required attention for maintaining the area. Crash in coconut prices and the stoppage of government support for dewatering created havoc with the farming system resulting in its collapse. The owners virtually abandoned the area. Many of the land owners sold the property to speculators who had no interest in agriculture. The small holders could not even repair the pumps nor pay for the electricity. Thus an area which was once a model of intensive multiple cropping collapsed on account of a combination of factors – economic, demographic and institutional.

Contributed by MP Parameswaran

private ownership and are subjected to changing markets for land and products. The change from joint families to nuclear families, boom in land values and the high liquidity, especially in the context of increased inflow of remittances all have contributed to land use changes with the attendant impacts on the Vembanad estuary.

Yet there are also efforts to intensify mixed cropping and there are several examples of such initiatives, some of which are linked to farm-based (or home-stay based) tourism (For example Philipkutty's Farm). Mixed farming systems are labour intensive and its economic viability depends on several factors, most notably the input costs and the price of products. Some of the notable success stories (for example R block – see Box 7) have collapsed on account of various institutional, ecological and economic factors.

## **Below-sea level farming in Kuttanad: A heritage farming system of global relevance**

Notwithstanding the overall decline witnessed in agriculture and that agriculture seems to pass through from one crisis to another, there are hopes for revival and it is possible to visualize a brighter future, making land use economically viable, socially relevant and more importantly ecologically sustainable. Rice cultivation in most of the area is done below sea level and in the context of climate change triggered sea level rise the farming system in the area is receiving global attention. In 2013 the Food and Agriculture Organization of the UN has designated Kuttanad agriculture as a Globally Important Agriculture Heritage System (GIAHS). It is one of the 26 sites in the entire Asia-Pacific region and one of the three in India. An integrated approach linking diverse sectors – rice cultivation, horticulture, fisheries, animal husbandry and farm tourism - provides a unique opportunity for economic and ecological revival. As part of the GIAHS initiative an International Research Centre for Below-Sea-Level-Farming has been established, which has considerable potential to provide alternative models of natural resource use to address emerging economic and ecological challenges.

### **Fisheries including clam collection**

Given the vast expanse of water linking the rivers and the sea and the seasonal changes in water

#### **Box 8: Impact of Thanneermukkam Bund on Fisheries**

“Prior to the construction of the Thanneermukkam barrier, the entire Vembanad Lake was a single continuous aquatic habitat for foraging to the fry of marine prawns and fishes. With the commissioning of the salinity barrier and also due to large scale reclamation, the total area got reduced to 50 percent of what existed earlier, thus bringing about a spectacular difference in the production pattern, migration, etc. of animals in the upstream regions of the lake.

The barrage remains closed during December to May restricting the tidal influence in the southern sector of 8300 ha of water spread area into a stagnant system. The stagnant period is marked by low concentrations of dissolved oxygen and high sulphide and nutrient accumulation all along the peripheral areas receiving run-off from agricultural fields and domestic sewages”.

NEERI, 2003 – page 4.1.24

flow and salinity, fishing has been probably the most important means of livelihood for a large number of people living in the area surrounding the lake. Abundance and quality of aquatic life is very much dependent on natural and anthropic processes and fishing has been one of the most affected by the multitude of changes that have taken place in the area including in the distant upland catchments. The most notable of this is the decline in fish stock and declining catch stemming from the collective impact of several anthropic factors. Some of the causes of decline in fishery resources are as follows (NEERI, 2003 See Box 8):

- Changes in ecosystem brought about by the construction of dams, barrages, reservoirs etc. and in the case of Vembanad changes in the ingress of saline water, and the prevention of upstream migration of fish for breeding (see Padmakumar et al);

- Reclamation of backwater reducing the water spread area;
- Dumping and disposal of industrial and domestic wastes into the estuary;
- Coconut husk retting has led to high levels of BOD, low oxygen and high levels of sulphide. With the decline in coir industry and changes in the retting technology, this is no more a serious problem;
- Prolific spreading of *Salvenia* reduces primary productivity and dissolved oxygen concentration;
- Periodic dredging operations conducted in different parts of the lake increase turbidity, affecting primary productivity, fish health, etc. Dredging also destroys the bottom fauna which forms the food of some of the fishes.
- Stakenet fishing indiscriminately filters juveniles and fingerlings from backwaters.
- Fishing using explosives and poison is also rampant, and this results in large scale death and decline in fish stock.

Openness of the system makes it extremely difficult to assess the stock of fish resources; yet several studies have highlighted the decline in the fish stock largely based on data relating to fish landing and other evidences. This is further corroborated by representatives of fishermen associations as also the fisher folks during the focus group discussions. Given the very high population density and the multitude of interventions that have led to changes in hydrology and water quality, a decline in the fish stock and catch seems inevitable.

The impact of decline in fish-stock and catch has varied depending on whether those dependent on the fishing have been able to diversify their sources of income. Shortage of fish along with the emergence of more remunerative employment opportunities have led to a reduction in the number of people who are primarily dependent on fishing. However, there are still those who continue to rely on fishing and clam collection partly because of their limited ability to shift to new income earning opportunities. For them it is still largely “a hunter-gatherer’s existence”. Information collected during the focus group discussion suggests that most of them are predominantly older people with a high proportion being women. They seem to be the most affected by the environmental degradation, especially on account of the reduction in fish stock and other factors like water pollution, spread of water-borne diseases, flooding and so on.

### **Industrial development**

The areas adjoining the Vembanad backwater has been one of the very early centres of industrial development in Kerala. Largely this is related to the connectivity of the area, particularly the development of Kochi port and the railway and road networks. Early industrial development was largely agro-based – especially coir and fish processing, rooted in local resources – locally procured raw material and labour. Also early industrial development was dominated by small enterprises considering the dispersed nature of labour and raw materials. This also led to a situation where environmental problems were widely dispersed – for example the pollution from coconut husk retting.

The nature of pollutants and the level of concentration changed significantly with the establishment of large chemical industries – especially fertilizers, insecticides, mineral processing, etc. - and vast tracts of land and water have been affected (the typical example being the Eloor-Kalamasserry industrial belt) creating havoc with the lives of people. Here again the distribution of costs and benefits has been uneven – most of those dependent on traditional activities like agriculture and fisheries have been adversely affected while most of the benefits have gone to the owners and workers in the industries. There was a strong interest (from the government, managers and workers) to support industrial development notwithstanding their adverse environmental impacts and any effort to regulate them is interpreted as “anti-development”.

On the whole the commitment to implement rules and regulations aimed to reduce industrial pollution have been extremely poor. In an environment where key decision makers including political parties, government departments, investors and trade unions are pushing along a path of development that relegates environmental concerns to the background, industrial pollution, irrespective of its source, seems inevitable. When profitability remains the main priority, environmental externalities are ignored or at best patchy efforts are pursued often to temporarily pacify those affected. There are no systematic efforts to address the root causes of the problem. The current situation suggests that existing enforcement mechanisms are not very effective. There is considerable reluctance for compliance of air and water pollution control regulations and to implement the “polluter pays principle” based on an effective system of monitoring.

## **Mining**

Though not very extensive, dredging of white lime shell also adds to the problems confronting the Vembanad ecosystem. White lime shell dredged from the area is an important ingredient of white cement produced by Travancore Cements Ltd., a public sector undertaking. Studies reveal that the lime shell mining during the past few decades has already crossed the reported reserve in the lake. Mechanised dredging of white clams affect the benthic environment of lake, particularly affecting the breeding of black clams and certain fish species. Here again the industry is more focused on its immediate objective and much less concerned about the social and environmental impacts. There is a need to undertake a high resolution resource survey assess the lime shell deposits of the basin, estimate what can be sustainably collected and more importantly how to make it socially and ecologically viable and sustainable.

## **Tourism**

Tourism has emerged as an important economic activity in and around the Vembanad estuary, especially during the last two decades. Backwater tourism is the main attraction in Kerala for 20 percent of the foreign tourists and 15 percent of the domestic tourists. The kind of tourism being promoted in and around the Vembanad backwater is dependent on the unique scenic beauty, especially the lake and the associated network of canals, diverse land uses and the relatively pristine environment. Certainly nature based tourism helps to protect the natural environment intact and at the same time creates better opportunities for livelihood. In a way nature based tourism is often

considered as a win-win option, creating livelihood opportunities without impacting the environment drastically.

However this is not always the case and there are instances where uncontrolled tourism has led to severe environmental degradation as also failing to improve the livelihoods of people. In the Vembanad area tourism related environmental impacts can be broadly grouped into:

- Those arising from the building up of tourism infrastructure, especially hotels, resorts and associated facilities; and
- Environmental impacts stemming from the day to day operation of the facilities, including the operation of houseboats (see Box 9).

**Box 9: Twin challenge: Illegal boats and pollution control**

“Officially there are only 634 houseboats in Alappuzha. But a surprise inspection by a squad under the Alappuzha collector three months ago seized 38 houseboats that did not have valid licence. Though these vessels can be reclaimed by owners after paying a fine of Rs.30, 000 very few pay the amount.

“It is a largely unregulated sector and we have over 1000 houseboats in Alappuzha. It has come to our notice that two to three house boats are operating under a single license number” said Alappuzha collector, N Padmakumar.

Despite an order in 2013 that banned the addition of new house boats in the Vembanad, more vessels were added illegally. Almost 35% of the houseboats are illegal. “Two years ago, only 470 house boats were registered. Now it is 634. However there is no record of the number of persons using houseboats both licensed and unlicensed.

“Kuttanad has paid a very heavy price in the name of tourism. Engine and toilet waste are still dumped in the Vembanad and authorities just turn a blind eye till there is a tragedy” said Alappuzha panchayat president Pratibha Hari”

**Source: Times of India, Monday March 9, 2015 page 4**

During the last two decades there has been a rapid expansion of tourism related infrastructure, especially resorts and hotels, small and large. In the process there has been allegations of encroachment of public property, including the lake. Also in some cases tourism related infrastructure development has violated existing environmental regulations, most notably the CRZ rules as also the Paddy and Wetland Conservation rules. Resorts have come up totally violating environmental regulations and it seems that even judicial intervention at the highest level is not making any significant impact. Filtration ponds and mangroves have been reclaimed totally disregarding the provisions in the CRZ notification (see Figure).

land and violation of environmental regulations, generation and disposal of waste from resorts and other facilities remains a major problem.

Apart from encroachment of public

**Transformation of Nediyaamthuruthu Island in Vembanad kayal – 2006 and 2015**



This is of course not an exclusive problem of the tourism sector. Although resorts and house-boats claim to have established waste treatment systems, there is no guarantee as regards their effectiveness. The problem is particularly severe in the case of houseboats, which often dump the untreated waste directly into the water as pointed out by many who participated in the focus group discussions. The carrying capacity of the lake as regards the number of house boats that can be supported by the ecosystem needs to be assessed and there is concern that the number has already far exceeded the carrying capacity (see Box 10).

Most of the problems related to tourism related infrastructure development – one of the widely discussed one being that related to the sea-plane project – pertains to the competition for space and the concern that in a situation of limited resources, any new activity or expansion of an ongoing activity could have adverse impacts on people’s livelihood. These activities could be either in privately owned land or in common land (as in the case of water bodies that are often encroached or for which formal approval is obtained). Quite often what may be considered “legal” in a narrow sense could have adverse impacts on other people. Many are typically activities that generate private profits at public costs. Circumventing environmental regulations has become a relatively least-cost

option and in many cases environmental rules and regulations enhance rent-seeking opportunities rather than actually addressing the problem.

**Box 10: Carrying capacity of Vembanad Lake as regards the number of house-boats**

The rapid growth in house-boat based tourism requires a detailed assessment, especially as regards the carrying capacity of the lake giving due consideration to the multiple uses of the backwater. Some of the available studies suggest that the supportive and assimilative capacities have already been exceeded significantly (see Rajan et al 2011). The optimum boating density is dependent on several site-specific factors. The assessment made by Rajan et al adopts a boating density of 50 acres (20 ha) per boat. Giving allowances for shallowness and other factors, the usable surface area in the case of Vembanad is only about 65 km<sup>2</sup>, which implies that at any given time only about 130 boats can use the area. Though this estimate may require refinement, it still clearly indicates that the present number of over one thousand boats far exceeds the carrying capacity of the lake.

No doubt tourism has immense potential to improve livelihoods considering that it is one of the fastest growing sector with very high employment potential. Tourism has in fact brought about vibrancy to the local economy in a place like Kumarakam, especially in a situation of declining agriculture and fishing. Environmental damage can be significantly reduced if tourism is regulated and environmental

regulations are strictly adhered to. However in a situation of resource scarcity, tourism does have a number of negative impacts especially on many traditional activities. What matters is how the costs and benefits are distributed. While resorts, hotels and houseboats create more employment, the local people are not always the gainers from such opportunities. Economic compulsions have led to increased use of labour from outside Kerala and to be competitive the industry has to cut costs, especially in a situation where poor public infrastructure like water and electricity supply and the state of public infrastructure enhances the costs of operations. Most of the hotels and resorts operating in the area have to obtain essential inputs like water from far away sources increasing the

operational costs. Uninterrupted power supply is also a problem. Operating in such a situation, improvement of environment becomes a low priority.

While the vast expanse of water is the most important attraction, increasing pollution is precluding any recreational activity involving direct contact with water. There are already indications of the current approach to tourism entering into a phase of economic and ecological crisis. While it has led to some apparent signs of prosperity, the ecological conditions of the Vembanad Lake have only deteriorated. Further most of the benefits from tourism have been garnered by a small proportion of the people while those who have been marginalized by the developments in agriculture and industrial sectors continue to be marginalized. Impact of efforts to introduce responsible tourism have been at best marginal. A detailed assessment of this has been carried out as regards Kumarakam, the most important hub of tourism in Vembanad (see Vidya Rangan 2011). Unless there is a significant effort to improve the situation, Vembanad will be missing an opportunity that could help in its economic and ecological revival.

There is however increasing pressure from various quarters to improve sustainability of tourism,

**Box 11: Violation of CRZ regulations on the banks of Chilavnnur Kayal**

Chilavannur kayal is part of the Vembanad estuary, a major part of which lies in the Kochi Corporation area. Being part of the Corporation, the water front area along the Chilavannur kayal is one of the most sought after area for real estate development especially luxury apartments and villas. In the process filtration ponds and inter-tidal areas have been encroached and transformed violating the CRZ provisions. Encroachment into the backwater started in the 1980s, which accelerated during the last 10 years. A vigilance enquiry is in progress as regards several apartments many of which have been constructed illegally including violating the floor space index/ floor area ratio stipulated in the CRZ. Obviously this suggests the existence of a powerful nexus of builders, officials and political leadership who have little concern for environmental protection.

especially as the key players in the tourism sector become more concerned about protecting the environment, the very basis of existence of tourism. Opportunities exist to build strong linkages with local economy and there are some early efforts to implement responsible tourism. However considerable uncertainty prevails as to the directions in which the tourism in the Vembanad area will evolve – whether it will follow a more environment-friendly and socially appropriate path, fully involving the local communities, or whether it will be primarily a profit driven path spearheaded by large investors who

are often compelled to cut corners ignoring ecological vulnerability and socio-economic conditions of people in the area.

## **Urbanization and development of infrastructure**

Abutting one of the most rapidly expanding urban area, Vembanad has been subjected to intense changes on account of urbanization and associated infrastructure development. Major reclamation of Vembanad backwater has taken place in Kochi Corporation, Maradu Municipality and the nearby grama panchayaths. Kumarakam and Alappuzha are the other areas where large scale reclamation has taken place. Filtration ponds and inter-tidal zones have been reclaimed for construction of apartments, villas, and resorts (see Figure). Some 101 cases of CRZ violations have been reported



from Maradu Municipality alone during 2002 to 2013 and most of the constructions have taken place in the inter-tidal zone reclaiming filtration ponds and mangrove areas. Parallel to this there have been increasing pressure to expand urban infrastructure – especially for transportation – resulting continued reclamation. In the process mangroves have been cleared and mangrove buffer zones encroached upon (see Box 11).

## 5. VEMBANAD – FROM ONE CRISIS TO THE NEXT

While public concern about widespread violations of environmental regulations (especially of CRZ and Paddy and Wetland Conservation Rules) and their implications were the “raison d’être” for establishment of the Commission, soon it became very clear that such violations are essentially symptoms of a much larger and complex problem. Of critical concern is whether the way Vembanad is being managed will enable the area to remain a livable place now and in the future. Already there are clear indications to the contrary. A multitude of human interventions, past and ongoing, purportedly done in the name of development, have brought about major changes in the ecosystem, undermining key life support system components, especially water land (soil) and biodiversity.

Long term survival of any society depends on three critical pillars namely (a) economic, (b) social and (c) environmental. In the context of Vembanad ecosystem, it is important to consider whether the different human interventions have been:

- Economically viable in the long term in a broad sense taking into account the entire range of costs and benefits accruing to the present and future generations.

- Equitable and just, ensuring that those who are socially and economically weaker are benefitting from the interventions or whether the interventions are in fact undermining their livelihood; and
- Sustainable such that the ability of Vembanad ecosystem to provide environmental goods and services for future generations are not undermined.

In this context it is pertinent to consider whether the area would have supported an increase in human population in the absence of interventions like land reclamation, infrastructure development, establishment of industries and more recently tourism-related investments. Certainly without human interventions in nature, society would not have reached its present stage of development; but that doesn't mean that the environmental impacts are to be ignored. Environment and socio-economic development are inseparable and all environmental issues have an economic dimension, directly and indirectly affecting human welfare. .

The prevailing vision of development however primarily focuses on immediate economic benefits and consider environmental concerns as a barrier in the pursuit of progress. Ultimately what matters is the livelihood and well-being of the present and future generations ensuring both inter and intra-generational equity. Keeping nature in its pristine state without any human interventions would have maintained the carrying capacity of the Vembanad ecosystem at very low levels and it would have been impossible to support the burgeoning population without interventions. Therefore modification of ecosystems is unavoidable, but it has to be ensured that this in no way directly or indirectly undermines the carrying capacity, both now and in the future.

Notwithstanding the socio-economic importance of the Kayal, there has been very little effort to make a holistic assessment of the sustainability of various interventions. The National Environmental Engineering Research Institute (NEERI) in collaboration with other institutions including KSSP conducted a study on the carrying capacity of the Greater Cochin region (including Vembanad) during 1998 – 2003 (see ANNEX IV for a short summary – NEERI 2003). Carrying capacity studies have also been undertaken in the case of certain sectors like tourism (for example the optimum number of houseboats that can be operated in the backwater). In general carrying capacity assessments focus on two aspects, namely (a) supportive capacity based on primary production, and (b) assimilative capacity, especially to absorb the waste generated from production and consumption. A wide array of approaches – technologies – are deployed to enhance both the supportive and assimilative capacities. But beyond a point it becomes difficult to augment the supporting and assimilative capacities, thus leaving significant ecological foot-print. It seems that such a situation has already reached in the case of Vembanad Kayal and the adjoining areas.

In the early stages of development primary production was largely dependent on natural processes. Fertile soil brought by various rivers formed the very basis of agriculture production. Essentially carrying capacity relied on integrated use of all natural resources and not just one component. Responding to the increasing demand, agriculture development at a later stage began moved along a path of intensification of one component – in this case rice cultivation – adopting the “green

revolution package” which not only undermined integrated land use practices, but also led to cascading negative impacts.

Subsequent pathways of development especially through industrialization and growth of the services sector brought about fundamental changes in the supportive and assimilative capacities. It was thought that industrial development and later tourism will help to address the crisis in the agriculture sector. Early industrial development centered on traditional industries like coir was very much linked to local productive capacity, although it raised challenges in terms of the assimilative capacity of the environment in terms of pollution. Dispersed small scale production to some extent helped to reduce the negative impacts of pollution. Development of large scale industries and urbanization, however brought about major changes in the carrying capacity of the area. While dependence on the supportive capacity of the ecosystem – essentially in terms of primary production – declined drastically (especially as most of the consumption is sourced from outside the area), production and consumption severely strained the assimilative capacity of the system. Pollution from industrial and services sectors and household and municipal waste is exacerbating the problem.

Tourism development is currently seen as a way out from the economic and ecological crises facing the agriculture and industrial sectors. However the path being pursued by tourism sector – notwithstanding the lip-service being paid to responsible tourism – is adding to the problem. Scenic value of Vembanad including the mosaic of land uses is the most important asset for the tourism sector. However being a “public good” very little attention is being paid to protect and nurture this ecosystem service. Profit driven tourism sector is focused on keeping the costs low and this would suggest that we are already at the door-step of the next round of economic and ecological crisis.

These crises are manifesting in various ways including acute shortage of potable water for domestic uses, increasing incidence of pollution related health problems, severe flooding (whose frequency, severity and duration have increased), etc. Invariably the socially and economically weaker sections in society are the most affected by environmental deterioration. Many developmental activities have curtailed the access of ecosystem people to natural resources; at the same time many of them have not been able to take advantage of emerging opportunities or excluded. As elsewhere in the case of Vembanad also the capitalistic mode of production focused on maximizing private profits is sowing the seeds of a series of crises adversely affecting people and environment.

There are indications that many of the interventions in the Vembanad area have failed to pass economic viability, equity and environmental sustainability tests. The problems are compounded on account of major uncertainties like (a) climate change and (b) market vulnerabilities in a globalized environment. Most of the grandiose projects and programmes implemented have rarely been viable even in the narrow economic sense. Those who are socially and economically weaker are losing out in terms of meeting their livelihoods especially as availability of and access to resources decline. Worsening environmental problems are adversely affecting the health and vitality of people accentuating their slide into poverty and deprivation.

The Kuttanad Package developed by the MS Swaminathan Foundation is probably one of the most comprehensive proposals hitherto aimed at the ecological and economic revival of the area forming part of the Vembanad kayal. (MSSRF 2007). The report underscores the centrality of ecological revival in addressing the economic distress faced by people, especially farmers and fisher folks in

the area (see Box 12).

Unfortunately implementation of the package is facing many challenges and there are indications that essentially it is becoming an “engineering solution” focused on civil construction ignoring complex ecological, economic and social issues. Evidently the package ignores the complex governance challenges, especially in a situation of contesting demands on resources (KSSP 2011).

There is therefore an urgent need to pursue an alternative path of development which is people and environment friendly ensuring that the place remains a livable area

for both the present and future generations.

## 6. DRIVERS OF CHANGE AND ENVIRONMENTAL DECLINE

There are several factors that collectively impact the Vembanad estuarine environment, modifying the society-nature relationship, altering the flow of goods and services. The most important of these are (a) demographic changes, (b) economic changes, (c) changes in political and social environment, impacting policies, legislation and institutions that govern society-nature relationship and (d) developments in science and technology. Undoubtedly the political environment and how individuals, groups and society as a whole define and pursue their goals of development have an overwhelming impact. The relative roles of the different drivers will differ depending on the context and time. What may be a key driver at any given point of time will cease to be so in a different context and time. For example, population growth could have a significant impact on resource use in the context of technological stagnation and inappropriate and ineffective policies and institutions.

### **Box 12: Recommendations and thrust areas of Kuttanad Package (MSSRF 2007)**

#### **A. Strengthening ecological security**

- Task 1: Protection and ecological restoration of the water-spread area
- Task 2: Measures for salinity and flood management in Kuttanad
- Task 3: Measures for pollution control.
- Task 4: Total elimination of aquatic weeds.
- Task 5: Measures for augmenting biodiversity in the backwaters.
- Task 6: Improving health and sanitation

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

- Task 7: Declaring Kuttanad as a Special Agricultural Zone
- Task 8: Provide infrastructural support to paddy cultivation.
- Task 9: Enforce a crop calendar
- Task 10: Strengthening research and extension.
- Task 11: Strengthening economic viability.
- Task 12: Coconut based enterprises and integrated farming.
- Task 13: Actions to promote fishery wealth of Vembanad Kayal.
- Task 14: Promoting fishery infrastructure capacity and fishermen’s welfare
- Task 15: Infrastructure support to facilitate responsible tourism

In the context of Vembanad, demographic factors, especially the high population density, and the rapid pace of urbanization will remain major factors impacting directly and indirectly the Vembanad estuary and the surrounding areas (See Box 13). As per the 2011 census the population density in

**Box 13: Drivers impacting Vembanad estuary**

“Among the wetlands of Kerala, Vembanad is the most affected as a result of urbanization and population growth, industrial development, agriculture and aquaculture, services, water transport, tourism etc. An analysis of the population data reveals that the population density in the area stands at 3000 persons/ km<sup>2</sup> (Census 2001). Areas like Kumarakam, Njarakkal, Vypin, etc. are swiftly urbanizing. These areas and the urban centres like Kochi, Alappuzha, Cherthala, and N. Paravur are expanding at the expense of Vembanad wetlands.

KSCSTE 2007

the Panchayaths surrounding the Vembanad (including Kochi Corporation) varies from 438 in Kumarakam to over 6400 persons/ km<sup>2</sup> in the case of Kochi Corporation. Thirty seven out of the 45 Panchayaths (including municipalities and Kochi Corporation) have population densities of over 1000 persons per km<sup>2</sup> and there are many Panchayaths where the

population density exceeds 3000 persons/ km<sup>2</sup>. In addition to this, economic activities are bringing in substantial number of non-residential/ floating population straining the carrying capacity, especially as regards the ability of the environment to assimilate waste.

With the rapid pace of urbanization, the population density is bound to increase, notwithstanding the low overall population growth rate. Obviously primary production from the Vembanad and adjoining areas will not be able to support the present and future population and resources will have to be drawn from far away sources, a typical feature of urbanization. The major problem however will be the disposal of waste generated by the increasing population – both resident and floating – and this has already become severe on account of policy, legal and institutional failures.

Another major change taking place in the area (as is the case with the rest of the State) is the economic transformation, which manifests in the form of higher income (obviously resulting in higher consumption levels) and the structural change in the economy, as reflected in the decline in the contribution of agriculture and allied sectors and the increasing dominance of the services sector. An increasing share of employment and income is derived from activities like construction, commerce and trade with a corresponding decline in the share of agriculture and fishing. This has also changed the relative value of assets like land which has become much more valuable as space for infrastructure development rather than being used for farming. Speculation has led to a boom in real estate prices, making agriculture a less attractive option.

The rapid pace of globalization has further accelerated the pace of structural changes in the economy. The boom in transport, trade and tourism and the need to build infrastructure is a major driver impacting the Vembanad estuary directly and indirectly. Whether it is the Vallarpadam container terminal, or the Kochi Metro, or the multitude of buildings that are coming up on the

shores of Kochi backwater, they all are leaving their ecological foot-prints, especially by way of reducing the water-spread area, depth and water quality.

The political processes and the concomitant policies, legislation and institutional arrangements play a very crucial role in building a new balance between society and nature. Unfortunately this is an area where fundamental flaws prevail. Irrespective of the differences in the proclaimed political ideologies, most of the governments in Kerala have pursued a narrowly defined approach to development and environmental issues are at best addressed only peripherally/ superficially. Often policies are formulated to give a feeling that environmental issues are being addressed; but there are other policies – especially dealing with agricultural, industrial and infrastructural development – that seldom take account of the environmental aspects and override environmental policies and regulations. Legislation and institutions purportedly aimed to protect the environment are much weaker than the legislation and institutions dealing with mainstream “development”.

Overall a “laissez-faire” approach prevails and this has become much stronger during the last couple of decades. All the indications are that this scenario will continue to prevail for some time which could hasten the environmental degradation. Efforts to attract private investments seem to encourage a race to the bottom by way of diluting environmental regulations (as also other regulations especially labour laws). Recent developments at the national level – especially the efforts to create a more-investor friendly environment - will worsen the situation. Instead of strengthening environmental governance through more democratic and accountable institutions, we are witnessing a dilution of rules and regulations, all done in the name of making the country and the state “investor friendly”. There is a systematic effort to remove all the checks and balances.

Another key driver that redefines society – nature relationship is technology. In fact technological

improvements are unavoidable to enhance the carrying capacity of land and other related resources. Resource use in Vembanad and adjoining areas is characterized by the increasing use of resource/ energy intensive technologies, whether this be in the case of agriculture, fisheries, and industries. Land reclamation was one of the earliest efforts to enhance the resource base and to increase the area available for agriculture. The technology for fishing has also undergone major changes and part of the problem of stock depletion stems from the use of particular methods and gears of fishing. In almost all areas of human interventions it is possible to

**Box 14: Biodiversity decline in Vembanad**

*“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, prawn population and bird diversity. The changed ecology is believed to have led to the loss of about 23 species of fishes, prevented migration of about 13 other species, led to the decline of 33% of bird population, brought in new predatory bird species like “Neerkozhi” and increased the population of reptiles”*

MS Swaminathan Research Foundation 2007 (Page 11)

identify “green” and “non-green” technologies and invariably the latter seems to dominate largely on account of economic reasons. Although there are some efforts to improve the proportion of “green technologies”, it is doubtful whether there will be a major departure from the past trend. One of the most important impact of the multitude of interventions has been the significant decline in biodiversity as brought out by several studies (Box 14)

On the whole the collective impact of demography, socio-economic conditions, politics, policies, legislation and institutions and technology suggests that the current “business-as-usual” scenario is unlikely to change in the immediate future. All the indications are that Vembanad estuary will continue to deteriorate especially as some of the ongoing efforts to improve the situation are overwhelmed by the pressures to use the resources unsustainably.

## **7. GOVERNANCE: THE CORE ISSUE**

Obviously governance failure is the fundamental cause of degradation of the Vembanad backwater. As the pressure on the ecosystem increases on account of demographic and economic changes, the governance system – the policies, legislation and institutions –should improve continuously ensuring that the negative externalities on the present and future generations are fully accounted and choices made ensuring that they are avoided or minimized. The governance arrangements need to be continuously improved fulfilling the principles of (a) accountability, (b) effectiveness, (c) efficiency, (d) equity and fairness, (e) transparency and (f) participation, which should be mainstreamed at all levels, including in the design of policies, legislation, institutions and regulatory framework, plans and programmes and in their implementation, enforcement and compliance. Unfortunately governance as a whole is getting weaker and in a situation of resource scarcity there is widespread corruption as those wielding political and money power are able to circumvent policies and legislation imposing significant costs on the public as a whole. Institutions that are supposed to implement rules and regulations are silent spectators, or worse, active accomplices to environmental degradation.

The problem relating to the degradation of Vembanad estuary is nothing new and volumes have been written on the subject. Invariably many of the initiatives attempt to pursue a techno-centric approach – whether it be flood control measures as outlined in the Kuttanad package or integrated management of Vembanad once proposed for consideration by the Ministry of Environment and Forests. Bringing about fundamental changes in the governance system has seldom been discussed and alternatives examined.

To a large extent governance failure stems from the pursuit of the narrow agenda by government departments primarily operating in a “silo framework”. Seldom there has been any effort to examine the roles and responsibilities of different agencies and to rework the policy and institutional framework adopting a holistic approach. And the usual prescription is to strengthen coordination and oversight through the creation of “Authorities” or “Boards”. Such coordinating mechanisms

have largely been ineffective. In a situation where competition to control/ access resources is intense the willingness and ability to enforce environmental regulations remain weak and ineffective.

With several contesting stakeholders pursuing divergent interests, obviously the system of governance is probably the most critical factor in arresting and reversing environmental degradation of the Vembanad Lake. Being an open system what happens to Vembanad Lake is also influenced by what happens in the distant catchments and therefore consideration of governance has to go beyond the immediate vicinity of the lake. A typical case is the huge volume of pollutants including human fecal matter that the Pamba River receives from Sabarimala and other urban centers on the river banks.

### **Ownership of resources and governance**

Ownership of land and other resources is at the core of how people use the resources and the nature of governance system to be put in place. Broadly resources in the Vembanad area – mainly land and water – comes under two ownership categories:

- Public land owned by different government departments; and
- Private ownership by individuals and institutions.

While the water body and the land classified as revenue puramboke, is under public ownership, different departments with diverse interests use the resources all in the name of larger “public interest”. Government agencies that influence resource use in the Vembanad are:

#### **Box 15: Cochin Port Trust and the Lulu Convention Centre**

Reclamation of the area where the present Lulu complex is coming up was carried out during 2005-13. The Cochin Port Trust carried out the reclamation in the water spread area as also the inter-tidal zone without obtaining any prior CRZ or other environmental clearance. The reclaimed area was subsequently leased to the Lulu Group International which was given CRZ and environmental clearance based on a letter from the Cochin Port Trust that hotels and convention centres are part of port activities. The Cochin Port Trust has argued that (a) the Kerala Land Conservancy Act is not applicable to its property which is governed by the Major Port Trust Act and (b) that the convention centre will increase the number of ships docking in the Cochin port enhancing its income. It also argued that the Kochi Corporation or the State Government have no right over the land. This is a typical example of conflicting jurisdiction resulting in violation of environmental regulations pursued by government agencies driven by the “silo mind set”. Overlapping and conflicting policies and legislations provide a convenient escape route for those violating environmental regulations.

- Revenue department;
- Local Self Government Department and the various local bodies including Grama Panchayaths, municipalities and corporations.
- Agriculture Department;
- Animal husbandry Department
- Fisheries Department
- Water Resources Department;
- Transport Department
- Cochin Port Trust
- Tourism Department

Over time a complex, confusing and conflicting system of governance has evolved with each department or agency pursuing its narrow interests. Invariably when development projects are initiated

and implemented the wider implications – including economic, social and environmental – are seldom considered, as each department focuses on their narrow objectives. This forms the basic cause of almost all environmental problems, whether it be the construction of the Thanneermukkam Bund, building of roads and bridges, dredging for lime shells, and reclamation of the backwater for agricultural expansion, encroachment of kayal area for the construction of residential and commercial complexes and so on. Also many of the government agencies have deviated from their mandate and used their control over resources to pursue activities which are not directly related to the initial objective of their establishment (see Box 15).

Most of the land other than that under the *de jure* ownership of government, are under private ownership. The larger socio-economic changes are bringing about fundamental changes in the use of private lands directly and indirectly causing ecosystem degradation. Considering the ecological continuum, land use and changes thereof result in a number of environmental externalities, affecting the well-being of other people and the entire society.

Efforts to ensure that environmental dimensions are taken into account are focused on (a) regulations which specify what are prohibited activities and (b) system of environmental clearances. The most important environmental regulations relevant to the Vembanad kayal are:

- The 1991 and 2011 Coastal Regulation Zone notifications.
- The Kerala Conservation of Paddy Land and Wetland Act 2008.

There are several other legislation intended to regulate individual and collective behavior in the larger interests of society (see Box 16). The greatest challenge however stems from poor

#### **Box 16: Important acts and rules that impact the ecology of Vembanad**

##### **The Environment (Protection) Act, 1986**

Objective of providing for the protection and improvement of the environment. It empowers the Central Government to establish authorities charged with the mandate of preventing environmental pollution in all its forms and to tackle specific environmental problems that are peculiar to different parts of the country. The Act was last amended in 1991. The CRZ notifications 1991 and 2011 were issued within the framework of the Environment (Protection) Act 1986.

##### **The Water (Prevention and Control of Pollution) Act, 1974, amended 1988**

CPCB and SPCBs constituted; Powers and functions of SPCBs defined; Role of LSGs limited to sewage/sullage treatment & assisting SPCBs in discharging functions; Possibility for improving the compliance if LSGs are made the enforcement agency in the case of small industries and watchdog in the case of bigger polluters

##### **Kerala Panchayath Raj Act, 1994**

Empowers LSGs to take necessary steps for environment protection; especially by protecting water sources, managing solid wastes, imposing penalty for littering, implementing water supply and drainage schemes and insisting the polluting industries to take environmental mitigation measures.

##### **Kerala Municipalities Act, 1994**

Empowers Municipalities to take necessary actions for environmental protection, the provisions being similar to that in Panchayat Raj Act.. Authorize to plan, implement and be in charge of water supply & sewerage; provide public latrines and maintain it and major establishments; highlight the collective responsibility of public and the Municipality for storage and disposal of rubbish and solid waste. Regulate quarrying, cultivation, burial grounds & abuse of water bodies. Voice opinions on establishment on Industrial Estate or Industrial Development Area when consulted

##### **Kerala Protection of River Banks and Regulation of Removal of Sand Act, 2001**

Protection of river banks and river beds from sand mining; regulation of removal of river sand; conservation of the biophysical environment of the river ecosystem; constitution of District level Expert Committee; Fixing the quantity of river sand that can be removed without affecting the environment of rivers; constitution of Kadavu Committee; DEC to have supervisory and monitoring role; Creation of River Management Fund and River Bank Development Plan; undertaking the maintenance and protection of sand mined from river banks.

##### **Wetlands (Conservation and Management) Amendment Rules, 2016**

implementation. Most often, public sector agencies have become the major violators of the regulations. Many of such violations are justified in the name of “development” and dubious “public interest”. Raising questions on the impact of projects is considered “anti-development” and even traditional cost-benefit analysis that could show whether a project is financially viable or not is not carried out. Because of this several projects of questionable relevance are implemented and the existing system of giving environmental clearance has become dysfunctional. Though rules regulating the use of land and water bodies exist, they are often violated by both government agencies as also by investors.

## ***Private land ownership***

A number of policies and legislation have been formulated to ensure that larger public interest is unaffected on account of individual actions. Among these the most important are the CRZ Notifications 1991 and its 2011 re-notification and the Paddy and Wetland Conservation Act 2008. There are many others, including those dealing with control of air and water pollution and municipal building rules. The Paddy and Wetland Conservation Act explicitly prohibit the conversion of paddy and wetlands primarily to ensure that such lands are protected in view of their larger ecological significance in maintaining hydrology and other environmental services. An attempt has been made to compile the list of paddy and wetlands, but hitherto the list has not been notified in the gazette.

On the whole there is no strong commitment to implement the Paddy and Wetland Conservation

### **Box 17: Subversion of the Paddy Land and Wet Land Conservation Act 2008.**

Yielding to the pressure from various groups – especially realtors and land mafia - , the Kerala Government has attempted to amend the Kerala Paddy land and Wetland Act passed in 2008. As per the proposed amendment all conversions made before 2008 are to be regularised after securing 25% of the fair value of land from the owners. The 2008 act was passed in the context of the continuing decline of paddy and wetlands in the State on account of their conversion to other uses. The provision that paddy and wetland of up to 10 cents could be converted for building houses has been misused and conversion – both large scale and small scale – continued in the context of government’s inability to implement the Act and in many cases the luke-warm approach of those in power. The proposed dilution will open the flood gates of conversion.

Rules and in fact there are powerful interests pushing for its dilution. Delay in publishing the data base and the continued efforts to dilute key provisions in the Act, send confusing messages encouraging continued conversion of paddy and wetlands in the State (see Box 17). Willingness to implement the rules are at best luke-warm. When government agencies themselves become a major violator of the rules, the moral authority to enforce such rules on others and improve environmental governance becomes extremely weak and untenable.

Further the machinery for implementing environmental rules are extremely weak. The major responsibility for implementing the Paddy and Wetland Conservation Act vests with the Revenue Department and the local self-government institutions. Absence of political will coupled with inadequate capacity of the administrative system continue to undermine the purpose of the Act.

The situation with regard to CRZ notification is also similar. Here the primary responsibility rests with the local self- government institutions, which is overseen by the State Coastal Zone Management Authority. The local self-government institutions are expected to ensure that before permits for buildings are issued under the Municipal Building Rules, they are in compliance with the provisions in the CRZ notification. However there are umpteen instances where buildings have come up with no clearance from the local self-government organizations or the Kerala State Coastal

#### **Box 18: Failures in implementation of environmental regulations**

A plethora of acts and rules aimed to protect the environment would give an impression that everything is going well on the environmental front. However we come across major gaps in their implementation. In particular there is considerable reluctance among various government departments to comply with the directions in the acts and rules thus negating the very objectives enshrined in public policies. Some examples of commissions and omissions in this regard are given below:

The CRZ 2011 notification has declared certain environmentally sensitive areas including the Vembanad as Critically Vulnerable Coastal Areas (CVCA) for promoting its conservation and sustainable use of resources. The notification directs the government to prepare Integrated Management Plans (IMP) for managing the CVCA with the involvement of the local coastal communities including the fisher folk. According to the CRZ notification the Ministry of Environment, Forests and Climate Change (MoEFCC) has to provide detailed guidelines for identifying, planning, notifying and implementing CVCA in consultations with the stakeholders like the State Governments, local coastal communities and fisher folk. The IMP for Vembanad is yet to be prepared. The MoEFCC is yet to formulate the guidelines for the same even after 6 years of issuing the CRZ notification.

Following the issuance of CRZ notification the MoEFCC vide its communication No.11-83/2005-IA-III dated 25-1-2011 directed the State Coastal Zone Management Authorities to identify the violations of the CRZ Notification, 1991 within a period of four months and initiate action under the Environment (Protection) Act 1986, the details of which are to be uploaded in their respective websites. This is yet to be complied with.

The Wetlands (Conservation and Management) Rules 2010 directs the State Governments to prepare a brief document with geographic delineation of the wetland and other information such as the map showing the zone of influence of wetlands, the size of wetland and an account of pre-existing rights and privileges. The final notification listing the wetlands will be issued by the Central Government based on this document. This has not happened even after 7 years and in a way negated by the Wetland (Conservation and Management) Rules 2016.

The Supreme Court in 2013 has taken *suo moto* notice of the fact that Vembanad Backwaters is presently undergoing severe environmental degradation and there has been large scale encroachment and illegal constructions in violation of the CRZ Notification. Accordingly the State was directed to explain the steps taken to (a) implement CRZ, in the lake and Islands as a whole, (b) to restore the illegally reclaimed banks of the lake,(c) to avert pollution, etc. within a period of six weeks. The State Government has informed the Supreme Court that it has initiated action to identify encroachment and illegal constructions in violation of CRZ notification and restore the illegally reclaimed banks of the lake. But no effective action in this regard has been taken yet on this.

Zone Management Authority. Implementation failures are quite widespread (see Box 18). Often there is a strong informal nexus between elements in the different institutions, which pursues an agenda very different from what is envisaged in public policies and legislation and the formal governance system is unable to counter this.

Obviously environmental improvement should become the responsibility of every citizen and the governance system should help to accomplish this. As such most players continue to pursue their “business as usual approach” and the responsibility of correcting environmentally inappropriate behavior is left to a small number of inefficiently managed agencies. In the government hierarchy those responsible for enforcing environmental regulations have very little clout and when proposals are scrutinized there are always pressures to dilute implementation of regulations. There are many ways in which environmental regulations are sidelined as indicated below:

- ❖ Projects are undertaken without any environmental impact assessment; there is a strong tendency to avoid EIA especially when such assessment could potentially undermine the chances of obtaining environmental clearances.
- ❖ Falsifying environmental impact assessment, deliberately underplaying adverse environmental impacts, manipulating the process of environmental clearance. The recent attempt to dilute the powers of the National Green Tribunal is another example of ongoing efforts to reduce environmental checks.

In a densely populated area like Vembanad where access to resources is highly contested environmental improvement and sustainable use of resources will require more effective governance, ensuring that the larger common interest is safeguarded. This is particularly when markets are incapable of accounting less perceivable environmental damages and those operating on the basis of private profit motives are able to impose significant direct and indirect costs on the rest of the society including future generations. Governance is getting weaker and in a situation of resource scarcity, primitive accumulation, speculation and rent-seeking behavior are resulting in the dilution of environmental policies and regulations. Broadly the following situations are met with in the case of Vembanad estuary:

- Policies, regulations and institutions are inadequate to address the complexity of issues, especially as new challenges emerge in the context of larger external factors (for example climate change and globalization) and there are large gaps in this regard;
- Even when policies and regulations and institutions exist, there are implementation failures and environmental rules are violated with impunity; Institutions that are supposed to implement rules and regulations fail to discharge their responsibilities or worse become accomplices in violating the rules through acts of omissions and commissions.
- Inability to pursue corrective action even when there is widespread recognition that some of the past efforts have resulted in significant negative impacts (for example the Thanneermukkam bund).
- A more recent trend is to totally dilute existing policies and legislation so that violations are perfectly legal and cannot thus attract legal intervention. Under pressure from vested interests

there are also efforts to change policies and legislation diluting or even negating environmental controls in the name of providing a “favourable investment climate”. A classic example of this is the report by the TSR Subramanian Committee recommending the revision of various regulations relating to protection of environment to create an “investor friendly” environment.

### **Vembanad estuary: A common property**

Although most of the water body of Vembanad estuary is a common property – a heritage for the entire society – it is managed as a free access resource and there are no effective checks to ensure that larger public interests are not compromised and the multitude of environmental functions critical to safeguard the livelihood of the present and future generations are not undermined. The multitude of players who are using the lake and the adjoining land however adopt a narrow perspective leading to “zero sum game”. In addition to the use and misuse of land, water and other resources, the estuary is also a point of accumulation of waste brought from the upstream area.

### **A vision for Vembanad**

There is therefore an urgent need to develop a long term collective vision for the Vembanad articulating the views and perceptions of all stakeholders ensuring that the ecological, social, economic and cultural values of the estuary are improved. Within the next few years the quality of water needs to be improved and the natural processes that have been interrupted are restored to the fullest extent possible. Another component is that the public land that has been illegally occupied is brought back to public control and the concept of zoning based on the biophysical and socio-economic characteristics are implemented. Use of land, water and other natural resources are to be fully integrated and so are key activities like agriculture, fishing, urban development, tourism and small scale enterprises. **A healthy and living estuary, improved carrying capacity and sustainable livelihood for the people** will be the motto for management of the backwater.

### **Key elements of improved governance**

Improvement of governance along with science-based interventions will remain the foundation for accomplishing the vision stated above. The key elements that will contribute to improved governance of the Vembanad estuary are:

- Democratic decision making and implementation, ensuring that all key stakeholders are fully involved in decision-making and implementation;
- An effective mechanism for conflict resolution;
- Science based;
- Transparency and accountability;
- Independent monitoring and evaluation involving people and grass roots level institutions;
- Pursuit of integrated approaches ensuring that organizations are not narrowly focused on their very limited agenda ignoring the wider impacts of their interventions.

## Alternative governance options

Managing large areas involving stakeholders with very diverse interests is extremely challenging, and typically such situations result in “wicked problems” that are not amenable for conventional approaches. Especially in the case Vembanad which is an open intensively used ecosystem, regulating the behavior of individuals become extremely challenging. Inter-group and intra group competition to access resources is very intense. It is in this context that we have to carefully consider the governance arrangements ensuring that they are widely accepted and at the same time the transaction costs in managing the resources are at an acceptable level. There are two options in this regard:

- Establishment of an area based authority or board to coordinate and regulate the activities of different stakeholders;
- Establish a Joint Committee of Local Bodies (Panchayaths) taking advantage of the existing provisions in the Panchayati Raj Act.

### *Area based authorities/ boards:*

One option that has been widely pursued to improve governance in the context of competing and conflicting interests is to establish area based management authorities or boards. Such lake or wetland development authorities have been established in a number of states to manage all the wetlands or specific wet lands. Some of the notable examples of such authorities include the Lokta Lake Authority in Manipur and the Chilika Development Authority in Odisha (Box 19). Both are

#### **Box 19: Chilika Development Authority**

Chilika, situated in Odisha, is one of the most important wetlands in India and was included in the Ramsar sites as early as 1981. In order to provide an integrated approach to resource management the Chilika Development Authority was established in November 1991 with the following objectives:

1. Protect the lake ecosystem with all its genetic diversity;
2. Survey, plan and prepare project proposal for integrated resources management for all-round development in and around the lake;
3. Execute various multi-dimensional and multidisciplinary developmental activities by itself or through other agencies;
4. Cooperate and collaborate with other institutions of the state, national and international institutions for all-round development of the lake;
5. Establish management information system for the lake;
6. Promote long term multidisciplinary research, prepare environment status report and undertake education and extension;
7. To facilitate:
  - Control of silt load of streams and rivers and siltation;
  - Watershed management, opening of the mouth area and maintenance of salinity gradient;
  - Scientific management of weeds
  - Promote sustainable fisheries and aquaculture
  - Wildlife conservation

The Authority is chaired by the Chief Minister and every effort is made to pursue a participatory

important Ramsar sites (Wetlands of International Importance) in the country. There are some 7 authorities in India dealing with management of wetlands and the experience of these institutions provide an indication of the options that may be considered for the Vembanad estuary.

The main thrust of such authorities is to bring the management of the water body under one umbrella to minimize the conflicts that are characteristic when lake resources are used by diverse stakeholders. Typically the authority, drawing its power from an act of the legislature, provides a coordination framework regulating/ controlling the actions of other stakeholders/ players and on its own taking up activities aimed to reverse degradation and restore the ecosystem. The structure and functions of such authorities vary and most of them are registered under the Societies Act with some having statutory powers through specific acts of the legislature. The relevant acts empower the authority to regulate and coordinate the different activities and certainly this helps to avoid the conflicts that may arise in the use of resources. For example the Lokta Lake Protection Act 2006 empowers the Lokta Development Authority to take all the necessary measures to protect and improve the lake environment. As per the Act the lake area has been divided into a core zone and a buffer zone specifying what are not permitted in each of the zones.

**Box20: An Authority for Vembanad Lake**

“The team is of the view that for ensuring the revival of the clean water regime of the Vembanad lake, revival of fishery and its conservation and management, there is an urgent need for an independent authority with full powers constituted by a statute to be set up by the Government of Kerala as the present arrangement lacks the requisite state support...It is recommended that the State Government set up Vembanad Lake Development Authority/ Agency immediately with full powers and autonomy for enforcing the legal mechanisms for protecting and reviving the ecosystem.

Planning Commission 2008

**Ongoing efforts to establish an authority for Vembanad Estuary**

The need for establishing a coordinating authority has been put forth for quite some time. A report prepared by a Planning Commission team (Planning Commission 2008) noted “...*the virtual lack of coordination between various state government departments in protection, conservation and management of the lake and its resources*” and called for unified efforts from all concerned for restoring the fragile ecosystem” (see Box 20).

Vembanad Eco development Authority

The Commission is aware of the initiative by the Kerala Government to establish an area based authority – Vembanad Eco-development Authority (VEDA). As early as November 2011 a cabinet decision has been taken and a draft of the structure and functions has been prepared (see Box21). However even after almost six years the idea of an overarching authority remains in paper. Though an authority could provide a better framework, it is important to consider whether this is the most

**Box 21: Vembanad Ecodevelopment Authority (VEDA)**

The Vembanad Ecodevelopment Authority (VEDA) was proposed to be established with the objective of creating a “sustainable and healthy Vembanad socio-ecological system which supports its rich biodiversity and the livelihood needs of the stakeholders. As per the proposal VEDA will have jurisdiction over 38 grama panchayats, three municipalities, the Kochi corporation and certain areas of Alappuzha, Kottayam, Ernakulam and Thrissur districts covering the water spread area of the Vembanad-Kol wetlands, which is the designated Ramsar site. The Authority’s governing body will be headed either by the Chief Minister or the Minister for Environment. The Minister for Water Resources will be the Vice Chairman and the Ministers of Agriculture, Revenue, Fisheries and Tourism will be its members. Other members will include the Members of Parliament, Members of the Legislative Assembly from the constituencies, Chief Secretary and Secretaries of the Departments of Forests, Water Resources, Agriculture, Revenue, Fisheries and Tourism. Also proposed are an empowered committee for taking administrative decisions, a management committee for local planning and consultation and a technical advisory committee.

The Authority is to oversee the socio-economic and environmental appraisal of natural resources management, infrastructure development and area development plans of the local bodies. The local bodies should consult the Authority on matters of environmental implications, land use and infrastructure development while formulating their annual and five year plans.

Although the proposal to establish VEDA was approved by the Cabinet in November 2011, not much progress has been made as regards finalising the legislation in support of its establishment and management. Even if eventually it is established, there is concern as regards its ability to fulfil its mandate, especially considering the potential divergences of resource management objectives of different departments, bodies and stakeholders in the area. Ultimately the main challenge for such an organization is to develop a collective vision ensuring that all stakeholders think and work for a common purpose and the silo approach to resource management is avoided. Most often there is intense competition between different agencies/ departments even within the government and such “territorial disputes” are an important cause of dysfunctional environmental governance.

appropriate option in the present context considering the complexity of the issues and the ability of such an authority to manage the conflicts and mobilize social action to accomplish a collective vision.

Proposal to establish Kerala Wetland Management Authority (KWMA) by Wetlands International South Asia

The Wetlands International South Asia (Wetlands International South Asia 2013) has also come up with a detailed proposal for a similar institutional arrangement – Kerala Wetland Management Authority (KWMA) – to provide a unified institutional framework for management of all the wetlands in the State, initially focusing on the three Ramsar sites – Vembanad –Kol, Ashtamuti and Sasthamkottah lakes – and later expanding the coverage to other wetlands. The proposal envisages a

three-tier structure with a governing body chaired by the Chief Minister, an executive committee under the chairmanship of the Principal Secretary, Forests and Environment and an office of the Chief Executive to implement the programmes and plans and to pursue regulatory measures. The proposal is primarily modeled on the framework adopted for such authorities elsewhere in India. However this idea has not been pursued further.

#### State Wetland Authority Kerala (SWAK)

In pursuance of the Wetlands (Conservation and Management) Rules 2010 notified by Government of India, Kerala Government has constituted the State Wetland Authority Kerala (SWAK) as outlined in GO (MS) 08/ 20015/ Env't. Dated 25 May 2015. SWAK is to be registered as a government owned society under the Travancore-Cochin Literary, Scientific and Charitable Societies Act 1955. A revised GO issued on 13 November 2015 gives the names of the expert members in pollution control, limnology, hydrology and ecology and reiterates the intention to register the authority as a government-owned society as per the Travancore-Cochin Literary, Scientific and Charitable Societies Act. SWAK is to function as the regulatory authority to fulfill the stipulations under Rule 7 of the Wetlands (Conservation and Management) Rules 2010. However not much has happened in registering SWAK as a society or as regards wetland conservation since its establishment more than two years back. Meanwhile ineffective implementation of the 2010 rules has led to its revision in 2016. However, it is a highly watered-down version and makes the state government fully responsible for implementing the provisions of the wetland conservation and management rules. Absence of involvement of local self-government institutions (which is critical for effective participatory management of wetlands) and the very broad mandate but without the requisite authority or ability to regulate the activities of the multitude of stakeholders, would suggest that SWAK is unlikely to provide a robust institutional mechanism to address complex problems confronting wetlands like Vembanad. At best it could emerge as an agency for channelizing central funds to the different agencies. .

#### **Effectiveness of centralized authorities**

When externalities are widespread on account of fragmented management of natural resources as in the case of the Vembanad ecosystem, there is a strong tendency to propose more centralized management frameworks on the assumption that the externalities will then be automatically internalized. However there is a need to carefully consider the pros and cons of such centralization tendencies and whether this will be conducive for people taking full responsibility for sustainably managing the resources. Especially in the context of Kerala where resource use competition is extremely intense, the conventional approach of establishing an authority may not necessarily result in positive outcomes. In particular we need to take cognizance of the following:

- Environmental management requires substantial social mobilization so that every person/ entity is fully involved and takes responsibility for the sustainable use of resources. Once a centralized system is established there is a strong tendency to put the entire onus of management on such authorities. Such authorities are unlikely to be effective in situations where resource use conflicts are intense. The experience with many centralized institutions has been at best mixed.
- Proposals like VEDA, KWMA and SWAK fail to take into account the ongoing efforts to decentralize resource management through the Panchayati Raj institutions. Establishment of authorities largely consisting of officials and technical experts tend to undermine the very basic principles of participatory resource management.
- Some of the problems pertaining to the Vembanad ecosystem have their origin outside the estuary per se. While an area based authority may be in a position to regulate in-situ activities, it may face constraints in dealing with the ex-situ causes of degradation.

The Commission is therefore not in favour of a highly centralized area-based authority considering that it goes against the principles of decentralized participative resource management. Even the implementation of the much acclaimed Kuttanad Package under the Kuttanad Prosperity Council has been riddled with problems. The assumption that improved coordination of resource use by diverse players can be accomplished through an apex body even under the chairmanship of the Chief Minister is debatable. Under intense competition for resources, the ability of traditional institutions to mediate conflicts and provide acceptable and actionable options is becoming more challenging. Even judicial intervention at the highest level is being subverted due to institutional inadequacies. An area-based authority could potentially become one among the plethora of boards and authorities that are increasingly becoming means for dispensing political favours without making any dent on the problem.

## **8. AN ALTERNATIVE FRAMEWORK**

### **A bottom up approach – Joint Committee of Panchayats**

Considering the fact that environmental management requires significant social mobilization and increased commitment by all stakeholders, there is a need to explore the feasibility of a more “bottom-up approach”. Dealing with eco-restoration of a large area which is administered in a fragmented manner by several local self-government institutions is quite challenging. The entire

thrust should be to take advantage of grass roots level administration and at the same time provide a framework to address larger problems that encompass several local bodies. Under the Kerala Panchayat Raj (Constitution of Working Committees and Joint Committees and Procedures for their Meeting) Rules 1995, provision exists for the constitution of Joint Committees of different local bodies to address specific issues, though experience in actually implementing this is still limited.

Considering the need for large scale social mobilization, one may explore an option that combines the advantages of decentralized environmental management, but at the same time providing an integrated framework for the entire Vembanad area, going beyond the boundaries of the estuary. Notwithstanding some of the current inadequacies of decentralization, still it provides the most workable option to mobilize and coordinate grass-roots level eco-restoration efforts. The following paragraphs provide a broad indication of the governance system that may be put in place for the restoration and sustainable development of the Vembanad ecosystem.

The Commission therefore proposes a complete revamping of the management of the Vembanad backwater system through the establishment of a Joint Committee of the Panchayaths and providing it all the statutory powers to ensure that all stakeholders function within the framework it provides. While building it on the existing decentralized system, it is important to ensure that it avoids a narrow and fragmented resource management approach failing to consider the larger implications of decisions the local level.

The functions and structure of such a Joint Committee of the Panchayaths - which may be named as Social Authority for Vembanad Eco restoration and Development (SAVED) – could be as outlined below:

#### Functions of the Authority

The Social Authority for Vembanad Eco restoration and Development will be responsible for ensuring that the entire lake and adjoining areas to a width of 500 metres are managed in a sustainable manner arresting further degradation and enabling the continuous improvement of ecosystem health. The Authority through the local bodies will also ensure that nothing that significantly undermines the environmental quality is done outside the designated area but within the Vembanad watershed. Quality improvement of the lake ecosystem will be measured on the basis of a set of indicators. The Authority will be responsible for mobilizing social action for eco restoration of the Vembanad estuary and will have all the powers to intervene and take corrective action. Since the District Planning Committees are an integral part of the Authority and involved in the formulation and implementation of eco-restoration, they will also ensure that activities/developments that are detrimental to the health of the ecosystem are avoided in the entire watershed.

The essential principles of functioning of the Authority will be as follows:

- It will be built on the existing framework of decentralized governance, ensuring that the local bodies are fully involved in its functions;

- Interventions to enable eco restoration and development will be based on the latest available scientific knowledge;
- Civil society organizations and public at large will be fully involved, especially in monitoring changes in ecosystem and in assessing the accomplishment of the Authority's objectives;

### **The Authority**

The composition of the Authority will be as follows:

- The Chairpersons of the District Planning Committee of the 6 districts in which the Vembanad backwater and its watershed is spread over.
- The District Collectors of the six districts.
- One representative of the Municipal Chairperson.
- One representative of the Mayor of Kochi Corporation.
- A senior scientist familiar with the ecological and socio-economic issues relating to the management of Vembanad estuary (To be nominated by the government).
- A representative of the NGOs nominated by the government
- Chief Executive Officer cum Member Secretary, who will be a senior Indian Administrative Service Officer (Addl. Chief Secretary level).

Government will nominate one of the DPC Chairpersons as the Chairperson of the Authority. Depending on the issues to be addressed, leading experts as also representatives of civil society organizations may be invited to attend the meeting of the Authority.

### **Duties and responsibilities**

The main duties and responsibilities of the Authority will be as follows:

- Preparation of an integrated plan for eco-restoration and development of the Vembanad backwater;
- Ensure that all the organizations in the district fully abide by the eco-restoration plan and do not undertake any activities that are detrimental to the health of the Vembanad ecosystem.
- Undertake activities that are required to restore the health and vitality of the ecosystem in collaboration with the local self-government organizations and other agencies.
- Monitor the health of the ecosystem on a regular basis and pursue actions that are required to accomplish the mandate of the Authority.
- Mobilise public support for participatory restoration of the ecosystem through awareness generation and mobilizing collective action.
- Establish and manage the Vembanad Ecosystem Restoration and Development Fund.

The Chief Executive Officer will be responsible for the implementation of the decisions of the Authority which will involve (a) development of strategies and plans for eco-restoration, (b)

implementation of strategies and plans either directly by the Authority or through other organizations (including local self-government institutions and government departments), (c) monitoring and evaluation of the activities, (d) compliance of environmental regulations by all the stakeholders, (d) periodic assessment of the state of environment through independent auditors and (e) mobilization of resources in support of eco-restoration.

### **Making the Authority effective and responsive.**

Whether it is an authority or a joint committee of the Panchayaths, the real issue is how such an institution can be made effective in fulfilling its functions resolving the conflicts in managing a complex ecosystem like Vembanad. Some of the key requirements in this regard are:

- Statutory powers that enables the Authority to intervene to fulfill its mandate;
- Technical competence to ensure that its interventions are science based; This is to be done through a highly competent Science and Technology Advisory Committee
- Independent monitoring of the ecological characteristics indicating changes in the condition of the estuary;
- Ability to mobilize the support and involvement of all stakeholders in eco restoration and to mobilize resources.

### **Statutory powers**

Statutory powers to be provided to the Authority within the framework of the Panchayati Raj Act will be examined by an expert committee appointed by the Government. It has to be ensured that the Authority has all the necessary legal powers to fulfill its functions and to ensure compliance of its decisions by all stakeholders

### **Science and technology support**

Sustainable management and eco-restoration of Vembanad requires the best available scientific knowledge which will be provided through a Science and Technology Advisory Committee. The Committee will draw on the best available expertise in the field including social scientists in order to provide a balanced perspective. The Committee will consist of a core group of experts and will also have a panel of experts from different disciplines whose opinion will be sought depending on the issue to be decided. Every decision by the Authority should take into account the views of the Science and Technology Advisory Committee.

### **Monitoring of violations and assessment of environmental quality**

A major challenge confronting Vembanad estuary is the widespread violations of environmental regulations, in particular the Paddy and Wetland Conservation Act and the CRZ Notification. As such at present there is no effective system of monitoring and timely detection of violations. By the

time violations are detected it becomes too late and the usual tendency is somehow “regularize” such violations which in a way encourages further violations. In fact there is reason to believe the existence of a powerful informal system that is bent upon thwarting well-intentioned public policies undermining people’s faith in the formal system.

The only way to curtail violations is to develop an open, transparent and participatory monitoring system involving the concerned public.

An important aspect of environmental management is the regular (continuous) assessment of critical environmental parameters. The STAC should provide the parameters to be monitored including the periodicity/ frequency. Some can be monitored easily adopting simple methods while others will require specialized equipment. Land use changes need to be monitored using satellite imageries at least once in six months and a system of sensor based real time water quality monitoring needs to be put in place for identified hotspots. A network of sensors mounted on buoys could provide real time information on how critical environmental parameters are changing and the impact of different interventions including the nature of corrective actions. The information should also form the basis of preparation of an annual environmental report card.

### **Code of conduct for all players**

Considering that everyone is contributing to environmental degradation, the responsibility for cleaning up the environment has to be assumed by everyone and no one agency can do the entire scavenging task. Through a participatory process clear guidelines (Dos and Don’ts) need to be drawn up indicating what needs to be done by the different players. This should be widely discussed and substantial peer pressure needs to be built to ensure compliance.

Such a code of conduct should be made applicable to the upstream resource users also to ensure that their actions (or inactions) undermine the environmental quality of Vembanad estuary.

### **Financing Vembanad eco-restoration**

Restoring the ecosystem functions of Vembanad will require substantial efforts to mobilise resources. Social mobilization encouraging positive actions by all stakeholders will help to reduce resources that need to be mobilized through traditional approaches. Diverse means of resource mobilization needs to be attempted depending on the nature of interventions required. The following aspects need to be considered in resource mobilization.

1. The Vembanad backwater fulfills critical ecological functions which are essentially public goods. Although putting a value to the ecological services provided by the Vembanad ecosystem is challenging, yet governments, both state and central, need to support Vembanad eco restoration efforts through a regular budget or through a one-time contribution to a corpus fund.
2. Sectors like tourism – especially resorts, hotels, home stays and houseboats - are thriving entirely on the natural beauty of the area and it is to their advantage to pay for the ecosystem services. An

ecosystem services tax – as a proportion of the turn-over tax - may be levied on tourism related establishments.

3. A share of the penalty levied by local self-government institutions, pollution control board, etc. for violation of environmental regulations should also go into the eco restoration fund.
4. Contribution by industries and businesses by way of fulfilling their CSR obligations.
5. Voluntary contribution by individuals for specific programmes and projects.
6. Programmes and projects aimed to undertake eco restoration funded by central and state governments and international organizations. In this regard considerable scope exists to intelligently use MNREGS for social mobilization especially for desilting waterways, removal of water weeds, improving hydrology, land improvement, rehabilitation of mangroves, etc.

A wide array of novel funding options are available and considering the high level of environmental awareness, people are likely to support ecological restoration as long as resources are used effectively and efficiently and fulfill the principles of accountability and transparency. One need not limit to cash contribution alone and could tap into in-kind contribution also, especially labour for cleaning and other related restoration activities.

## **9. SUMMARY AND RECOMMENDATIONS**

### **A highly degraded environment**

The fact that Vembanad is undergoing severe environmental decline remains an undisputed fact. Every available evidence indicates a continuous degradation of the Vembanad environment, severely affecting the ecosystem services and consequently the lives of people. Almost all studies paint a picture of crisis affecting the area of the lake, its depth, biodiversity, and water quality and there are hardly anything that gives any indications to the contrary. Almost all those who participated in the FGDs confirmed the significant decline in environmental conditions. Ecosystem people in particular fisher folk, including those dependent on black clam collection are the most affected.

### **Vembanad becoming an unliveable place?**

At the outset it became very clear that encroachment and violation of environmental regulations are just symptoms of a more fundamental problem and therefore there is a need to consider the larger changes in society-nature relationship over time and how we have reached the current situation. The collective impact of several drivers – including demographic, economic, technological and political – have brought about major changes in resource use. Overall there is a failure to reduce the negative impacts of certain drivers and to augment positive impacts. As such the quality of life of many people in the area has declined. Persistence of the present trends – the business as usual scenario – will have far reaching consequences and the area will become an unliveable place for a much larger proportion of people.

### **From one crisis to the next:**

While some of the interventions in the Vembanad kayal did have some short term positive impacts, the very nature of market driven developments have sown the seeds of one crisis after another. Large scale reclamation intended to expand rice cultivation reduced the extent of the Kayal significantly. The next round of agriculture intensification focused on productivity enhancement severely affected the hydrology and accentuated the pesticide-fertilizer linked pollution undermining the fisheries economy. Development of industries – traditional and modern - seen as a solution to the agrarian crisis worsened water pollution further undermining people’s livelihood. Urbanization has further accentuated the crisis, especially as legal and illegal land conversions reduced the lake area and increased the pollution from residential and commercial establishments. Tourism development was envisaged as another way out of the crisis; however, notwithstanding all the discussions about responsible tourism, it is worsening the situation, especially as reclamation and illegal constructions spread and more pollutants are off-loaded into the lake. Further those who have been significantly affected continue to be excluded from the benefits stemming from tourism development. On the whole every effort to overcome a crisis has led to a new set of crisis.

### **The common thread of the crises**

In essence the capitalistic mode of production driven by markets fail to take into account the negative externalities. This is especially so considering that Vembanad estuary is an intensively used common property with contested/ conflicting demands. Almost all stakeholders are pursuing their narrow short term objectives which inevitably tends to ignore the impacts of their actions on other sectors and stakeholders. There are umpteen examples of how this has affected key ecological services like hydrology, water quality, biodiversity as also equity and livelihoods of people, especially those who continue to rely on the ecosystem services.

### **Decline in carrying capacity**

Undoubtedly the major challenge facing the Vembanad ecosystem is the continued decline in both the supportive and assimilative capacity, which together determines the overall carrying capacity. Technological changes have helped to increase the supportive capacity through enhancing productivity (most often short term) in some sectors (for example rice cultivation), but this has increased the dependence on external resources as also affected productivity in other sectors (for example fisheries). Of major concern now is the decline in assimilative capacity especially as the load of pollutants from diverse sources increase. This has further eroded the supportive capacity significantly. The impact of these are all there to see and manifests in several ways, including the health and vitality of the people.

### **Causes of environmental degradation**

In the ultimate analysis two most important factors responsible for environmental degradation are (a) an overall failure of governance in general and environmental governance in particular and (b) the adoption of technologies that are economically unviable, socially inappropriate and ecologically unsustainable. As society evolves, its relationship with nature changes and this will require that governance systems and technological interventions are continuously refined and improved. In both

these areas there have been significant failures and precisely the degradation we witness now is an outcome of such failures. In particular:

- The current system of governance driven by a plethora of departments/ agencies/ institutions, each focusing on their narrow domains ignoring the implications of their actions on others is the root cause of degradation of the Vembanad ecosystem. No systematic effort is made to undertake an assessment of the long term impacts of interventions. In the case of private investments, profitability remains the main consideration, encouraging circumvention of environmental rules and regulations.
- The overall commitment to pursue a path of sustainable development and to adhere to the various environmental policies and legislation is very weak. Failure to effectively implement policies and legislation is widespread.
- While most of the stakeholders are aware of the seriousness of the problem of environmental degradation, there is a strong tendency to put the responsibility on others.
- Often government departments/ agencies are themselves the major violators of environmental regulations through their acts of omissions and commissions.
- The oversight mechanism for checking violations including encroachment, unauthorized construction and discharge of pollutants is very weak and ineffective.
- Although some effort is being made to use more environment-friendly technologies – for example organic farming -, there are little incentives for their wider adoption. Narrow economic objectives determine the nature of technologies applied in all the sectors. Every key player using the Vembanad ecosystem is attempting to maximize their benefits degrading the ecosystem imposing costs on others.
- On the whole what we are witnessing is a typical “laissez-faire” approach notwithstanding the various pronouncements about sustainably managing the ecosystem.

## **The way forward**

### Reforming the governance system and social mobilisation

Saving Vembanad ecosystem and ensuring that its economic, social and environmental functions are improved and sustained will require fundamental changes in the governance arrangements. The current system of fragmented governance (which in effect has encouraged a “laissez faire” approach) with no one taking responsibility to the totality of interventions and impacts will result in the rapid decline of the ecosystem. Key aspects that a governance system should strive to accomplish are:

3. Large scale social mobilisation ensuring that everyone takes responsibility in the upkeep and improvement of the ecosystem ensuring that they cannot continue on the “business as usual” path of using the ecosystem imposing costs on others.
4. Effective implementation of all the rules and regulations.

### Joint Committee of District Panchayats

Notwithstanding some of the draw backs of the system of governance under the Panchayati Raj institutions, certainly it has considerable potential to provide a democratic foundation for ecological

and economic revival of Vembanad ecosystem fully involving all the stakeholders. It is recommended that a Joint Committee of the Panchayats be established as an Authority to manage the Vembanad ecosystem. All the activities that will directly and indirectly impact the Vembanad Lake should be brought under the purview of such an Authority. The Authority will be fully responsible for large scale social mobilization in support of revival of Vembanad.

#### Science and Technology Committee to enable science based interventions

Science has to play a key role in the use of a highly vulnerable ecosystem like Vembanad and the science-policy interphase needs considerable strengthening. To facilitate this a science and technology committee consisting of eminent scientists will be established. The Committee will be responsible for providing science inputs to all important decision relating to the management of the kayal.

#### A ten-year social mobilization plan for eco-restoration

The Joint Committee through a consultative process will develop a detailed plan for social mobilization for restoration of Vembanad ecosystem. This will specifically address issues like shrinkage of the lake including through encroachments, changes in hydrology, water quality decline on account of pollution/ effluent discharge and loss of biodiversity and what needs to be done to improve the livelihood of ecosystem people, in particular the fisher-folk. The action plan will provide details of how social mobilization can be accomplished.

#### Code of conduct

Restoration of the Vembanad ecosystem will require fundamental behavioural changes by all who are directly and indirectly using the lake. Certain activities will have to be totally prohibited while several others will have to be regulated. All key sectors and activities should abide by a code of conduct – Dos and Don'ts – developed through a consultative process. If required this may be formalized as Vembanad Ecosystem (Protection, Restoration and Sustainable Management) Act.

#### Identification of violations and legal action.

There is an urgent need to prevent further encroachments and to reclaim public land that has been encroached and illegally appropriated by individuals and institutions. A time-bound programme will be initiated to remove all illegal construction/ occupation in accordance with the provisions in the existing rules and all land/ water bodies that are public property will be brought to public control:

- Demarcation of the kayal boundary as per the revenue records;
- Identification of encroachments; and
- Eviction of encroachments.

#### A system for participative monitoring and reporting environmental changes/ violations

A key to the ecological and economic revival of Vembanad is an effective system for monitoring and reporting environmental quality changes. Modern technologies like satellite based monitoring to detect land use changes including encroachments and a network of sensors to assess water quality

changes on a real-time basis are to be deployed. Ward and Panchayath level environment committees (which will have representation from local civil society organizations, students, teachers, etc.) will be established to encourage public participation in monitoring and reporting changes. An effective system for verifying reported changes in key environmental parameters and to take appropriate corrective action is to be put in place.

#### Adoption of an integrated approach to resource management

Most of the problems pertaining to Vembanad relates to the fragmented approach to the management of resources ignoring the linkages between land, soil, water and biodiversity. Traditional low intensity integrated management systems have been replaced by intensive single use management aimed to increase profitability of a particular component. There is an urgent need to reinvent and improve multiple use resource management practices taking advantage of local knowledge and some of the ongoing initiatives like one rice-one fish systems. In fact the future direction of resource use should be to strengthen the integration between agriculture, fisheries, animal husbandry, small scale agro-based processing and tourism.

#### Financing ecological restoration of Vembanad

Eco restoration of Vembanad will require efforts on the part of all stakeholders and it should not be dependent entirely on government funding. A wide array of funding arrangements needs to be deployed. In particular those who are commercially benefitting from the ecosystem services (in particular the tourism industry) and those who are polluting the environment will have to meet a major share of the ecological restoration costs. Other sources of funding ecological restoration will include:

- An annual budgetary allocation from the Kerala government;
- Project specific funding by state and central governments as also international organizations.
- Support from private industries in fulfilment of their CSR obligations;
- Voluntary contribution by individuals and organizations.

With effective social mobilization it should be possible to obtain in-kind support, including in the form of voluntary labour to undertake cleaning up degraded areas and to undertake ecological restoration. Putting in place a transparent, accountable and efficient governance system will help to mobilise most of the resources required from non-traditional sources.

#### **Social control over natural resources use**

Sustainable management of an ecologically sensitive area like Vembanad would require effective social control over the use of natural resources like land, water, air and biodiversity. Market determined use by individuals will invariably generate externalities imposing significant costs affecting those who are already marginalised as also future generations. Policies, legislation and institutions need to be reformed to ensure better social control in the larger interests of society as a whole and individual use of resources does-not impose any direct and indirect costs on society.



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## CARRYING CAPACITY STUDY IN THE VEMBANAD BACKWATER AREA

### An overview of the NEERI study

In 1997 The Ministry of Environment and Forests, Government of India sponsored a major study on carrying capacity based development planning for the Greater Kochi region. Coordinated by the National Environmental Engineering Research Institute (NEERI) and implemented in partnership with seven institutions (Centre for Earth Science Studies (CESS), Centre for Water Resources Development and Management (CWRDM), Cochin University of Science and Technology (CUSAT), Kerala Forest Research Institute (Kerala Sasthra Sahithya Parishath (KSSP), Kerala State Pollution Control Board (KSPCB) and Regional Centre of National Institute of Oceanography (NIO), the study was completed in 2003. For the purpose of the study the Greater Kochi Region was defined as the entire watersheds of Vembanad estuary, including catchment areas of seven rivers – Periyar, Chalakkudi, Muvattupuzha, Meenachil, Manimala, Pamba and Achenkovil – along with the adjoining coastal areas totalling to 14,931 km<sup>2</sup> or 34 percent of the geographical area of Kerala. Detailed account of the characteristics of Vembanad Lake, its socio-economic functions and the nature of interventions in the area have been outlined.

The study provided a detailed account of the various issues relating to carrying capacity and how the different components of carrying capacity functions particularly focusing on the following:

- Existing human settlements along with related issues and projection of regional growth scenarios;
- Assessment of supportive and assimilative capacities;
- Delineation of optimum resource allocation strategy;
- Study of administrative, institutional and interagency issues;
- Preparation of guidelines for decision-making based on environmental considerations;
- Preparation of short and long term action plans to be implemented by concerned agencies; and
- Delineation of alternate development/ growth scenarios and the preferred scenarios.

These assessments were undertaken in three phases and dealt with (a) resource base of the region, (b) existing scenario of environmental quality, (c) impact of developmental activities on resources and environmental quality, (d) environmental hotspots, limiting resources and short/ long term management plans, (f) estimation of assimilative and supportive capacity, (g) business-as-usual scenario and (h) long term alternative development scenarios. Most of the issues relating to the Vembanad backwater have been analysed in detail and an attempt has been made to provide a comprehensive approach to development planning detailing what needs to be done in each sectors. Some 149 strategies/ action plans in 19 sectors have been listed. As regards the Vembanad estuary the strategies/ action plans include the following:

1. Rejuvenation of the existing backwater system.
2. No or restricted expansion of activities along the estuarine/ coastal zones.
3. Protection and periodic maintenance of embankments of the backwater.
4. Adoption of flood control measures.
5. Notification of backwater system as a protected zone and maintenance of ecology of backwater system.
6. Regular monitoring of estuarine water quality.
7. Periodic flushing of Vembanad Lake.

For implementation of the above, the study proposes the establishment of Vembanad Rejuvenation and Development Board, a new institutional mechanism.

There are also several recommendations pertaining to other sectors that have direct and indirect implications on the Vembanad ecosystem. In general these largely focus on technical solutions to enhance the supportive and assimilative capacities of the different sectors without giving due consideration to the divergent needs, competition for resources, and the policy, legal, institutional and socio-economic dimensions. No precise figures were provided for the overall carrying capacity in the different areas. In some respects the sectoral focus – inevitable when a study is undertaken by institutions that tend to focus on narrowly defined domains – made it difficult to adopt an integrated approach. The study however brought together a wealth of information on very diverse issues, but probably it was challenging to analyse and synthesize the vast wealth of information to provide a more holistic approach. The fact that the study area covered almost one-third of the state's geographical area made it particularly challenging to make a realistic assessment of the current carrying capacity and how the carrying capacity may change under different socio-economic developmental scenarios.

## KEY ISSUES EMERGING FROM THE FOCUS GROUP DISCUSSIONS

In order to gather the views of different stakeholders, the Commission with the support of the Kerala Sasthra Sahithya Parishath organized a number of focus group discussions. In all 23 such discussions spread over the three districts – Alappuzha, Kottayam and Ernakulam - were held in August 2014 enabling the Commission to interact with various interest groups and gather the wide-ranging perceptions relating to various environmental, economic and social issues and what needs to be done to deal with the challenges from the

perspective of the different stakeholder. Table below indicates the number of FGDs and the broad group of stakeholders involved. A summary of the issues

**Table AII - 1: Details of focus-group discussions**

No	Stakeholder group/ topic	Number of FGDs in different districts			
		Alappuzha	Kottayam	Ernakulam	Total
1	Agriculture	3	1	1	5
2	Fisheries	1	2	3	6
3	Clam collection	-	1	-	1
4	Women's groups	1	1	1	3
5	Fish processing	1	-	-	1
6	Coir industry	1	-	-	1
7	Modern industries	-	-	2	2
8	Hotels and resorts		2	-	2
9	Houseboats	2		-	2
	<b>Total</b>	<b>9</b>	<b>7</b>	<b>7</b>	<b>23</b>

pointed out by each group is given below.

### AGRICULTURE

Altogether five FGDs were held to ascertain the issues pertaining to agriculture and related activities in the area. These included a wide range of stakeholders including the Karshaka Thozhilali Federation, Paddy and Wetland Protection Samithy, Patasekhara Samithis, Agriculture Department, Local Bodies, etc. Key issues confronting agriculture and the suggestions to address them as outlined by the FGD participants are summarised below:

#### Key issues

1. Water management system that has evolved over time is having severe negative impacts. Thanneermukkam bund management far from satisfactory.
2. Unscientific implementation of Kuttanad package is aggravating the problems: Money is being wasted in unnecessary constructions. Some of the farmers emphasized that Kuttanad package has done more harm to farming. The package had recommended widening of the bunds, but in many places concrete bunds have been constructed and this has increased the vulnerability of the mud bunds elsewhere to madaveezhcha.
3. Intensification of rice cultivation especially the conversion from one to two and three crops has led to several negative impacts.
4. Water holding capacity of the lake has declined due to large scale reclamation. This has been the main cause of severe flooding during rainy season. Incidence of bund collapse (madaveezhcha) has increased significantly.
5. Labour shortage, especially during the harvesting season is very severe and access to machinery remains limited.
6. About 1500 houseboats operate in the backwater and they have become another important source of pollutants, especially oil and organic wastes.
7. Domestic toilet wastes, faecal sludge and waste from slaughter houses and fish processing units are other important sources of pollutants.
8. Significant decline in the interest in agriculture, especially as labour shortages and increasing wages. On the whole agriculture has become less remunerative and thus the interest in shifting from agriculture.

### **Suggestions**

1. An ecosystem approach is required and this would require restoration of the hydrology of the area. The Thanneermukkam bund should be kept open all through the year so that regular saline ingress will help to restore natural flushing of the area south of the TMB.
2. Kuttanad package needs to be implemented in its totality.
3. A system of labour bank will help to ensure improved labour availability.
4. Group farming needs to be encouraged.
5. Paddy procurement arrangements need considerable improvement including remunerative procurement price.
6. Pokkali cultivation requires significant financial and technical support considering its unique characteristics.
7. Effective action is required to prevent reclamation and encroachment. Constructions that obstruct natural flow in the canals need to be demolished.
8. Timely and coordinated desilting of canals and improvement of side protection need to be carried out.
9. Drop pit latrines should be replaced on a war-footing with those having septic tanks.
10. There should be improved integration between different agencies, in particular Irrigation Department, Agriculture Department, Revenue Department, Kerala State Electricity Board and various banks.
11. The calendar of operations needs to be strictly adhered to.

### **FISHERIES**

#### **Key issues**

1. The water-spread area and the depth of the Vembanad estuary have declined significantly.
2. The quality of water in the estuary has declined very significantly and it cannot be used for bathing or washing clothes.

3. Fish catch is declining on account of environmental problems and unsustainable fishing especially on account of the use of inappropriate gears (for example Adakkankolli vala);
4. Oil spill from boats is affecting the quality of water.
5. Fish diversity has declined considerably from about 60 earlier to about 15 now.
6. Mining of clam shell deposits have adversely affected breeding.
7. The benefits from tourism development have not reached the fishermen community.
8. Scientific recommendations on improved management are not considered in taking decisions which are largely governed by short term interests.
9. River linking schemes – Achenkovil – Pamba – Vaippar – will have severe negative consequences.
10. Spread of weeds, accumulation of plastic wastes and stagnancy of water in the absence of regular tidal waves, have drastically reduced fish yield and so this practice is not there now.
11. Ownership of land, especially in the water-front area is changing and in some places 75% of such area is owned by outsiders.
12. Acid effluents discharged from Newsprint factory and wastes from resort construction activities in Nedyanthuruthu, Panavally have led to water quality deterioration and damaged clam wealth.
13. The needs of the traditional fishing community is completely neglected.
14. Most of the water-front areas have been bought by resorts and other private entrepreneurs. This has curtailed the access of fisher-folk to the water. Further some of the resort owners are cordoning off lake areas in front of their property. This is further curtailing the area available for fishing.
15. Fisher-folk has been alienated and the Vembanad Lake has become a dumping ground for all kinds of waste.
16. Fishing is inadequate to provide a decent livelihood and this is encouraging the shift of the young generation to more remunerative occupations, especially construction. Similarly clam collection has also become un-remunerative and confined to those who have no other livelihood options.

### **Suggestions**

1. The growth of the tourism sector needs to be regulated keeping it within the carrying capacity of the ecosystem.
2. Discharge of wastes from resorts and house boats into the lake needs to be prohibited.
3. Efforts should be made to remove the accumulated plastic waste in the lake bottom and thus to revive the lake ecology.
4. Fishing zones need to be identified and tourist activities need to be prohibited in such zones.
5. Operation of the TMB needs to be streamlined to restore migration and breeding.
6. Wastes from coir industry, open latrines, faecal-sludge, animal and chicken slaughter, fish and clam processing, surface flow from farm fields, plastics and other debris are to be removed/treated/managed at source in an environmentally safe way. Strict vigilance and stern actions are needed.
7. Management of the Thanneermukkam bund needs to be improved.
8. People's movement for the protection of the lake is the need of the hour.
9. People's Committee for Lake Ecosystem Management shall be constituted and maintained.
10. Clam collection techniques need considerable improvement.
11. Reclamation of wetlands should be prohibited and rules relating to these should be strictly implemented.

### **CLAM COLLECTION**

#### **Issues**

1. Illegal clam collection is widespread and they even encroach into the areas allocated to the clam collection societies.
2. There is no scientific approach to clam collection and no one has any idea about how clam collection can be sustainably managed.
3. No one is paying any attention to scientific aspects and no official agency is paying any attention to this resource.
4. The availability of clam is diminishing particularly in the southern region where the salinity is generally below 0.5 ppt, whereas for estuarine clam breeding requires a salinity level of 8-18 ppt. Closure of bund during the spawning season (May-August and January- March) is the main reason for decline of clam in the southern part of the Vembanad kayal. Water weeds - for example Salvinia and Eichornia- also contribute to clam habitat destruction.
- 5.

### **Suggestions**

1. Clam societies shall be strengthened with full participation of clam fishermen community to regulate aspects such as conservation, optimised exploitation, sale of meat and sale of shells.
2. Clam process centres need to be made more hygienic and environment friendly. The feasibility of a centralised processing facility needs to be examined.

### **FISH PROCESSING**

There are a large number of fish processing units on the shores of the Vembanad Lake and they have been an important means of livelihood to local communities. However many challenges have emerged in the context of increasing pollution, reduction in fish catch, etc. Some of the issues that were brought up during the discussions are summarised below:

### **Issues:**

1. Workers in the fish processing units suffer from poor service conditions and unsatisfactory working environment. Most workers are not covered by ESI and PF benefits.
2. Effluents are discharged into the kayal without any treatment. Acid pollution is particularly high in areas like kaithapuzha kayal which remains isolated from tidal influence.
3. Fish quality is declining on account of pollution.
4. The Pollution Control Board is unable to enforce regulations relating to effluent treatment and discharge
5. Unscientific dredging, dumping of wastes and disruption of natural tidal flow have reduced the water holding capacity of the Lake as a whole, inviting flood conditions in many areas during monsoon. Connectivity of canal network into the lake has broken as a result of land conversion for Lake- side constructions.
6. The depth and spread of the lake is declining on account of reclamation and encroachment.
7. Aggressive tourism promotion is bound to undermine the industry.
8. Ecosystem degradation has severely undermined the livelihoods of fishermen communities.

### **Suggestions**

1. An inclusive approach involving the fisher-folks is required to develop sustainable tourism in the area.
2. Strict vigil is required in the operation of fish processing units to ensure that they adhere to pollution control measures.

3. Dredging operations needs to be strictly regulated and proper environmental impact analysis needs to be undertaken.
4. Weed control measures needs to be implemented systematically.
5. The Thanneermukkam Bund should be kept open on experimental basis and its impact monitored to take a decision on future management of the bund.
6. The CRZ rules need to be modified to accommodate the needs of fishermen community who have been living in the area and who has no place to go.
7. Strict action should be taken against violations of CRZ.
8. Waste management should become a priority.

## **WOMEN**

### **Issues**

1. The state of women, especially those from the fisher families and clam collectors is extremely challenging. They are the most marginalised among the marginalised. Life is a daily struggle to fulfil multiple responsibilities under extremely unfavourable economic, social and economic conditions.
2. Environmental deterioration has severely diminished the availability of fish and clam, especially for those who use traditional methods of fishing and clam collection.
3. Income from sale of fish and clam are low and far from adequate to meet the daily needs of the families.
4. Growth of hotels and resorts have curtailed the access to resources, especially as some of the resorts and hotels block the access to lake areas by constructing barriers.
5. Many of the schemes intended to help the marginalised remains in paper only. They seldom reach the intended beneficiaries.
6. Many families live in highly unhygienic conditions, which continues to affect their health and productivity.
7. Tourism development has not improved their income opportunities. Very few get employment in resorts and hotels.
8. Social support system is far from adequate considering the magnitude of the challenges.

### **Suggestions**

1. Basic amenities, especially water supply and waste management requires considerable improvement.
2. Measures to support older women – many who are on the verge of destitution – need significant improvement.

## **COIR INDUSTRY**

### **Issues**

1. The coir industry is facing an economic decline on account of several factors.
2. Absence of skilled workers remains a major problem especially as the sector is unable to attract younger educated people.
3. Stringent pollution control rules have affected the coir industry.
4. The potential of coir products as an environment friendly alternative has not been fully taken advantage of.

### **Suggestions:**

1. There is need to revive this sector by proper scientific back up and government support.
2. Growing demand for coconut pith is a positive development and this should be fully taken advantage of.

## **LARGE INDUSTRIAL UNITS**

Industry related discussions took place in Udyogamandal and very useful and divergent views were shared by (a) owners/ managers of industrial units and (b) workers and trade union representatives. Key issues pointed out by those associated with modern industries are summarised below:

### **Industry representatives**

While the industry managers/ owners agree that the level of pollution in the area they operate is very high, they feel that they are being singled out for all the pollution problems in the area notwithstanding their effort to reduce pollution through treating effluents. All the industrial units have installed effluent treatment systems and the State Pollution Control Board is regularly monitoring pollution levels. Industry representatives argued that a significant share of pollution is not originating from the industrial units. Several factors have affected natural flow of water affecting the flushing of the pollutants. Further huge quantity of wastes including household and municipal waste is dumped in the water bodies. A significant share of pollutants originate from the upstream area. While the natural flow is interrupted on account of bunds, land reclamation, bridges, culverts, buildings, roads and such other haphazard land use changes, water quality deteriorates on account of dumping of city wastes, faecal- sludge from toilet cleaning operations, fresh toilet wastes, slaughter wastes, fish market wastes, and effluents from small and large industrial units and such other wastes. The situation could be improved through:

- Restoring the flow especially through desilting canals and rivers;
- Remove all the constructions that adversely affect natural flow.
- Adopt an integrated approach to environmental management.

### **Industry workers**

Representatives of workers, including trade union representatives have a very different view and they pointed out that pollution abatement arrangements are far from satisfactory. Release of raw effluents into the Periyar occurs on a regular basis – partly due to genuine technical failures or often deliberately. The system for timely monitoring and fixing responsibility – individually or collectively -is ineffective. Since the source points cannot be identified taking punitive action becomes difficult. There are several pitfalls in the implementation of pollution control. The State Pollution Control Board is not effective and its functioning is not transparent. Some of the suggestions to improve the situation are:

- Revive the monitoring system established earlier under the directive of the Supreme Court.
- Monitoring of pollution and ecosystem management should be made more participatory with the Panchayats and Municipalities taking the lead role.
- A River Basin Authority could be in a better position to adopt an integrated approach.
- Modern technology including satellite imageries could help in systematically monitoring pollution and other negative impacts.

## **RESORTS AND HOTELS**

Discussions were held with hotel/ resort owners as also workers in such establishments. Important issues and suggestions brought out during the discussion are summarised below:

### **Issues**

1. There has been a very rapid growth of hotels and resorts as also home stays during the last few years and there is concern about oversupply of these.
2. Tourism in Vembanad region is struggling hard to maintain its eco-friendly and sustainable characteristics.
3. Tourism in the area is totally dependent on how effectively the beauty of the environment is maintained. Unfortunately the scenic value is being undermined by various factors.
4. In many areas water-way remains obstructed with accumulated weeds and wastes, making boat journey rather impossible. Water-front portion of the lake bank are maintained poorly, inviting more aversion than attraction. All sorts of wastes and dirty water outlets are visible along the bank.
5. The allegations of lake encroachment, reclamation and bank protection with concrete walls are all baseless. Resort owners/ hotels are often forced to erect barriers to keep the lake in the vicinity of their property clean. This is often misinterpreted as encroachment.
6. Thanneermukkam Barrage is preventing natural flushing and keeps the water adjoining the resorts south of TMB polluted.
7. Poor public infrastructure, especially roads and undependable power and water supply is increasing the costs and affecting competitiveness of tourism in comparison with other destinations.
8. Growth of small scale tourism will reduce the viability of resorts and hotels.
9. There is considerable reluctance among hotel/ resort owners to employ local people on account of the perception of high absenteeism among locally connected staff.

### **Suggestions**

1. Environment management in Vembanad Tourist Destination has to be undertaken by the Government on the basis of an integrated-scientific action plan.
2. Alternate sources of energy (for example solar) and water (especially water harvesting and reuse/ recycling) needs to be supported through subsidies.

## **HOUSE BOATS**

House boats have become another signature attraction in the area and during the last few years there has been a rapid growth in house-boat based tourism. The number of licensed house-boats is said to be about 1000; however the total number is much more considering the existence of unlicensed houseboats. A rapid increase in house-boat tourism has drawn attention to a number of environmental issues especially pollution. Though they claim to follow all rules and regulations of the State Pollution Control Board, several problems relating to pollution, especially release of faecal wastes, are reported. Key points emerging from the discussions with houseboat owners, operators and workers are summarised below.

### **Issues:**

During the FGDs, owners of houseboats pointed out the following:

- Putting the blame on houseboats for all the pollution in the kayal is incorrect. Registered houseboats fully abide by the stipulations of the pollution control. Most of the problems are caused by unregistered boats who evade compliance of pollution control measures.

- Hotels and resorts are trying to keep tourists within their premises and seldom provide a broader experience. Even conducted tours operated by resorts keep the tourists to a pre-determined route.
- The local bodies are not making timely efforts to removal and treatment of wastes. Heavy metal pollution is very high and this is not contributed by houseboats as this is mainly coming from drainage channels. Similarly human waste from pilgrim centres along the river banks in the upper reaches also increase the severity of pollution.
- Boat landing centres are becoming waste dumps on account of poor efforts to removal and recycling of wastes.
- In many places lake is becoming shallow making it difficult to dock the boats.
- High wages of local workers are resulting in the use of workers from outside the state who are willing to work for lower wages. This is affecting the employment opportunities for local people.

**Suggestions:**

- There is a need to develop a comprehensive plan for tourism development linking it with a wide range of activities. Tourists would like to visit villages, do shopping and mingle with the local communities learning about their life and culture.
- Canal networks and water bodies need to be desilted and cleaned to make them attractive and navigable.
- The nature of tourism experience sought by foreign and domestic visitors are quite different. There is a need to take into account this differing needs.
- Strict action needs to be taken against unlicensed boats whose number is reported to be about 500.
- More boat landings that provide diverse experience – shopping, cultural shows, and local traditional arts and crafts – to cater to diverse needs of the tourists should be developed.

## SUMMARY OF WRITTEN SUBMISSIONS RECEIVED BY THE COMMISSION

Apart from issues raised by those who participated in the focus group discussions, the Commission received written statements from several individuals and organizations. Prior to the focus group discussions the

Commission distributed a questionnaire containing 16 questions and the written submissions provided answers to these questions. These submissions – twenty one in all (see Box for list of organizations and individuals who provided written submissions) - provided a detailed account of the current state of problems, their causes and what may be done to remedy the situation. These submissions helped the Commission to get the views from a wide spectrum of people who shared their concern about the deterioration of the ecology and economy of Vembanad kayal and suggestions as to what may be done to prevent further deterioration and to restore the ecology of the backwater. Below is a summary of the key points raised in the different submissions.

### **Box: List of organizations and individuals who provided written submissions**

1. Abraham K Philip
2. NN Karunakaran
3. AITUC – Kottayam Jilla Matsya Thozhilali Committee
4. PA Mohiyudhen
5. CPI Kumarakam North Local Committee
6. SK Swaminathan
7. Kumarakam Nature Club
8. V G Sivadasan
9. Shaji Joseph
10. TN Amruthanath
11. KK Ramesan, Secretary Malsya Thozhilali Union
12. Salim M Das
13. Associate Director, Regional Agriculture Research Station, Kumarakam
14. Kuttanatan Karshaka Sanghatana
15. John C Mathew, MG University
16. KN Madhu and others, Panavally
17. VN Natarajan
18. VK Unnikrishnan
19. Sabu Anand
20. R Prasad, Fishworkers Federation (AITUC)
21. KS Haridas

### *Nature of the problem and the causes*

*thereof.*

1. Almost all the submissions highlighted the severe ecological deterioration of the Vembanad kayal. The extent of the lake has declined due to various interventions. Also there has been reduction in the depth of the lake, though unscientific dredging of white lime shells has increased the depth in certain areas.
2. Change in hydrology on account of the Thanneermukkam Bund has been identified as one of the most important cause of the present crisis. Several cascading adverse effects have been attributed to the Thanneermukkam Bund, in particular its very poor management. Though built to support rice cultivation, many question the contribution of TMB to enhancing rice production. Overall there is a perception that TMB has not produced the desired economic benefits while it has imposed significant environmental and social costs.
3. Hydrological changes caused by TMB have been exacerbated by widespread reclamation reducing the water-spread area. While the earlier reclamation was for agricultural development, recent reclamation is focused on real estate development, in particular hotels, resorts and residential and commercial complexes as also infrastructure development. Illegal reclamation along the backwater shores is widespread notwithstanding regulations prohibiting/ restricting such activities.

4. Poor waste management and pollution from several sources have significantly reduced water quality. Vembanad kayal has become a dumping place for waste from several sources including from the upper reaches of the rivers. Urbanization and development of industries have accentuated the problem. The situation is particularly severe south of the Thanneermukkam Bund, which is cut off from natural flushing that takes place if salt water is permitted to move upstream. Accumulation of pesticide and fertilizer residues has further compounded the problem.
5. Several cascading problems have emerged from changes in hydrology and increased concentration of pollutants. Water in the kayal cannot be used even for washing clothes and bathing. Large area of the lake surface is covered by water weeds. Water quality in the adjoining wells have deteriorated. Water-borne diseases have become wide-spread, Intensity and duration of floods have increased.
6. Fish stock and catch have declined and so is black- clam collection. Several factors have led to this situation, the most important being ecological changes stemming from pollution and change in salinity due to inefficient management of the Thanneermukkam bund and unregulated fishing.
7. Although resorts, hotels and other tourism related activities like house-boats have provided new opportunities, they are also contributing to ecological degradation. Though a clean environment is the most critical asset for tourism, pollutants from resorts, hotels and house-boats are accentuating environmental degradation. Most of the representations from individuals and organizations have pointed out the increasing role of tourism sector in pollution. Tourism development centred on resorts and hotels have benefited only a few.
8. Although the Kuttanad package was initiated with the objective of ecological revitalisation, the manner in which it is being implemented will only help to aggravate the problem. Construction of bunds has become the main thrust, which while generating more in-situ problems will have negative off-site effects, especially as stones and soil are obtained by destroying hills elsewhere.
9. Infrastructure development – especially roads and bridges – has been undertaken totally neglecting their environmental consequences, aggravating water logging and flooding.
10. On the whole the Vembanad ecosystem is in crisis severely undermining its carrying capacity.

### **People most affected**

While ecological decline has affected most of those who are dependent on the Vembanad kayal, probably the most affected are the fisher folks, whose livelihood is very much dependent on the health and vitality of the ecosystem. Decline in fish wealth and black clam has impoverished the ecosystem people. Pollution related problems have led to a significant decline in the quality of ecosystem services. Women who have been traditionally dependent on black clam collection is probably the worst affected. Opportunities stemming from development of tourism have largely bypassed them. In a way they have become economic refugees in the area where they lived and thrived for generations.

### **Main challenges**

Fundamental to the problems listed above is poor governance and most of the submissions received by the Commission drew attention to inadequacy of policies, legislation and institutional deficiencies. Poor implementation of environmental regulations was identified as a key challenge:

1. There is widespread violation of rules and regulations. Encroachment of the lake area is a major cause of reduction in the extent of the kayal.
2. Several islands that have mangroves and filtration ponds have been bought by large investors and there is no control over land use changes – especially construction that has a number of negative impacts on the ecology.

3. While rules and regulations as regards pollution control exists, they are poorly implemented. Commitment to adhere to environmental regulations is poor.
4. Management of the Thanneermukkam bund has been inefficient aggravating environmental degradation, especially south of the Thanneermukkam bund.
5. Poor coordination of disparate activities of different agencies, each pursuing their narrow objective, is identified as a major challenge.
6. Most of the technologies used have produced back-lash effects. Increased use of fertilizers and pesticides to enhance agricultural productivity is a typical example, which focused entirely on improving production, failing to take into account the long term impacts.

#### **What needs to be done?**

1. Establish an authority – Vembanad Lake Management Authority – to take full control over the management of the lake.
2. Demarcate the lake boundary and remove all encroachments.
3. Empower local community to monitor wetlands.
4. Prohibit the development of new resorts and the introduction of additional houseboats.
5. Ensure that all resorts and hotels adhere to environmental regulations.
6. Ensure that the natural hydrology is not interrupted through any interventions.
7. The operation of the Thanneermukkam Bund needs to be improved and closure is to be limited to when it is absolutely required.
8. Put in place a mechanism to monitor and regulate land transactions and changes in land use.
9. Shift to organic farming, reducing the dependence on pesticides and organic fertilizers. Increased costs on account of such shift should be borne by the government. Strictly adhere to an agricultural calendar.
10. Regulate fishing and ensure that no unsustainable fishing is taking place.
11. Ensure that local people are fully involved in tourism development and are able to fully benefit from the emerging opportunities.
12. Land management in the catchment areas of rivers flowing to Vembanad needs to be improved, especially to reduce soil erosion and to improve lean season flow.

## PESTICIDES IN KUTTANAD ECOSYSTEM<sup>1</sup>

### **Insecticide use descending, Herbicide use ascending and IPM Practices yet to pick up**

Large scale pesticide use began in Kuttanad in the 1960s in the context of intensification of paddy cultivation and for over three decades Organo Chlorine (OC) insecticides such as DDT, Lindane (Gama BHC), Endrin, Dieldrin, Aldrin, Heptachlor, Chlordane, Methoxychlor, Dicofol and Endosulfan were widely used for rice pest control in varying quantities. These first generation pesticides, though cheap and effective, were all very dangerous chemicals considering their resistance to biological and chemical degradation, consequent bio-magnification through food chains leading to significant secondary toxicity. In the situation like Kuttanad where natural flushing process has been disrupted the problem becomes highly acute. Continuous use of persistent pesticides has also led to pesticide resistance and drastic decline in rice and fisheries productivity, mainly due to the deterioration of the overall environmental quality.

#### ***Bio accumulation and chronic toxicity***

OC compounds are not soluble in water and they get deposited in sediments. Being contact poisons they are absorbed by the skin and the mucous membranes. They affect the body as stimulants of central nervous system and are also hepatotoxic. They can express chronic toxicity as they are lipid soluble and hence affect future generation as well. Thus they cause permanent damage to all sorts of life forms. Because of this most of the countries have discontinued the use of OC pesticides now. Kerala has banned the use of OC pesticides in agricultural practices. DDT was banned in 1992 but it is still available in the market for malaria control. BHC was banned in 1997 but its gama isomer called Lindane is readily available in the market meant officially for termite control. Endosulfan was banned for use in Kerala since 2012 but it is still in use. The Kuttanad Ecosystem has been subjected to continuous application of OC pesticide in one way or other for over three decades before the restrictions came into force. Therefore how much OC compounds and their degradation products persist in the ecosystem has always been a matter of great concern.

#### ***Second generation pesticides and their hazards***

Organo Phosphorus (OP) and Carbamates are the major groups of second generation pesticides, which replaced some of the OC pesticides in Kuttanad for crop protection in the form of insecticides, fungicides and herbicides. Compounds such as Ethyl Parathion, Heptachlor, Menazon and 2.4.5 T were discontinued after 3 decades of their use, as they proved to be among the

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dangerous pesticides banned for use. Other pesticides like Carbofuran, Fenitrothion, Fenthion, Formothion, Methyl parathion, Diazinon and Phosphamidon are either banned or restricted for use very recently, after their extensive application for pest control in Kerala particularly in Kuttanad until 2012. The most popular Insecticide at present used here is Acephate and the other ones are; Carbaryl, Malathion, Dimethoate, Quinalphos, Lindane, Monocrotophos, Phorate, Phorate sulphone, Chlorpyrifos, Triazophos, alpha-Endosulfan, lambda-Cyhalothrin, delta-Methrin and cyprymethrin. The most popular Fungicide in use is Hexaconazole and the other ones are; Carbandazim, Ediphenphos, Kitazan and Mangozeb. The most popular Herbicide in use is 2.4.D and the other ones are; Glyphosate, Paraquat yellow and Butachlor.

### ***Indiscriminate use and consequences***

Unlike OC pesticides, OP and Carbamate pesticides are much less persistent in the environment; consequently their bio magnification is meagre. They are either soluble or partially soluble in water, degrade and get detoxified fast. Generally their half-life period (time needed for degrading to 50%) would be in the range of 1-3 days. They are unstable in hot, humid climates. They exhibit varying degrees of toxicity and environmental degradation. These compounds seldom cause chronic toxicity but their hazard is more in terms of acute toxicity. Many of these compounds like the ones banned for use cited earlier are either extremely poisonous (Red category) or highly poisonous (Yellow category). These pesticides are readily absorbed by the skin, mucous membranes and also through the GI tract, lungs and eyes. They show the clinical signs of acute toxicity relatively faster as they are readily distributed throughout the body. With sub-acute dose, recovery would be easy. Higher doses however would even be fatal because OP and Carbamate compounds act as either direct or indirect inhibitors of the vital enzyme called Acetyl Choline esterase. The potential danger associated with these groups of pesticides is due to the greater chances of dermal exposure of workers involved in their application and residual contamination of crops when pesticide is applied immediately before harvest. Mortality of fishes and other aquatic species would be a natural consequence of indiscriminate pesticide application in submerged paddy fields from where water used to be pumped out into outer canal- stream- river-lake network system like the one in Kuttanad. However since the dissipation of pesticides under this condition is accompanied by dilution it would often go unnoticed and most of the harmful chemicals would soon get destroyed through natural degradation process. Indiscriminate Pesticide application and clandestine use of banned as well as restricted pesticides have to be curbed and it needs to give way to Integrated Pest Management and Good Agricultural Practices.

### ***Recent studies on the levels of pesticide residues in Kuttanad rice ecosystem***

Two studies (*Sosamma Cherian 1997-1999; Priya Mohan 2007-2010*) conducted by the Kerala Agricultural University in the recent past on the impact of pesticide use in the rice ecosystem of Kuttanad, revealed that the concentrations of the residues of the pesticide belonging to the persistent category of Organo Chlorine Insecticides, already banned and withdrawn from use in this area and their degradation products in the environment, are being continuously decreasing in various ecosystem elements and the present levels of these pesticide residues are well below the recommended concentrations stipulated by WHO, apparently indicating that they have now reached

at a harmless stage notwithstanding the possibilities of bio accumulation and slow degradation. Analysis of water samples from rice fields, river, channels and wells as well as samples of harvested rice grain, straw, fish and clam indicated that residues of OC pesticides were reported to be below the limits prescribed by WHO.

The other study conducted by Priya Mohan (2007-2010) was part of the FAO IAEA (International Atomic Energy Agency) Co-ordinated Research Project under the Principal Investigator ship of Dr Nazeema Beevi S, for investigating the impact of pesticides on abiotic and biotic components in rice ecosystem of Kuttanad. This study has brought out some of the undesirable trends as regards pest control practices in the rice ecosystem of Kuttanad. While pesticide application per hectare has reached an all-time low (0.56 to 3.38 kg ai ha<sup>-1</sup>) and also may be a desirable trend to that extent, a substantial increase in the amount of Herbicides used (0.3 to 1.63 kg ai ha<sup>-1</sup>) over that of Fungicides (0.04 to 0.097 kg ai ha<sup>-1</sup>) and Insecticides (0.09 to 0.947 kg ai ha<sup>-1</sup>) is a matter of concern. Herbicides are applied at the seedling stage in the rice field where their residues were detected in the samples of water and soil collected from the field, field outlet and drainage channel. Insecticides and fungicides were applied during the tillering stage, booting stage and milky stage and that their residual presence in the same sampling- points were meagre is certainly a welcome sign. Moreover, residue values below the detectable levels in river and stream water samples and their total absence in harvested rice grains, straw, fish, mollusc, duck meet, eggs, and animal meet, illustrate a better trend in the management of OP and Carbamate pesticides in the Kuttanad farm fields.

However the study has highlighted some of the inherent weaknesses in enforcing WHO and FAO guidelines in the handling and application of pesticides. Safety guidelines to be followed such as adherence to label instructions, use of protective gears and guidelines for the disposal of used pesticide containers are not taken up seriously. In 2011 Kerala Government has banned pesticides such as Carbofuran, Phorate (red), Monocrotophos, Triazophos and Methyl Parathion and suggested substitute chemicals as per the KAU recommendations. This is yet another matter of concern in Kuttanad as these chemicals used to be very popular among the farming community here and they may continue to use them if available in the market. A survey conducted as part of this study showed that although 75% of the rice cultivators are aware of IPM practices only about 39% adopt IPM practices. And only 4% of the farmers have heard of the Good Agricultural Practices recommendations put forth by KAU.