WETLAND CONVERSION: THE CASE OF BACKWATER RECLAMATION IN KERALA

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Jeena T S*

Abstract

Wetlands in their natural state bring substantial benefits to society. Nevertheless, there is growing concern over conversion of wetlands. This study examines the case of coastal wetland conversion in Kerala, known as backwater reclamation. The conversion of wetlands involves not only irreversibility in the environmental or ecological processes but also uncertainty. The study points to the need for incorporating the option value of wetlands in any cost-benefit calculation regarding the conversion of wetlands.

Keywords. Wetlands, backwater reclamation, institutional failure, option value

Introduction

Wetlands are ecosystems of great importance and they are the first ecosystem to have an international convention under which the contracting parties agreed to conserve and protect it. The Ramsar Convention of 1971 of IUCN defined wetlands as areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salty including areas of marine waters less than six metres deep, all rivers and coastal areas, and most coral reefs. These may be classified as natural or artificial by their occurrence. The Asian Wetland Bureau (1991) broadly defined wetlands of South and West Asia as estuaries and deltas; salt marshes, mangroves and mudflats; coastal lagoons, freshwater lakes and marshes; oasis, salt marshes, seasonal flood plain wetlands, swamp forests, rivers and streams; human-managed systems such as rice fields, fish ponds and reservoirs. In addition, wetlands may incorporate riparian and coastal zones adjacent to the wetland and islands or bodies of marine water not deeper than

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six metres at low tide lying within wetlands. Geo-morphologically, wetlands may be divided among five major systems at the broadest level as marine, estuarine, riverine, lacustrine and palustrine. They are also broadly classified as inland fresh and saline wetlands as well as coastal fresh and saline wetlands (Nair A S K, 1997).

The importance of wetland ecosystem has to be seen in the context of physio-chemical and biological processes that occur in a wetland. These include sedimentation, storage, ion exchange, nutrients uptake, absorption, bacterial and fungal dissimilation, solubilization, gasification, transport, immobilization, nitrification, denitrification, bioconversion, and so on (Nair A S K, 1997). It is also significant to note that the wetlands hold an important position among ecosystems when we consider the ecological aspects like genetic and ecological diversity, endemism of plant and animal communities, hydrological function, etc. Besides these, wetlands function as the natural filters upgrading waste water, assist in the recharge of groundwater and regulate the intrusion of salt water. Wetlands also absorb large quantities of storm waters and thereby reduce flooding of adjacent areas. Above all, they are a major source of livelihood for rural people in developing countries.

However, years of neglect and anthropogenic pressures pose a grave threat to these important ecosystems. Wetlands were once considered as wastelands and were indiscriminately converted for agriculture, human habitation, discharge of industrial effluents, etc. Besides, the excessive use of fertilisers, pesticides and overexploitation has led to the deterioration of the quality of the system and has adversely affected the fisheries, which are the main source of livelihood of rural people.

The coastal wetlands are the most vulnerable ones in this regard for the following reasons: The coastal ecosystems and estuarine systems form the interface between continental lands and oceanic islands and their surrounding seas are among some of the most productive ecosystems of the world. Many marine species require estuaries for part of their life cycle. For example, many fish species migrate between systems, and a variety of organisms have their larval stages in the estuaries. It has been noted elsewhere that the increasing atmospheric concentrations of methane, carbon dioxide and other greenhouse gases are expected to raise the earth’s average temperature by a few degrees centigrade in the next century. Such warming could raise the sea level by a few feet as ocean waters expand. Since most of the coastal wetlands are within a few feet of the mean sea level, a rise in the water level could cause a major loss of these ecosystems (Nair A S K, 1997). Any degradation in the coastal wetlands is an irreversible loss of the ecosystem and there exists uncertainty about the impact of any change to the ecosystem. Therefore, these ecosystems are
particularly important for integrating sound ecological management with sustainable economics (Costanza et al. 1995). In this paper, we deal with a category of coastal wetlands in Kerala, known as backwaters. Large-scale reclamation of these backwaters had taken place in the past and the present study attempts to analyse the institutional aspects of these reclamation and the observed environmental impacts of such reclamation activities.

The paper is organised as follows: Section 2 provides the objective of the study and the analytical framework of the paper followed by background information about wetlands in Kerala in the third section. The fourth section gives an overview of the major institutional interventions on the backwaters of Kerala. The fifth section discusses the environmental concerns due to reclamation of backwater, and highlights the future researchable issues.

Objective and Analytical Approach of the Paper

The early literature on environmental economics has addressed the issue of environmental degradation from the point of view of market failure (Pigou 1920, Lindhal 1958, Arrow 1971, etc cited in Dasgupta 1996). However, as the degradation of the environment is the product of the independent decisions of billions of individual users of environmental resources, the underlying causes of environmental degradation accordingly lie in the determinants of those individual decisions such as preferences and institutional elements like property rights, cultural, religious and legal restrictions, on individual behaviour and economic aspects such as relative prices (Opschoor, 1996). Thus, the recent literature (for example see, Dasgupta, 1996) addresses the issue from a wider perspective, that is, from the point of view of institutional failure that includes policy failure, market failure and micro institution failure. The present paper addresses some important issues facing the coastal wetlands of Kerala from this perspective. The prime objective of the paper is to analyse the institutional interventions in the coastal wetlands of Kerala that has led to backwater reclamation. The study also discusses the environmental impact of such reclamation measures as is evident from the existing literature. We examine the problem of backwater reclamation in general and, depending upon data availability we have cited specific cases. Published literature, including government reports, comprises the major sources of data.

Wetlands of Kerala: Background Information

The Centre for Earth Science Studies, Trivandrum, in collaboration with the Space Application Centre, has mapped the wetlands of Kerala. A detailed classification of wetlands in Kerala is given below.
### Table 1 Wetland Classification System

<table>
<thead>
<tr>
<th>Inland Wetlands</th>
<th>Coastal Wetlands</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Natural</strong></td>
<td><strong>Human made</strong></td>
</tr>
<tr>
<td>1 Lakes/Ponds</td>
<td>Reservoirs</td>
</tr>
<tr>
<td>2 Ox-bow Lakes/</td>
<td>Tanks</td>
</tr>
<tr>
<td>Cut-off Meanders</td>
<td></td>
</tr>
<tr>
<td>3 Playas</td>
<td>Waterlogged</td>
</tr>
<tr>
<td>4 Swamp/ Marsh</td>
<td>Abandoned Quarries</td>
</tr>
<tr>
<td>5 Ash Pond/</td>
<td>Bay</td>
</tr>
<tr>
<td>Cooling Pond</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

Source: Nair ASK(1997)

Notes: Rivers and wetlands put to regular agriculture use have not been included.

From the table it is evident that in Kerala has different types of coastal natural wetlands. A recent mapping of wetland results shows that Kerala has a total coastal wetland of about 3311.51 sq km (Nair and Sankar 1995) which forms 8.5 per cent of the total area of the state. The areas of various coastal wetland units are given in table 2.
Table 2 The Area of Various Coastal Wetland Units in Kerala

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Name of Wetland Unit</th>
<th>Area in sq.km</th>
<th>Percentage to Total Coastal Wetland Area in Kerala</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Beach</td>
<td>47.281</td>
<td>(1.43)</td>
</tr>
<tr>
<td>2</td>
<td>Rocky Coast</td>
<td>26.446</td>
<td>(0.80)</td>
</tr>
<tr>
<td>3</td>
<td>Vegetative Wetland</td>
<td>25.080</td>
<td>(0.75)</td>
</tr>
<tr>
<td>4</td>
<td>Estuary</td>
<td>447.591</td>
<td>(13.51)</td>
</tr>
<tr>
<td>5</td>
<td>Creek 13 Nos</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Kayal (Backwater)</td>
<td>85.911</td>
<td>(2.59)</td>
</tr>
<tr>
<td>7</td>
<td>Inlet (Temporary) 28 Nos (Permanent) 20 Nos</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Flood Prone</td>
<td>267.195</td>
<td>(8.07)</td>
</tr>
<tr>
<td>9</td>
<td>Coastal Dune</td>
<td>13.640</td>
<td>(0.41)</td>
</tr>
<tr>
<td>10</td>
<td>Reclaimed Land</td>
<td>866.109</td>
<td>(26.15)</td>
</tr>
<tr>
<td>11</td>
<td>Cliff</td>
<td>5.379</td>
<td>(0.16)</td>
</tr>
<tr>
<td>12</td>
<td>Strand plane</td>
<td>1467.379</td>
<td>(44.31)</td>
</tr>
<tr>
<td>13</td>
<td>Island/ Islets</td>
<td>48.455</td>
<td>(1.46)</td>
</tr>
<tr>
<td>14</td>
<td>Freshwater lake</td>
<td>11.051</td>
<td>(0.33)</td>
</tr>
</tbody>
</table>

Source: Nair (1997)

* Figures in parentheses represent the percentage to total coastal wetland area in Kerala

The coastal wetland ecosystem, comprising estuaries of the rivers, their lower reaches within the tidal influx, the brackish water lakes and backwaters along with their estuaries, contributes 2,42,600 hectares, that is, 68 per cent of the 3,36,000 ha inland water area in Kerala. Among these, the peculiarities
of these backwaters are the bar-built nature to the extent that they could be treated as coastal lagoons. These backwaters originated as lagoons in which rivers kept their flow, rendering estuarine characteristics to them. Hence, these water bodies are unique enough to be treated as a special intermediate class between lagoons and estuaries (Government of Kerala 1988).

According to the official documents there are 30 important backwaters in the state. Among them the most important are Vembanad Lake and Ashtamudi Kayal. The Vembanad Lake stretches from Alleppey in the south to Azhikode in the north and is generally known as the Cochin Estuarine System. This huge water body, which is about 90 kms, is also regionally known as kayas. While this long stretch of water body is known as Vembanad Lake from Thanneermukkam to Alleppey, it is known as Cochin Backwaters or kochi kayal from Thanneermukkam to the upper reaches of Azhikode. Even though these demarcations exist, in this paper we are using the names Vembanad Lake, Cochin Backwater and Cochin Estuarine system interchangeably. It is seen from the literature that the institutional interventions were very high in this ecosystem.

An Overview of Institutional Interventions in the Backwaters of Kerala

In this section, we trace the important institutional interventions and their implications on backwater reclamation of Kerala. Based on the suitability to the context we have used Commons’ definition of institutions. Thus ‘institutions’ means a going concern which engages in a series of transactions within the guidelines of a set of working rules and includes the government. An individual is a part and a product of these going concerns. The individuals realise their potential (or fail to do so) in going concerns, because it is through collective action that an environment is provided for effective individual action (Commons 1950). Institutions, thus, refer to the rules and conventions of society that facilitate co-ordination among people regarding their behaviour, and include formal and informal, governmental and non-governmental rules and conventions (Bromley 1989; North 1989). It is also assumed that the degradation of backwaters could be better explained by placing the human behaviour in the institutional context or set-up.

It is reported that increased human interventions, both as individuals as well as organisational, have reduced the area and depth of the backwaters during the recent decades. These water bodies had been drained for agriculture, fish farming, harbour development, urban development and industrial development. Table 3 shows the land reclaimed from Vembanad Lake for various purposes as per the available information.
### Table 3 Land Reclaimed from Vembanad Lake for Agriculture and Traditional Industries

<table>
<thead>
<tr>
<th>Period</th>
<th>Reclaimed land in hectares</th>
<th>% of total area of</th>
<th>Type of activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1834-1903</td>
<td>2226.72</td>
<td>6.10</td>
<td>Paddy cultivation</td>
</tr>
<tr>
<td>1912-1931</td>
<td>5253.15</td>
<td>14.39</td>
<td>Paddy cultivation</td>
</tr>
<tr>
<td>1941-1950</td>
<td>1325.00</td>
<td>3.63</td>
<td>Paddy cultivation</td>
</tr>
<tr>
<td>1970-1984</td>
<td>800.00</td>
<td>2.19</td>
<td>Paddy cultivation + prawn farming</td>
</tr>
<tr>
<td>1900-1984</td>
<td>1500.00</td>
<td>4.11</td>
<td>Agriculture, housing and husk retting</td>
</tr>
<tr>
<td>1975</td>
<td>6900.00</td>
<td>10.90</td>
<td>Industrial Purposes and Thanneermukkam barrier</td>
</tr>
<tr>
<td>Total</td>
<td>23104.87</td>
<td>55.87</td>
<td></td>
</tr>
</tbody>
</table>

Source: Gopalan U K (1991)

*Figures in the parentheses show the percentage to the total reclaimed land

According to this source, the reclamation of the Vembanad Lake started as early as 1834, and by 1950 reclaimed about 24.12 per cent of the total area of Vembanad Lake for paddy cultivation alone. As the table shows in the nineteenth century the reclamation was very slow but gathered momentum during the period 1912-1931. Almost 22.74 per cent of the total reclaimed area was reclaimed for paddy cultivation during this period. While 24.12 per cent of the total area of the Vembanad lake was converted for paddy cultivation alone, another 16.16 per cent was reclaimed for paddy cultivation and prawn farming. Another 4.11 per cent was reclaimed for husk retting and other agriculture activities and not less than 10.9 per cent for industrial purposes. Besides the area reclaimed for agriculture, industrial and allied activities, vast
areas were reclaimed for harbour and urban developments. As per the available data (table 4) 1.9 per cent of the total area of the Vembanad Lake was reclaimed for harbour and urban developments during 1920-1985. A comparison of both the tables shows that land reclamation for agriculture, industrial, allied activities and harbour and urban developments together has significantly reduced the area of Vembanad Lake. However, we can see that major reclamation was for agriculture and allied activities. This calls into question the need for such reclamation activities. To answer this question we have to examine the situation that existed in Kerala during that time. Though data limitations preclude a rigorous time series analysis, from whatever data is available at hand, we have tried to examine the situation during the pre-independence and post-independence periods separately.

Table 4  Land Reclaimed from Vembanad Kayal for Harbour Development and Urban Development

<table>
<thead>
<tr>
<th>Period</th>
<th>Area in hectares</th>
<th>% total area of Vembanad Kayal</th>
<th>Type of activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1920-1936</td>
<td>364.37</td>
<td>1.00</td>
<td>Construction of Wellington island</td>
</tr>
<tr>
<td>-1978</td>
<td>10.78</td>
<td>0.03</td>
<td>Fishing and Harbour Development</td>
</tr>
<tr>
<td>1981-1985</td>
<td>141.70</td>
<td>0.39</td>
<td>Integrated harbour development</td>
</tr>
<tr>
<td></td>
<td>141.70</td>
<td>0.39</td>
<td>For filling of South of Wellington island</td>
</tr>
<tr>
<td>1981-1985</td>
<td>23.91</td>
<td>0.07</td>
<td>Urban Development</td>
</tr>
<tr>
<td>1981-1985</td>
<td>11.73</td>
<td>0.03</td>
<td>For Shipyard, C1F T tanker berth, etc.</td>
</tr>
<tr>
<td>Total</td>
<td>694.19</td>
<td>1.90</td>
<td></td>
</tr>
</tbody>
</table>

Source: Gopalan UK (1991)

The backwater reclamation, which is a unique feature of the conquest of nature in the backwaters and rivers, owes its origin in India to the tiny former princely state of Travancore (Government of Kerala 1972). It has been reported that the reclamation first started in the Kuttanad region for paddy cultivation as early as 1833 since the region was densely populated and suffered from chronic deficits in food supply from early times. According to the report of Government of Kerala 1974, Kerala had a chronic shortage of food even
though during that time the state produced 50 per cent of its demand of rice, the staple food. The increase in demand for food was mainly due to the increase in population, and even if all irrigation potential was used, the extension of area under paddy was limited, as the entire extent of wetlands in the state was under paddy. Therefore, the plausible way of bridging the gap between demand and supply of rice was the reclamation of the waterlogged areas. This included the shallow portion of backwaters, reducing or preventing the extent and duration of flood, submersion and removal of salinity, acidity and toxicity from the lands at present subject to these menaces. This was expected to increase the crop areas, thereby increasing the crop yield. (Government of Kerala, 1974).

The general consensus of opinion is that the entire area now known as Kuttanad in the erstwhile North Travancore has emerged as a result of reclamation activities by the riots spread over several centuries. During the second half of nineteenth century the pressure of an increasing population on the available food supply compelled the State to pay more attention to reclamation projects to extend the area under cultivation (Government of Kerala 1989). It is seen from the literature (Gopalan 1991) that the government promoted the conversion for paddy cultivation during the initial years by giving loans without interest. According to a report in 1972 of the State Planning Board, due to scarcity of food crops: at the beginning of the Second World War, the erstwhile Government of Travancore induced the farmers to reclaim land to raise a paddy crop annually using improved seeds. This gave an impetus to farmers to cultivate paddy after reclaiming land from backwaters. This was achieved by putting barriers against the entry of the brackish water from the lakes, and seas, and channeling the flow of fresh water from the river systems to the fields. The main reason cited for this is that he proximity of the low-lying rice belt to the backwaters and the sea made the intrusion of salinity a source of perennial danger in many areas that considerably diminished the yield from the lands.

Although the scarcity of food appears to be the obvious answer for the initiation of reclamation schemes, the circumstance that favoured such a measure draws us towards the issue of the property rights on the backwaters. It appears that the ownership right was with the government without properly defining the user rights. As we know, the individuals and the state, which surely retains certain rights or places restrictions on individual rights, are assumed to play a co-operative game in which the state is able to enforce the new set of property rights (Larson and Bromley 1990). In the case of the backwaters the property rights seems to be ill specified. Let us try to elaborate on this. We know that two axioms dominate discussions of resource degradation and property right (ibid.). One is the composition axiom, which states that the
complete control of a resource must be vested in a well-defined group for socially efficient use, and the second is called the authority axiom, which states that well defined groups must also act with a unified purpose. The supporters of the individual private property claim that since there is unity of both composition and authority axiom in it, the resource under private property will be used efficiently and, by implication, will be socially optimal (Cheung (1970), Demsetz (1967), Posner (1977) cited in Larson and Bromley 1990). From the survey of existing studies, it is learnt that the state failed to impart complete knowledge of the process whereby rights in backwaters are transferred to an individual, and also failed to redefine property rights. Theoretically, such a failure essentially creates a situation of open access thus violating the composition axiom. We know that when a given resource is open access, the agents have to decide whether or not they should ‘enter’ and start exploiting the resource. Their choice is based on the comparison between the price of entry, which they have to bear, and the expected income they will get. As long as the net expected benefit is positive, they decide to enter and exploit the resource. The problem is that the evaluation of the net expected benefits does not take into account the externality that they impose on others and the result will be overuse resulting in the degradation of the resource (Baland and Platteau, 1996). While production technologies may imply separable objective functions, individually optimal strategies deviate from the social optimum when property rights allow the members of the group to ignore the cost of their choices on other members of the group (Larson and Bromley 1990). From the following paragraphs it becomes clear that the social cost of reclamation measures were neglected due to the ill specified property rights, thereby making it open access in nature, leading to the degradation.

The reclamation of land from backwater (also regionally known as kaya/lands) involved two costly operations - bunding (constructing barriers) and draining. As the lands were generally 2 to 3 metres below the water level, it necessitated the construction of temporary or permanent barriers so that cultivation in the kaya/lands was made possible. Initially, the technology used for bund construction was a traditional one. The general method of construction of bunds for reclamation of kaya/lands was to form a double line corridor around the proposed area using pieces of coconut stems driven deep into the waterbed. It is then fenced on both sides with bamboo screen, and inside these screens is filled with sand, clay, twigs and garbage. After the construction of such bunds, water inside them is pumped out by either a water wheel or pump sets. The usual agricultural practices are then carried out in the area.

Although the construction of bunds appears to be simple, it had important implications for the ecosystem. Since the idea behind reclaiming
Kayal lands was paddy cultivation, the bunds constructed using traditional technology turned out to be a major hindrance for continued cultivation. The reason was that these types of bunds, made out of mud, lasted only six to eight months and were at risk of destruction and submersion under water due to flood hazards. Due to this, the cultivators had to re-erect bunds every year to make cultivation possible, which was very expensive.

In this context, knowing how this large-scale reclamation, a costly activity, was made possible or easy is imperative. This takes us to the post-independence period. After independence large-scale reclamation was made possible through the Soil Conservation Programmes. With the launch of Five-Year Development Plans, soil conservation became an integral part of agricultural development programmes. This aimed at the adoption of long-lasting and recurring measures for making the soil highly productive. In Kerala, soil conservation schemes were initiated during the First Five-Year Plan and the physical and financial targets were mainly set for the Contour Bunding Schemes. It is also reported that, since 1961, the Government of Kerala has initiated schemes, for the construction of permanent ring bunds in the kayal. The construction of bunds was aimed at stabilising the first crop and facilitating multi-cropping in the low-lying areas. Since 1966 the government has enlarged the scope of similar types of work and the following schemes took shape: The Kayamkulam reclamation scheme, Paravoor Kayal reclamation, Korapuzha reclamation, Vellayani reclamation and Mattancheri reclamation schemes have been sponsored by the state government (Government of Kerala, 1974). The salient features of all these schemes were the construction of temporary or permanent bunds to prevent the influx of salt water so that paddy cultivation could be extended to more areas. An important upshot of the above discussion is that it was a major policy initiative of the government that facilitated large-scale reclamation of backwaters. The government provided several incentives to the farmers for the reclamation of backwaters. These included the exemption from taxes during the first five years of reclamation, concessional rates of taxes during the subsequent years, extending loan assistance for cultivation and subsidies for using pump sets, etc. (Evaluation series No.12 State Planning Board, 1972). The government had been providing assistance to the farmers under various soil conservation schemes since 1961. However, the happenings in the due course of time show that it failed to meet the basic objective for which it was formulated.

Before independence the erstwhile Government of Travancore had allotted a certain part of Vembanad Lake to some cultivators for reclamation and cultivation. The land so reclaimed by the cultivators was classified under 20 sub-divisions and numbered alphabetically from A to T. Many of these
blocks were also brought under the Soil Conservation Schemes with the inception of Five-Year Plans after independence. The main reason for bringing these blocks under the soil conservation scheme was the fact that the paddy (punja) cultivation in the region was beset with several difficulties. Both Southwest and Northeast monsoons caused floods in the region. Let us take the case of 'R' block, which was extensively brought under Soil Conservation Scheme and for which an evaluation report of the scheme is also available. The main objectives of the 'R' block Kayal scheme were to construct rubble masonry outer ring bunds along the boundary of the 'R' block Kayal and provide suitable inlets and engine locations to convert the single-crop paddy field into double-crop paddy field under controlled conditions. Though the government undertook these soil conservation measures to enhance food production and achieving food self sufficiency in the state, certain drawback were observed in the soil conservation schemes.

In the case of 'R' block kayal scheme, the area under paddy reduced instead of increasing. The government of Kerala report of 1972 says that while the area under paddy cultivation in the 'R' block Kayal Scheme prior to the implementation of the scheme was 180.03 hectares, it reduced to a mere 7.23 hectares by 1971 after the scheme began. It is reasonable to believe that the cropping pattern might have changed against paddy cultivation in the 'R' block in line with the widespread change in the cropping pattern that has taken place in Kerala since the 1970s.

Another point to be noted is the decline in the cultivated area over the period, which implies that the land was left fallow or was used for non-agricultural purposes. During the same period the total cultivated land declined from 183.52 hectares to 68.94 hectares. It should be remembered that the substitution of one food crop by another food crop is not permissible under the land utilisation order. In the case of 'R' block Kayal one food crop was substituted by another food crop. This means that there were serious lapses in the implementation of the order.

This lapse in implementing the land utilisation order ought to be seen in the following context: One is regarding the type of land covered in the land utilisation order. According to the definition, 'land' means any land whether waste or arable. The order put restrictions mainly on the lands under cultivation or lands that were amenable for cultivation. While defining such categories of land, the order had not explicitly mentioned anything about reclaiming land from backwaters or any waterlogged area, which are not under individual ownership, which could be made amenable for cultivation. This definitional lapse helped the enterprising farmers to reclaim more land at desirable or undesirable places.
In addition to this, several other factors had facilitated the shift from food crops to non-food crops, of which the passing and implementation of Kerala Land Reforms Act, 1963 is important. Under the land reforms act, ceiling area was fixed which brought down the size of the holding that an individual or household owned. Moreover, whatever land they owned was subdivided and fragmented. This must have certainly reduced the economy of large-scale cultivation.

The land reforms act, which was undoubtedly a major breakthrough from the point of view of distribution, failed to augment the agricultural production base of the Kerala economy. These, together with the lapse in the implementation of the land utilisation order, resulted in failure of the reclamation schemes. Thus almost all reclamation schemes aimed at augmenting the paddy cultivation in the state, failed to meet the food security needs of the state. Nevertheless, these reclamation activities had serious consequences on the environment. We examine these aspects in another section of this paper.

Response of Micro Institutions

It should be noted that the causes of environmental problems are not limited to market and government failures; they also arise because such micro institutions such as the household can function very badly (Dasgupta, 1996). In fact, government assistance for land reclamation from backwaters led micro institutions like households also to adopt environmentally unsustainable practices. A brief analysis of these aspects is carried out in the following paragraphs. The case of Attumuttu Kayal Scheme is taken to analyze these aspects.

The Attumuttu Kayal takes its name from a block of land reclaimed from the lake for paddy cultivation. It is even interesting that the credit for pioneering the reclamation of Vembanad lake in the area goes to a particular family in the area. Here, the decision of a micro institution, a household, had an important influence as far as the reclamation of the backwaters is concerned. It was a particular family that ventured to reclaim the portion of Vembanad lake lying at the mouth of Chennankari river, realising the potentials of paddy cultivation there (Government of Kerala, 1985). The effort was to divert the course of the river, which was about 9 metres deep. It is also important to note that the economic factors speeded up the reclamation of backwaters. The abundance of indigenous materials and cheap local labour accelerated the reclamation. Using the abundant cheap labour and indigenous materials, the family erected a barrier which emerged as a bund.

It is to be noted that there are cases where it is individually rational to degrade a natural resource that may or may not run counter to collective
rationality. For instance, agents living close to subsistence level with no alternative income-earning opportunities are concerned that the income they derive from the exploitation of resources meet their subsistence requirement in each period (Baland and Platteau, 1996). This means that subsistence constraints may therefore drive people to draw down the resource to the shutdown point. One of the conditions that Baland and Platteau (1996) noted for the proposition to hold true is that of the imperfect capital market. The effect of the imperfect capital market is that the agents will not be able to obtain loans to undertake the necessary investments for conservation of the resource. However, in the case of backwater reclamation schemes the capital market was not so imperfect in the sense that the government was giving incentives by way of loans and tax exemptions in the initial years to those farmers who have reclaimed land from the backwaters.

It is important to note here that the individual rationality that led to resource degradation was counter to collective rationality, as is evident from the protest of the local people. Thus, it is obvious from the local peoples opposition that it is not the subsistence needs that forced the individual families to venture upon new projects for land reclamation from the backwaters.

This aspect has to be seen through the two theses regarding environmental degradation and poverty. According to one thesis, environmental degradation, such as eroding soil, receding forests, and vanishing water supplies, is a cause of accentuated poverty among the rural poor in poor countries. The second thesis states that poverty itself can be a cause of environmental degradation (Dasgupta, 1993; Dasgupta and Maler, 1995). The reason cited for this reverse causality is that some environmental resources like ponds and rivers are essential for survival in normal times, while others are a source of supplementary income in times of acute economic crisis. Nevertheless, with reclamation schemes there is no sufficient reason to believe that it was poverty induced one. It was more a market failure that reflects the inability of the market to lead the economic process toward a social optimum because of the failure to encapsulate in costs and prices the external effects, or reductions in utility and profits that economic agents inflict on others (Opschoor, 1991).

The case of backwater reclamation might be considered as an intervention failure that includes internal and external market failures resulting from the inappropriate actions of the government whether deliberate or not. To elaborate on this, it was the biased sectoral policy in favour of paddy cultivation that led to large-scale reclamation of backwaters. The subsidisation for paddy cultivation was decided purely upon the sector interests without any consideration for trade-offs with other sectors, namely backwater fisheries. Moreover, the environmental concerns were also not internalised, and the
individuals who were reclaiming the land were incurring less cost than the social cost associated with the reclamation.

The cost shifting was eased by certain factors. Distance-related distortions as Opschoor (1996) termed them, relate to different types of relations like distance in time, space, and scale. The environmental consequences of the reclamation of backwaters manifest themselves at often-large distances from the source or agent causing them. The diversion of water has an impact on the people living in far away places. For example, the construction of several bunds prevented the entry of salt water that in turn adversely affected fishermen in terms of reduced fish catch. Thus, concluding that the environmental consequences are shifted onto other people and even to future people would be logical. These types of distortions in distance are both in terms of space and time. The other type of distance-related distortion, namely, scale is also seen in the case of reclamation of backwaters. This type of distance is generally understood as the distance involved between ones' individual influence and the level at which a problem must be addressed for its solution. Here the main focus is on the decision levels and the decisions made. This is analogous to saying single actors in a multi-actor context may face situations where their privately optimal behaviour may lead to socially or collectively undesirable overall outcomes. Moreover, the absence of control or intervention leads to an irrational level of exploitation of a share or common property resource (Opschoor, 1996). In the above cited Attumuttu Kayal scheme, the individual decision to divert the course of river and reclamation was confronted with public opposition. In the wake of stiff public protest, the state could have intervened in such a way that at least the pace of reclamation could be brought down.

However, what happened was a sort of intervention failure, as evident from the fact that the then Dewan Peishkar of Quilon Shri Raja Rama Rao conducted an enquiry into the alleged diversion and, instead of halting it, gave his consent for it (Government of Kerala, 1985). This gave an incentive to more individual actors to reclaim land from backwaters without any concern for the sustainability of the resource in question. Here it is important to remember that even when the private individuals' optimal behaviours were socially or collectively undesirable, the government adopted a policy favouring paddy cultivation and failed to take appropriate regulatory measures to control it. The government also failed to ensure the continued cultivation of paddy on the reclaimed land.

Environmental Problems

We have noted above that the major institutional intervention in the backwater reclamation was directed toward the protection and enhancement
of paddy cultivation. This is justifiable in the light of the scarcity of food during the period. It should be noted that the conversion of wetlands involves not only irreversibility in the environmental or ecological processes but also in an important way, an element of uncertainty. This together with the lack of integrated and scientific approach for conversion produced deleterious effects on the ecosystem.

Let us elaborate on this point. The emphasis on food self-sufficiency by the government of India following independence necessitated the cultivation of two crops of paddy a year in the area. However, in the low-lying areas this attempt ran into several difficulties. While the cultivation of first crop of the paddy was difficult due to the intrusion of salt water in summer, the monsoon flood that caused difficulties in raising the second crop of paddy. The only solution for extending the cultivation of paddy twice a year was the construction of permanent barriers to prevent the intrusion of salt water. As a result, several permanent barriers were constructed in different parts of the backwater, of which the most important one is the Thaneermukkam regulator commissioned in 1973. The idea was to close down the regulator during December to June, salt water intrusion made the cultivation paddy impossible. Here it is important to note that through the construction of permanent barriers was an important step for enhancing the cultivation paddy, it had dire consequences on the ecosystem as a whole, and particularly on backwater fishery resource. The main reason for this was the failure to take note of the fact that the intrusion of salt water was not uniform in the different regions. However, this reduced the flow of water, which resulted in the accumulation of waste of husk retting, chemicals and fertilizers used for paddy cultivation, which finally resulted in pollution of the backwaters. This adversely affected the living species like fishes, clams etc. which meant that this resulted in the reduced fish catch, thereby adversely affecting the people depending on these for livelihood. There is paucity of data separately on the backwater fish landings to show the reduced catch of fish. Nevertheless, it is reported that not only the size of fishes caught but also the number of species reduced. In the fifties there were about thirty species available in the backwaters, but only half as many by the eighties (Gopalan, 1987).

At present the conversion or the reclamation of backwater for paddy cultivation is not taking place to a considerable extent. These wetlands are being converted mostly for developmental and other purposes. It should be noted that the conversion of these ecosystems is not only irreversible but also subject to uncertainty. This ecosystem performs a wide range of functions such as acting as natural filters upgrading wastewater to the support of fisheries. Among these the most important from the livelihood point of view is the fisheries.
Fishes are living organisms and are easily susceptible to any changes to the ecosystem. The backwaters provide a congenial nursery ground for many of the marine species. The most important species found in the Kerala backwaters are penaeid prawns, which have a high demand in both national and international markets. Fishing is the main source of livelihood of many people in Kerala. More than 80 per cent of the 2,21,710 inland fishermen depend on the backwater for their livelihood.

From the analysis of the backwater reclamation in Kerala, we can see that in the cost-benefit calculation regarding conversion, the option value of keeping the backwater in the natural state was ignored. Ignoring this option value must have accentuated the liberal conversion or reclamation of backwater. Even though the reclamation for paddy cultivation is not taking place now, even today there exists the liberal use of these resource for various other purposes that adversely affects the health of the ecosystems and thereby the fishery resources. The problem becomes more serious when we consider the fact that the property rights of this resource are not well defined. The administrative control of the backwater rests with different government departments like fisheries department, irrigation department, port trust, electricity department, etc, without proper co-ordination of the policies followed by them. Even when property rights are well specified and enforced, the failure to include the option value in the cost benefit calculation regarding the conversion might lead to the liberal use of the environment. In the case of backwater, the fishery is the most important direct use in the natural state and there is a need to incorporate the option value of keeping the resource in the natural state. This is very important when we consider that the backwater is facing a severe threat from the developmental needs of the society, the outcome of which is not certain today. Therefore, future research has to be directed towards incorporating this option value in the cost benefit calculation regarding the conversion or any liberal use of backwater resource. In other words, there is a need to estimate the value of backwaters for the support of fisheries or establishing backwater-fishery linkage so that appropriate policies can be taken to conserve the resource.

**Conclusion**

The wetlands in their natural state are sources of substantial benefits for society. However, the conversion of wetlands is a serious issue today. This paper analyses the case of coastal wetland conversion in Kerala. Generally known as backwaters, the coastal wetlands were converted for both agricultural and non-agricultural purposes. The study examines the causes and the observed impacts of such reclamation measures. From the analysis it is clear that the
reclamation of backwaters has resulted in the degradation and the major causes can be termed as institutional failure. We can see that in the decisions regarding the conversion of these wetlands, the benefits in its natural state were not taken into account. This has led to the liberal conversion of these resources. Even though in the past conversions were mainly for agricultural purposes, the present threats are the developmental needs of the society. The present study argues that as the conversion of wetlands involves not only irreversibility but to a large extent uncertainty, there is a need to incorporate the option value of these resources in any decision regarding the conversion of the wetland resources. Incorporating the option value in the cost-benefit calculation regarding the conversion of the resource is expected to avoid the liberal use of the unique natural resource. Further research is needed in this direction.

Notes

1 Ramsar Convention is a convention on wetlands of international importance, especially as Waterfowl Habitat held in Ramsar in Iran in 1971. The main aim of the convention is to halt the decline of wetland habitats and maintain their ecological functions and wildlife. Contracting parties agree to include wetland conservation in national planning, to promote sound utilization of wetlands, to create properly warded nature reserves and develop management research and training facilities (Maltby 1986, Scott & Poole 1989).

2 Estuaries are coastal indentations with restricted connection to the ocean, which remains open at least intermittently.

3 Kyal means backwater in the regional language.

4 There is a practice called prawn filtration in Kerala. In this method during summer, the fields are used for growing prawns. The prawn seedlings that come along with the tidal water are collected through a sluice in the shallow fields. They are allowed to grow there and once mature are caught and sold.

5 The reclamation of land from the backwater in Kuttanad area influenced other areas like Cochin and Trissur. In these places fresh water lakes were reclaimed for paddy cultivation and the beds of these lakes have come to be known as kole lands. The type of cultivation in these places today is known as kole krishi.

6 According to the definition given in the land utilisation order of Kerala, 1967, food crops include paddy, fish, sugarcane, vegetables, tapioca,
yam, tea, coffee, cardamom, pepper, groundnut, cocoa and banana plantain. By that order the state has the power to require holder of land to grow specified crops. This means that if the state considers that increasing the production of food crops in any area is necessary or expedient they may, by order, published in the Gazette, direct every holder of land in that area to grow, over such portions of his land and within such periods as may be specified in the order, such food crop or food crops as may be so specified in addition to any crop he may have grown over such land (Suresh G 1991). The land utilisation order also made it clear that land cultivated with any food crop is not to be cultivated with any other food crop. A holder of the land who had been cultivating a particular food crop continuously for three years is allowed to convert or utilise or attempt to utilize such land for the cultivation of any other food crop or for any other purpose only with the permission of the Collector.

7 The protest of the local people is reported in the Reports of the Evaluation Division, State Planning Board, 1985.

8 Button (OECD 1992) distinguishes between two types of market failure. One is the internal market failure that is the failure inside the market system that leads to inefficiencies even without environmental considerations and includes market imperfections. The second is the external market failure and is related to the phenomenon of environmental externalities and are outside the cost functions as perceived by the producers or consumers of the goods that they convey the externalities. These externalities are the result of the intended or unintended cost shifting or displacement of costs (Kapp 1969) that is, the adverse consequences of one actor's decision are passed on to others to bear.

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