

Carrying Capacity Study of Coastal Tourism in Kumarakom, Kerala.

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ABSTRACT

Kumarakom Panchayath falls under Kottayam taluk and the Pallom development block of the Kottayam district. At present 61.22 Hectare of land is categorized as Resort area. Due to rapid growth of tourism, there will be a higher demand for land which will result in the faster development of the remaining resorts. It is assumed that over and above 61.22 ha of already committed resort areas an additional 40.44 ha of perennial crop with settlement will also be utilized for resort development and related activities. For Kumarakom panchayath a future scenario (Year 2011) of spatial structure has been worked out here based on the existing scenario and the envisaged changes in the land use structure. In addition to the projected population of 27,300, the tourist equivalent population also has to be considered for evaluating all central facilities requirement as well as utilities service requirement for Kumarakom panchayath. This means Kumarakom Panchayath is loaded with 42,000 (27,300 + 14,700) population instead of 27,300 natural population for providing services and facilities. The holding capacity of 91.5 ha of resort area in Kumarakom Panchayath estimated till 2011 will be 3660 beds (40 x 91.5 beds). The holding capacity of tourist beds in Aymanam and Arpookara panchayaths will be 20% of 3660 i.e. 732 beds. Thus, total holding capacity will be approximately 4392 beds. Usual tourist staff ratio of a luxury resort of three to five stars is 1:3. Therefore, population equivalent for a tourist is assumed as 4. This means for a holding capacity 3660 tourist in Kumarakom panchayaths, population equivalent of tourist will be 14, 640 (3660 x 4). Various suggestions regarding restricted development and environmental protection are suggested through this study.

Keywords: *capacity study, coastal tourism, holding capacity*

INTRODUCTION

Tourism is the world's largest industry, and one that is continuously growing. According to the latest UNWTO World Tourism Barometer, international tourism arrivals expanded by 6% in 2007, to 898 million international tourist arrivals, as compared to 2006. Of the additional 52 million worldwide arrivals, Europe received some 19 million and Asia and the Pacific 17 million. Against the background of a strong growth of above 7% per year since 2000, Asia and the Pacific is also pushing international tourism and attracted 185 million visitors.

While Japan (+14%) has taken off as a destination, Malaysia (+20%) Cambodia (+19%), Vietnam (+16%), Indonesia (+15%), India (+13%) and China (+10%) keep improving their growth rates. In the Year 2008, confidence remains high, although this perception might deteriorate. Economies worldwide have shown increased volatility and confidence has weakened in some markets due to uncertainty about the subprime mortgage crises and economic prospects, in particular for the USA, alongside with global imbalances and high oil prices. International tourism might be affected by this global context. But based on past

experience, the sector's proven resilience and given the current parameters, UNWTO is of the opinion that it does not expect that growth will come to a halt.

"Tourism Vision 2020" prepared by the World Tourism Organisation with 1995 as the base year predicts that by 2020 the global number of travellers will reach to 1.6 billion (an increase of 4.1% per annum) and the travellers will spend around US\$ 2 trillion every year on tourism.

Tourism is an effective instrument for generating employment, earning foreign exchange and there by facilitating overall development. For many developing countries tourism is considered as the stimulus to local industries, hotels and restaurants, providing a market for local agricultural products, transport, guides, souvenirs and handicrafts.

Often tourism is considered as a double-edged activity. It has the potential to contribute in a positive manner to socio-economic achievements but, at the same time, its fast and sometimes uncontrolled growth can be the major cause of degradation of the environment and loss of local identity and traditional cultures. Biological and physical resources are in fact the assets that attract tourists. However, the stress imposed by tourism activities on fragile ecosystems accelerates and aggravates their depletion. Paradoxically, the very success of tourism may lead to the degradation of the natural environment; by depleting natural resources tourism reduces the site attractiveness to tourists, the very commodity that tourism has to offer. The interdependent, cyclic relationship between the tourism industry and the environment is fragile and requires precautionary and preventative action.

Therefore, given the economic significance of tourism, and projected growth in the activity, it is imperative that steps be taken immediately to protect the

natural resources on which tourism depends and without overlooking cultural or architectural heritage. Maintaining the balance between resource use and good environmental quality requires political commitment to undertake clear and consistent policy intervention, improve planning and management systems, immediate remedial action, and develop a base knowledge from which to operate.

Study Area

India with its long coastline of over 8000 kilometres supports a variety of natural ecosystems. In these coastal zones the terrestrial, marine and euclidean ecosystems that interact in a complex dynamic and often unknown ways. Coastal (marine and euclidean) habitats such as mangroves serve to protect coasts, prevent coastal erosion and mitigate the effects of natural disasters like cyclones and tidal waves. These ecosystems help to stabilize the physical environments by dissipating wave action, buffering salinity changes and by stabilizing sediments.

However, the rich coastal habitats of India are being threatened, among other things by pollution, (especially from land-based sources), "development" projects, such as ports, big dams, irresponsible tourism, deforestation, natural disasters, overfishing and destructive fishing practices. Coastal resources and habitats are being depleted and degraded with frightening rapidity and conflicts over scarce coastal resources are on the rise (Chandrika Sharma, 1997).

Coastal marine and estuarine tourism is a newly added activity, especially in the Kerala coast. Many regions are caught in the typical dilemma of tourism; they want the income from tourism, while at the same time they deplore the negative social and environmental impacts. As tourism is

environmentally dependent and the environment is vulnerable to the impacts of tourism, it becomes important to understand the ecosystem and developmental activities in the region. This helps us to evaluate the type and level of tourism and the tourism activities that may be allowed in the region. This further helps to increase the positive impacts which will also include conservation of the region and at the same time reduce the negative impacts of tourism.

The present study area is the Kumarakom Panchayath, a part of the Kuttanad wetlands in Kerala that comes under the Vembanad-Kol wetland system. Kumarakom panchayath falls under the Kottayam taluk of Kottayam district. It is situated in the southern portion of the Thaneermukkom bund and on the eastern bank of the Vembanad lake. It is located along the 9°38' North latitude and 76°25' East longitude. The panchayath is bounded by the *Kavan Ar* and Aiamanom Panchayath in the north, Thiruvappu panchayath in the east, Kottayam-Alleppey Canal in the south and Vembanad lake in the west. It covers an area of 51.66 sq.km. (5166 Ha) of which 24.13 sq.km. (2413 Ha) forms the lake portion and the remaining 27.54 sq.km. (2754 Ha) forms the land. Kumarakom is now well placed in the Tourist map with its natural beauty of greenland and the *Kayals* (backwaters).

Importance of the Study

Kumarakom Panchayath, is part of the Kuttanad wetlands and forms the southern portion of the Vembanad-kol wetland system. It has a characteristic estuarine environment and is a spawning ground for prawns and fishes of marine origin. The panchayath also has the longest chain of mangrove vegetation in the Kerala coasts and it supports 91 species of resident or local variety of

birds and 50 species of migratory birds. The area also shows high fish and agricultural productivity. Kumarakom is now being by the Kerala Tourism Department as one of the “*four get-aways*” (the other get aways being Kovalam, Thekkady and Kochi). It is also one of the six backwater tourism spots in Kerala. It is also noted that backwater tourism is the latest trend in Kerala tourism front.

Despite the importance and need to protect the ecosystem, many activities lead to the destruction of the lake and the surrounding regions. The activity that threatens the ecosystem includes agriculture, industries, transportation, housing, tourism etc. At present there has been a change in the land use of the panchayath from agriculture to tourism and also a slight shift in the occupational structure from primary to tertiary. Unplanned tourism activity will be responsible for further degradation of the environment in terms of assimilative capacity of the environment exceeding by the waste loading. Thus taking into consideration the ecological importance of the region, it is necessary to find out the type and level of tourism activities that can be permitted in the region.

Objectives of the Study

The main objective of the study is to evolve a management plan giving due importance to the carrying capacity of the environment. The study will also try to give an insight into the current status of tourism in Kumarakom and its implications on the physical, economic and social environment. As a final part of the study, the guidelines for management and conservation of the fragile ecosystem will also be suggested.

METHODOLOGY OF THE STUDY

To gain a clear insight into the development of tourism in Kumarakom and its impact on the physical, economic and social environment, we used both primary and secondary data for analysis. Through the primary survey, we analysed the present status of the mangroves, characteristics of the tourists visiting this place, satisfaction levels etc., while secondary data was used to have a clear idea regarding the history, population structure, occupational structure, land use pattern, evolution of tourism etc.

RESULTS AND DISCUSSION

The entire Kumarakom panchayath was once part of the sea and then part of the Vembanad lake. In A.D. 2nd century, there were writings about a port named *Koraura*; later the historian, Kesari Balakrishna Pillai opined that *Koraura* Port was the present Kumarakom. The ecological history of the Kumarakom is the same as in the Kuttanad region with sudden ecological changes due to human intervention. It can be divided into four phases, i.e. early subsistence agriculture with mangrove vegetation on the shores; large scale conversion into rice paddies, with native varieties for single cropping under the traditional cropping system; due to the Kuttanad Development Project, there was a shift to monoculture using a combination of high yielding varieties and fertilizers; and construction of the *Thaneermukkom* Bund, *Thottappally* spillway and the Alleppey –

Chenganacherry road has changed the ecology of the region.

An analysis of the nature and rates of environmental change over recent decades is essential for a proper understanding of why present environmental problems have arisen. It is also necessary in the formulation of accurate productive models of environmental change. In this respect, information on the existing land use/land cover pattern, its spatial distribution and changes in the land use pattern is a pre-requisite for planning, utilisation and formulation of policies and programmes for making any micro and macro-level developmental plan.

The land use change that has occurred in Kerala is the conversion and reclamation of paddy cultivated areas, both in the lowlands and uplands to non-agricultural uses jeopardising the food security of the State, when it is designated as a 'Statutory Ration State' with over 60% need of food grain met by imports. Kuttanad region, known as the '*Rice bowl of Kerala*' is a predominant rice growing agricultural wetland ecosystem of Kerala. The area under paddy cultivation in Kerala has reduced from 8.02 Lakh Ha in 1980 - '81 to more than 4.71 lakh Ha in 1995 – '96. The State is worst affected by this phenomenon, because of its impact on the health and socio-economic and living conditions of the people and the ecological and environmental condition, with the state government spending over 600 Crores of Rupees every year for rice imports from other states.

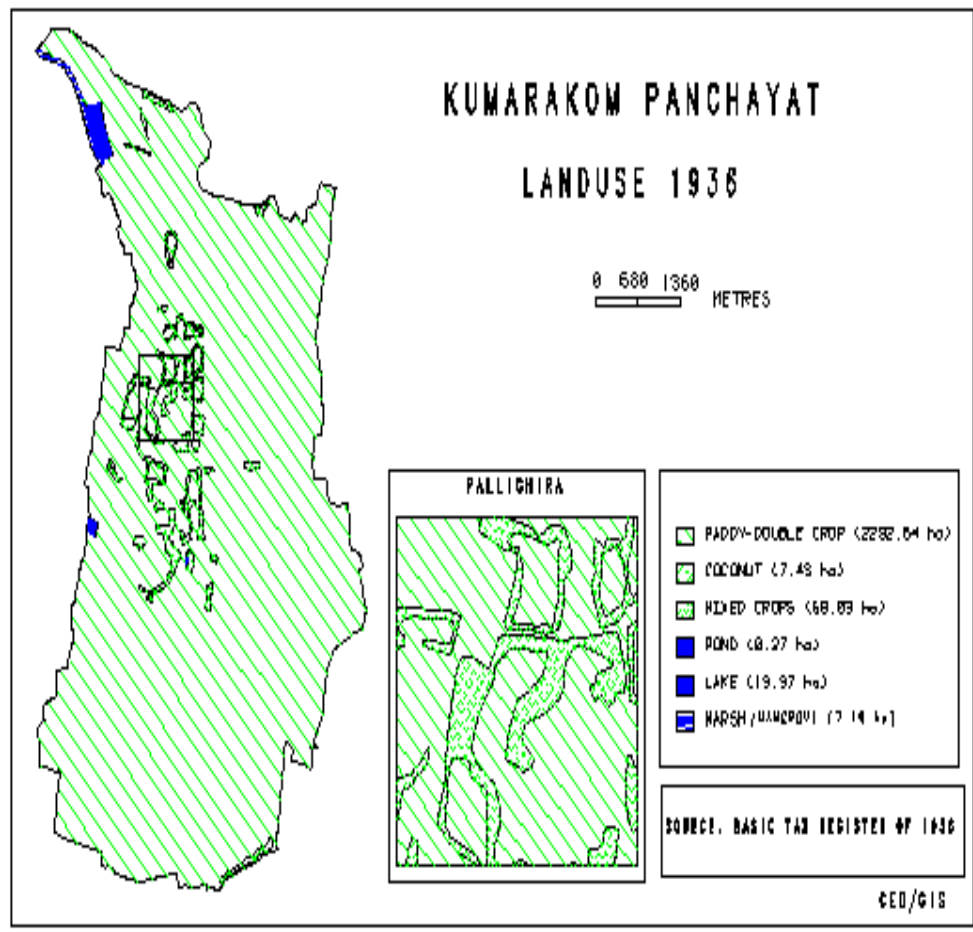


Figure 1
Land use Map of Kumarakom Panchayath - 1936
Source : Centre for Environment Education and Development

The comparison of land use in 1997 with land use in 1936 reveals drastic change in the components and pattern of land use over the last six decades. This change is more visible in paddy cultivation - double crop which formed about 96.37 percent in 1936 got reduced to 63 percent of the total geographical area of 2378.92 Ha in 1997. The lake area has also decreased considerably from 13.37 ha. (0.56 percent) in 1936 to about 1.73 Ha i.e., 0.07 percent in 1997.

Out of the total paddy conversion of 791.95 Ha, the majority

was to mixed crops category coming to about 577 Ha. i.e., 72.86 percent of the total change in paddy cultivating area. The area changed to settlement with mixed trees category is 111.22 ha. forming about 14 percent. The major conversion is to coconut plantation of 75.92 Ha. i.e., 9.59 percent. The conversion to other classes such as paddy with aquaculture, plantain, cocoa, pond and mango constitute 1.16, 1.12, 0.32, 0.23 and 0.16 percent respectively. The marsh and culturable waste comprise 0.92 and 0.28 percent respectively.

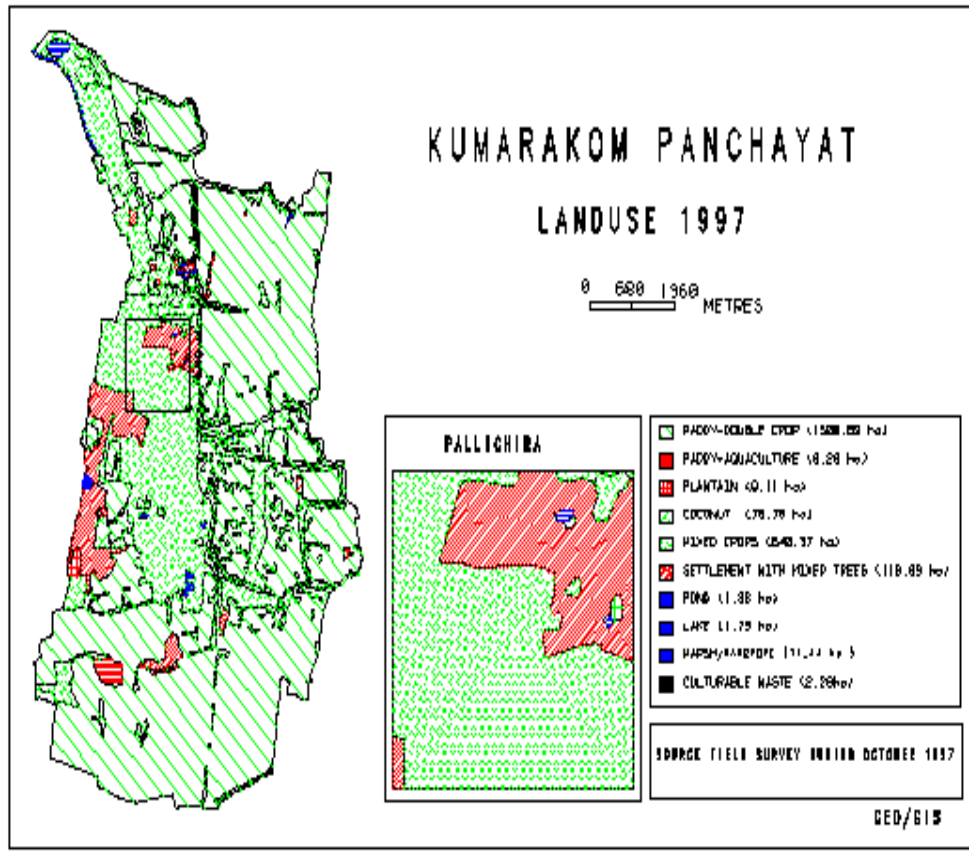


Figure 2

Land use Map of Kumarakom Panchayath - 1997

Source : Centre for Environment Education and Development

The main habitation land use categories viz., mixed crops and coconuts have increased from 2.44 % and 0.31% in 1936 to 26.92% and 3.31% in 1997 respectively. Another major habitation category i.e., settlement with mixed trees evolved constitutes about 4.99 percent. We can also observe the evolution of new categories in land use like paddy with aquaculture, cocoa, plantain, mango etc contributing only very small percentages. The reclamation of lake and conversion of paddy fields to habitation land is concentrated along areas adjacent to the Vembanad estuary on the western side of the panchayath, especially along the

banks of estuary and canals and on the sides of roads.

The conversion of paddy fields in recent years all along the lake side areas owes to the intensive tourism industry activities such as the construction of star hotels, restaurants and tourist complexes. This is also the reason for extensive reduction in mangrove areas shown as marsh in the Map. Here the paddy with aquaculture land use system is in conjunction with the integrated farming practices, which is a further progressive step along the way to make paddy cultivation remunerative.

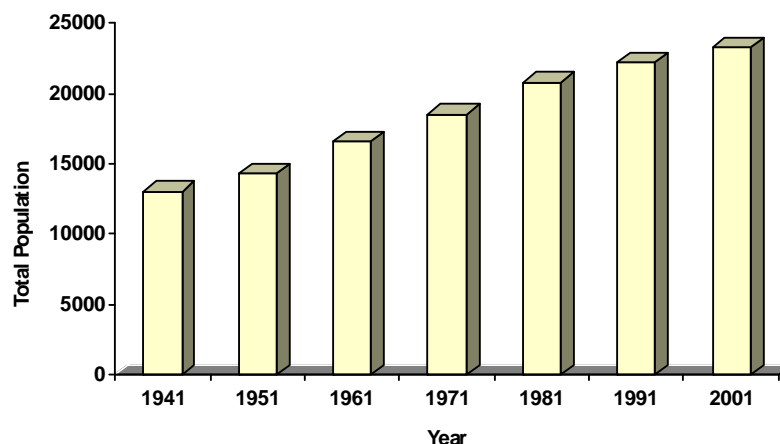


Figure 3
Kumarakom Population (1941- 2001)
Source : Directorate of Census, Government of Kerala.

Economy & Occupational Structure : The first census in Kumarakom was undertaken in 1891 and the last census was conducted during the period of 2001. The figure clearly depicts that there is a steady increase in the population in Kumarakom. The total population in 1971 was 18532 of which 5487 people were working i.e. 29.6% of the total population. The population in 1991 was 22232 and 7547 people were working i.e. 34.2% of the total population was working. Thus the work force participation rate has increased by 4.6% i.e. more jobs were created in 1991. There is also shift in occupational pattern from the primary to tertiary due to development and growth of tourism in this area. Main occupation of Kumarakom is agriculture followed by fishing, shell mining and household industries.

Physical infrastructure : Physical infrastructure consists of road and water transport, water supply, power network, sewage and solid waste disposal system etc. The Road Transport in Kumarakom consists of the Kottayam-Kumarakom road, which is a link road of the M.S. Road (Trivandrum-Angamaly) Road. At present Kumarakom is 16 km.

from Kottayam town, and the road ends at Aimanom, but construction activity is going on to connect it to Vechur, thus directly connecting Kumarakom to Ernakulam. This will further enhance the tourist flow towards Kumarakom.

Earlier every house had a non-motorized wooden boat or a canoe which implies that the most popular means of transportation was water transport. The construction of Thaneermukkom bund has brought about an increase in weeds in the channels, which makes it difficult for canoes to pass through and this has also lead to the closure of some of the channels. The Water supply in Kumarakom is from the Thazhathangadi Ar in Kottayam Municipal Area. Kumarakom has perennial water resources, but potable water is scarce due to soil acidity and salinity, thus the panchayath depends on tap water provided by the Kottayam Water Authority. The Power Supply to Kumarakom is from the Idukki-Sabarigiri region. The chengalam substain (110 KV/11KV) with 10 MVA capacity serves the panchayath through two 11 KV feeders – the Thiiruvvarppu feeder and the Kumarakom feeder.

There is an absence of a well developed sewage disposal system in Kumarakom. The study observed that out of the 4510 houses, 2067 houses doesn't have a developed sanitary facilities which along with the leach ate from the septic tanks in hotels had polluted the water table in Kumarakom.

Social Infrastructure : The social infrastructure important for tourism are Police station, Post Office, Telephone, Cinema theatres, Hospitals, Religious centres and Market centres. Kumarakom has a Police Station which is for 4 villages. The law and order situation and crime rate in Kumarakom is negligible. Kumarakom also has one branch Post Office and two sub-post offices. The village has one telephone exchange with over 436 connections. It also has 2 Cinema theatres.

Kumarakom has one Government primary health center, two private hospitals, three homeoclinics, two ayurvedic clinics and one old age home. Kumarakom has a high incidence of water borne diseases like typhoid, jaundice and stomach problems. Air borne diseases includes bronchial asthma, vector borne disease like malaria have also been reported from Kumarakom.

Spatial Structure : Since the coverage of this study is limited to assess the futuristic carrying capacity of tourism

activities, Kumarakom Panchayath, it may not be possible to carry out a detailed spatial analysis and evolve a Comprehensive Spatial Development Plan for the whole panchayath in all sectors. To overcome this limitation an attempt is made here to build different scenarios for existing and future situation based on the present land use structure and the probable changes envisaged in land uses. Tourism development is quantified using these scenarios and accordingly, appropriate analyses of tourism activities are carried out to assess the carrying capacity of the same. The study area covers Kumarakom panchayath in full and a small part of the adjoining Aymanam Panchayath and Arpoorkara Panchayath. Since majority of the area comes in the Kumarakom Panchayath, spatial study and analysis are carried out for Kumarakom Panchayath only. The Policy guide lines and other recommendations arrived from the study may be extended to the areas lying in other two panchayaths.

Existing Scenario : Area of Kumarakom Panchayath is 5167.00 ha. Out of this only 2731.94 ha is land area. The balance area of 2435.06 ha is lakes and canals. The total population of Kumarakom Panchayath is 22323 as per 1991 census. The present Population is estimated as 24900.

Table.1
Details of Land Use Pattern in Kumarakom

| Land use | Area in Hectare |
|---------------------------------------|-----------------|
| Paddy field | 1915.82 |
| Perennial crops | 141.13 |
| Perennial crops (with settlements) | 570.00 |
| Settlements | 4.51 |
| Recreational/Resort areas | 61.22 |
| Institutional areas | 3.90 |
| Fallow Land | 14.64 |
| Mangroves | 5.00 |
| Marsh | 8.01 |
| Ponds | 7.71 |
| Total land area | 2687.14 |
| Lake and canals | 2479.86 |
| Total area | 5167.00 |

Source : Centre for Earth Science Studies, Thiruvananthapuram.

Major portion of the land area is occupied by the paddy fields. During 1968 to 1991 16.2% of the paddy field has been reclaimed and put other uses i.e. an average of 0.7% paddy field has been reclaimed every year. Perennial crop with settlement is the area in which all the people are residing. This means the present population of 24900 is residing in 570.00 ha of area identified as “perennial crop with settlement”. The population density works out to 43.7 persons/Ha. The area identified, as settlement area is panchayath town centre are where all the non residential central amenities are located.

Most of the resort areas covered by land use survey are only the committed resort, lands owned by different hotel groups. Only very few resorts are developed or under development. In the land use the areas identified as “Resort areas” are not only the present functioning resorts but also the areas owned by hotel groups and others who intent to develop resort in these areas. Therefore, they are all committed resort areas. Out of 61.22 ha of committed resort areas, only 11.80 ha of land has been put to operation by two resort groups, namely, Taj Garden Retreat and Golden Water Resort. The resort “Coconut Lagoon” which is also in operation comes in adjoining Aiymanam Panchayath. Active Development is going on in few other resort sites.

Future Scenario : The reclamation of paddy field may continue in the same rate of 1968-1991-2 period increase in perennial crop with settlement area may continue in the same rate of 1968-1991 period or less. The paddy fields engulfed by the perennial crop area and perennial crop with settlement area will get reclaimed at the first instance. Perennial crop area engulfed by the perennial crop with settlement may gradually get changed to perennial crop with settlement. Average residential density in

perennial crop with settlement area may have to continue in the same manner as exist now or get reduced so as to retain the present rural environment.

AD 2011 is taken as the target year for the purpose of projecting future scenario. The land use changes are envisaged during 1999-2011 is the conversion of paddy field to other uses is expected to continue in the same rate as happened during 1968-1991 as assessed in the study report of Natural Resource Appraisal of Kumarakom Panchayath done by CESS conversion of paddy field during 1968-1991, which estimated the conversion rate to be 16.2% (0.7% per year). Applying this norm conversion of paddy field expected during 1999-2011 will result in 9.1% conversion (174.34 ha). The split of conversion assumed as follows.

- Paddy field engulfed by perennial crop with settlement is converted to some surrounding land use category. Total area identified in this category comes to 75.6 Ha. This is 4% of the paddy field.
- Half of the remaining 2.4% will be to purely perennial crops. This works out as 49.3 Ha.
- The balance of (2.4%) will be converted to perennial crop with settlement i.e. 49.37 Ha.

Earlier trend shows that there is substantial increase in perennial crop with settlement area. The Natural Resource Appraisal study of Kumarakom panchayath done by CESS shows that 56.5% increase in perennial crop with settlement area during 1968-91. This means an average increase of 2.45% per year. Assuming the same rate of increase there can be 31.8% of increase in perennial crop with settlement area during 1999-2011. It is expected that the increase in perennial crop with settlement area will happen in the following manner.

- 101.24 Ha of perennial crop area surrounded by perennial crop with settlement will gradually converted to perennial crop with settlement itself.
- 75.6 Ha of paddy field engulfed in perennial crop settlement are will also get converted to perennial crop with settlement as explained above.
- An additional 49.37 Ha of paddy field also get converted to perennial crop with settlement as explained
- It is assumed that 14.64 Ha of fallow land will be converted to perennial crop with settlement.

Along with increase in perennial crop with settlement area, some reduction is also envisaged due to pressure on demand for more competitive land uses. It is assumed about 10% of the perennial crop with settlement area got converted for general central facilities of panchayath and tourism activities. The breakup of conversion will be as follows.

- 40.44 Ha of perennial crop with settlement will change to general central facilities.
- Another 40.44 Ha of perennial crop with settlement will be used for Tourism and related activities.

Net effect on perennial crop with settlement areas will be increase of 570.00 Ha of land to 727.96 ha of land. This increase is 27.71% and slightly less than 31.8% increase estimated as per earlier trend. Therefore, it is within the possible range.

At present 61.22 Ha of land is categorized as Resort area. In this only a small portion has been developed at present. But demand for more tourist accommodation Kumarakom areas is increasing day by day in International Tourism Market. Therefore fast development of remaining Resort area is expected. It is assumed that over and above 61.22 Ha of already committed resort areas an additional 40.44 Ha of perennial crop with settlement will also be utilized for resort development and related activities.

The area utilized for central facilities (4.51 Ha) of panchayath is very much lower than the normal requirement. Assuming a standard of 1 Ha per 1000 population, the projected population of 42,000 (Natural projection of population by 2011 is 27,300 +14,700 tourist equivalent population require about 42.00 Ha land for hold central facilities, social amenities etc. Along with existing 4.51 Ha an additional 40.44 Ha of will get converted from perennial crop with settlement. Thus the availability of 44.95 Ha of land for central facilities is more than sufficient, comparing the estimated minimum requirement of 42.00 Ha.

Table 2
Projected Land Use Pattern in Kumarakom

| Land use category | Base land use 1999 & {Change in land use} Area in Hect. | Remark on Change | Future land use – 2011 area in Ha |
|--------------------------------|---|---|-----------------------------------|
| Paddy field | 1915.82{-75.60} | Engulfed paddy field changed to perennial crop with settlement | |
| | {(-) 49.37} | 2.4% of paddy field converted to perennial crop | |
| | {(-) 49.37} | 2.4% of paddy field converted to perennial crop with settlement | |
| Perennial crop | 141.13{-101.24} | Perennial crop converted perennial crop with settlement | |
| | {(+) 49.37} | 2.4% of paddy field converted perennial crop | |
| Perennial crop with settlement | 570.00{+75.59} | Engulfed paddy field converted to perennial crop with settlement | |
| | {(+) 49.37} | 2.4% of paddy field converted to perennial crop with settlement | |
| | {(+) 101.24} | Perennial crop converted to perennial crop with settlement | |
| | {14.64} | Fallow land converted to perennial crop with settlement | |
| | {(-) 40.44} | 5% of perennial crop with settlement converted for general central facilities of panchayath | |
| | {(-) 40.44} | 5% of perennial crop with settlement converted for Resort and other Tourism activities | |
| Settlement | 4.51{+ 40.44} | 5% of perennial crop with settlement converted for general central facilities of panchayath is added to settlement category | |
| Institutional area | 3.90{0.00} | No change | 3.90 |
| Recreational/Resort area | 61.22 {+40.44} | 5% perennial crop with settlement area converted for Resort and other Tourism activities | 101.66 |
| Fallow land | 14.64{-14.64} | All fallow lands are converted to perennial crop with settlement | 0.00 |
| Mangrove | 5.00{0.00} | No change | 5.00 |
| Marsh | 8.01{0.00} | No change | 8.01 |
| Ponds | 7.71{0.00} | No change | 7.71 |
| Total Land area | 2687.14{ } | | 2687.14 |
| Tank and Canal | 2435.00{ } | No change | 2435.00 |
| Total | 5167.00 | | 5167.00 |

For Kumarakom panchayath a future scenario of spatial structure has been worked out here based on the existing scenario and the envisaged changes in the land use structure. The target year is taken as 2011 with a projected population of 27,300. It is assumed that there will be no change in the area of Panchayath. The changes and the resultant land use structure is given in Table – 1.2. The land use changes

indicated as (-) is for reduction in area and (+) is for addition in area.

CONCLUSION AND SUGGESTIONS

The immediate impact of paddy land conversion will adversely affect rice production in the State which will also influence the socio-economic conditions of the farmers and farm workers. It is estimated that there are about nine lakhs of farm workers in the State, who get

their earning mainly from paddy cultivation. There should be a mechanism to conserve the existing paddy lands and also to implement an action program for increasing the production and productivity of paddy by providing essential science and technology input.

The rice fields also act as a viable ecosystem for innumerable number of organisms. In addition to this they act as a good drainage basin, to collect the rain water and run off and slowly penetrating it in to the ground water aquifer, thus recharging the ground water levels. The loss of drainage facilities and water logging has led to the increased run off, soil erosion, and frequent floods and droughts. This resulted in an increase in the concentration of pollutants in the water, like the pesticide residues, which resulted in the recent fish diseases in Kuttanad, and the frequently occurring water borne diseases in the area. The destruction of mangrove ecosystem also results in soil erosion and erodes the natural land building capabilities. The land use changes had resulted in an increase in the incidence of weed menace and the narrowing of natural canals leading to serious consequences on water transport, water flow and giving extra pace to the ongoing eutrophication of water bodies.

Let us assume that the projected population for the year 2011 in Kumarakom panchayath is 27,300 (27,294). It is assumed or rather preferred that Kumarakom panchayath will retain its rural nature in future and the people will reside in mixed nature along with agriculture gardens i.e., people will be living in perennial crop with settlement area. Assuming inform distribution of 27,300 people in 7299.96 Ha of perennial crop with settlement the density works out as 37.5 persons/Ha. The calculated density is slightly less than the existing density of population in perennial crop with settlement area which is about

43.7 person/Ha. Assuming a family size of five persons per family, 40 persons/Ha works out to 8 family/Ha i.e. 8 house per hectare. An average house with its apartment land will cover maximum 250 M² land area. Therefore housing area per hectare will be 3000 M². This means only 30% of the perennial crop with settlement will be used for settlement. The remaining 70% of land will be used of agriculture purposes.

Here an attempt is made to quantify the scope of tourism development in Kumarakom panchayath with a target year is taken as 2011. Such an assessment may help to understand the growth and spatial capacity of panchayath to hold the tourism development within the reasonable limit. Tourism development in this locality mainly concentrated in Kumarakom panchayath. It can be assumed that 80% tourism development will be Kumarakom panchayath. The balance 20% tourism development will be undertaken in adjoining panchayath like Aiyamanam and Arpookara. This distribution is worked out based on the existing situation as well as in proportion to Lake Shore length available in these panchayaths. Therefore, all assessment made to quantify the tourism development worked out for Kumarakom panchayath may be increased by 20% to get the total assessment.

As mentioned earlier at present 61.22 Ha of land has committed for tourism development, mainly for resort development by 14 agencies. It is assumed that another 40.44 Ha also will added for tourism development during the period 1999-2011 as projected. Thus, it is expected a total of 101.66 Ha of land in Kumarakom panchayath will be utilized for tourism activities. Out of 101.66 Ha of land, a major share will be used for establishing resorts. But it is essential to reserve a portion of land for the development of central facilities for tourists. Therefore it is assumed 10 % of

the total area estimated for tourism activities may be used for central facilities for tourist which will be about 10.16 Ha. The remaining 91.5 ha will be used for establishing resorts.

We had tried to work out optimum density of development of Resort in terms of number of beds per hectare. Most of the Resorts developed or under development in Kumarakom are 3 star or above category. Average built up area required per room in this category is worked as given below.

Resorts of such nature should not be allowed to built with an FAR (Floor Area Ratio) more than 0.25. This works out as total built up area per hectare as 2500 M² using the above calculated area requirement per room the number of rooms that can be constructed in one hectare will be 21. Therefore, we can assume a density of 20 rooms per Ha (i.e. 40 bed per Ha). The holding capacity of 91.5 Ha of Resort area in Kumarakom Panchayath estimated till 2011 will be 40 x 91.5 beds (3660 beds) The holding capacity of tourist beds in Aymanam and Arpookara panchayaths will be 20% of 3660 i.e. 732 beds. Thus, total holding capacity will be approximately 4400 beds (4392 beds).

Even though the natural population of panchayath is projected as 27,300 for year 2011, the tourists and the supporting staff required for resort are going to make a remarkable impact on the central facilities, utilities, services etc of a town. In addition to the natural population, the tourist equivalent population also has to be considered for evaluating all central facilities requirement as well as utilities service requirement for Kumarakom panchayath. A population equivalent standard for tourist accommodated is worked out for the purpose of providing population weightage in assessing facility and utility requirements. The idea is to estimate each tourist to a certain number of population. The following method is

adopted in working out the population equivalent for a tourist. Usual tourist staff ratio of a luxury resort of three to five star is 1:3. Therefore, population equivalent for a tourist is assumed as 4. This means for a holding capacity 3660 tourist in Kumarakom panchayaths, population equivalent of tourist will be 3660 x 4 = 14,640, i.e., about 14700. This tourist population along with natural population should be taken into consideration before making a projection regarding the utility and services needed in future. This means Kumarakom Panchayath is loaded with 42,000 (27,300 + 14,700) population instead of 27,300 natural population for providing services and facilities.

Tourism in Kumarakom has been developed and will be developed in future purely based on water and its natural setting. The tourists primarily use water for their movement for leisure and recreation. Even though Vembanad lake is the main water attraction to tourist, the net work of rivers canals also provides equal interest to tourist. The study suggests five main routes as primary canal routes - Kalppuzha Ar, Pennar Thodu, Kavan Ar, Chengalam Ar and the Methrankayal – Puthan thodu. In these routes, all types of mechanized boats can be permitted and additional provisions like food kiosks, toilets etc should be set-up along the routes. Approximate length of primary canal routes will comes to about 25 kms. Central Facilities available at Kumarakom should be further strengthened by adopting a PPP Model (Public-Private-Partnership). The study suggests the following locations - at north end – a portion of Baker compound, at Mid point on the side of estuary of Chengalam Ar and the final one close to Methran Kayal for the development of Central Facilities.

Suggested Standards to be Adopted
: The suggested Land requirement standards are for luxury resorts maximum beds that can be allowed is 40

beds/Hectare and that of economy resorts is 60 beds/ Ha (2 star and below). Water and vegetation should be the over ruling back ground for any development. Resort area should have minimum 100 coconuts per hectare so as to achieve at least 50% coconut canopy coverage to the area. The

maximum built up area coverage that can be allowed at ground floor level 25% of land area, first floor level 10% of land area and for the second floor level and above 5% of land area. Maximum floor area ratio (FAR) allowed is 0.25

$$\text{Floor Area Ratio (FAR)} = \frac{\text{Total built up area all floors}}{\text{Land area of plot}}$$

The height of building/structure should not rise above 1:10 slope line. Slope starts from shore line high water level (HWL) maximum height allowed is 15 M above HWL. Minimum set back required for any building or structure from lake is 50 mts and from the canal is either equivalent to the width of the canal or 50 mts whichever is less. Sewage and waste water should be treated using appropriate environmentally friendly techniques. For all other aspects not covered by the above mentioned guidelines and controls, the Kerala Municipal Building rules will be applied. Tourism department should take initiative to extend Kerala Municipal Building rules to Kumarakom, Aymanam and Arpookara panchayath by taking necessary action with Ministry of Local Administration. All these suggestions if incorporated will ensure that tourism is a sustainable industry in the long run.

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