



LANDUSE/LAND COVER EVALUATION FOR SUSTAINABLE COASTAL TOURISM DEVELOPMENT OF VARKALA, KERALA

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**ABSTRACT:** Tourism activities began in time immemorial, early travels were primarily for sustaining livelihood activities but the modern travel and tourism is mainly for pleasure and recreation; this results in an exploitation of newer and newer areas without any apprehension for nature. Varkala, a coastal town in Thiruvananthapuram district, is a fast developing tourism destination, all the time more attracting many Indian and foreign tourists. The area covers a total of 29.62 km<sup>2</sup>. Varkala has witnessed great infrastructure since the advent of tourism industry. There has been a detonation in the hospitality sector in Varkala in the recent years. Owing to the attractiveness of its beaches and various religious spots in the area, the maximum sustainable capacity of an area requires cautious planning of geographically separated access points and placement of tourist's facility to avoid excessive contacts between different groups visiting the area at the same time. The over exploitation of the tourism area can result in pollution, destruction of natural flora and fauna, natural beauty of the area, adverse social, economic and cultural impacts on local population. Tourism development based on carrying capacity and sustainable development becomes relevant in this scenario for proper management of natural resources so that the present as well as the future generation may enjoy nature's beauty and thereby augment tourist flows and revenue. The landuse/land cover analysis using remote sensing and GIS shows impending tourism sites for development through proper planning and encouragement.

**Keywords:** Tourism, Varkala, sustainable development, landuse/land cover, remote sensing, GIS

## INTRODUCTION

Coastal tourism can be defined as tourism brought to bear on the coastal environment and its natural and cultural resources. Large-scale tourism development over the past three decades have led to transformation of the landscape, degradation of the natural environment, destruction of coastal ecosystems, alteration of the existing social structure etc. All these physical, economic, and socio-cultural changes are undermining the foundation upon which coastal tourism relies. In the context of conservation and sustainable development of the coastal zone, key management issue of coastal environments becomes one of managing the amenity interactions of the range of these uses [1]. Coastal tourism destination areas together with urban fringes, mountainous areas, and lake shore environments are the fastest growing areas with rapid landuse change. The impacts, positive or negative, of landuse change are therefore relatively more serious. Land development sometimes even over development, leads degradation [2]. Landuse, land tenure, and land value can be decisive factors in tourism development [3, 4]. 95% of landuse decisions are made at the local level [5]. This implies that appropriate decisions lead to favorable landuse changes and sustainable development. Coastal tourism has perhaps been studied more than any other form of tourism. Many conceptual models about spatial structure [6, 7], spatial evolution [8, 9, 10], and temporal change [11] have been developed as a result of study on coastal resorts or coastal tourism.

## STUDY AREA

Sandwiched between the Western Ghats and the Arabian Sea, Kerala is blessed with unmatched natural beauty, which provides immense scope of tourism. Kerala state has been identified as one of the important tourism destinations in the world tourism map.

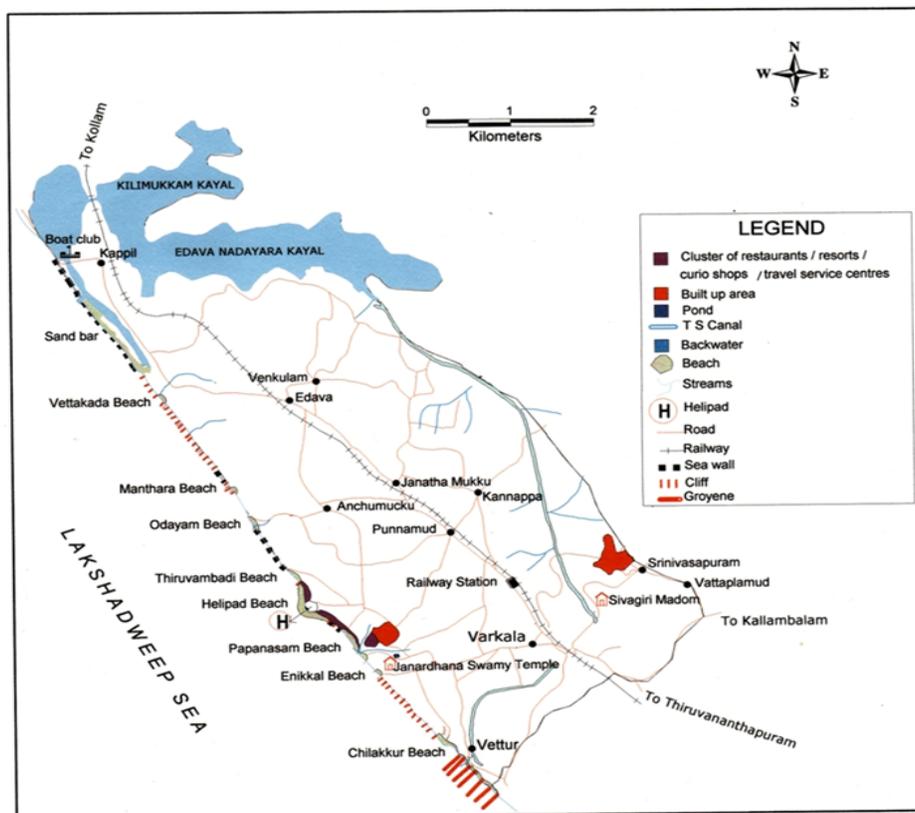


Figure-1 Map showing the study area

Varkala, a small coastal town in the Thiruvananthapuram district of Kerala is a fast developing tourism destination and is increasingly attracting many Indian and foreign tourists. The study area lies between  $8^{\circ}71'29''$  to  $8^{\circ}79'71''$  N latitudes and  $76^{\circ}67'29''$  to  $76^{\circ}74'71''$  E longitudes and is located about 50 km north of Thiruvananthapuram, the capital city of Kerala and International Airport (Fig. 1). The main tourist attraction of Varkala is Papanasam beach and many pocket beaches fringed by laterite cliffs and coconut groves, which attract many local and foreign tourists. Rich mineral springs originate at the foot of these laterite cliffs, which are well known for its medicinal properties. Varkala is also an important centre of Hindu pilgrimage and thousands of devotees perform rituals on special occasions at Papanasam beach. The 2000-year old Sree Janardhana Swami Temple and the Sivagiri Ashram, founded by Sree Narayana Guru, saint and social reformer of Kerala, attract many pilgrim tourists in Varkala. A century old Tunnel built in the TS canal, which flows in the eastern part of Varkala is also form an attraction.

## METHODOLOGY

The study area was demarcated based on a reconnaissance survey. A total geographical area of 29.62 km<sup>2</sup> was delineated covering the administrative units of Varkala Municipality, Edava Panchayath and the backwaters of Nadayara Kayal and Kilimukkam Kayal. The present tourism activity is mainly concentrated in the narrow stretch of coastal landmass from Papanasam in the south to Thiruvambadi in the north. It is essential to identify the potential sites for future expansion to arrest over development in the existing areas that has already caused many environmental problems. For the purpose of identifying the potential tourism sites it is necessary to delineate the present landuse system – its potentiality and constraints. Changes in the system of landuse can lead to very unfavorable secondary effects on fragile natural environments.

Assessment of spatial and temporal changes in landuse pattern is an effective tool for the evaluation of changes occurring in landuse and the extent of environmental degradation. Base maps including drainage, roads, settlement and study area boundary was extracted from the SOI topographical sheet (1967) no. 58C/14, 58 C/6, 58 D/14 and 58 D/9. Landuse/land cover maps for the periods of 1967 and 2004 were prepared and analyzed for major changes. Landuse/land cover map of 1967 was prepared based on the Topographic sheet published by Survey of India and the 2004 landuse/land cover map is prepared based on the interpretation of satellite imagery and through detailed field checks. Finalization of the mapping has done in GIS environment. Two different sets of questionnaire survey were also conducted among the visitors and in the resorts to identify the aspiration of the visitors and to assess the visitor inflow, estimate the infrastructure, environmental problems etc. Final conclusions were arrived based on the compilation of the landuse pattern and the findings in the questionnaire survey.

## RESULTS AND DISCUSSION

The landuse/land cover maps of 1966 and 2004 were compared and major changes are noticed in the landuse types such as paddy fields, perennial crops like coconut trees, built-up area and settlement areas. Fig. 1 and 2 shows the landuse pattern of 1966 and 2004 - 05 and Table 1 highlights the comparative area under different landuse units.

**Table 1: Changes in landuse/land cover types and their areal extent**

SI. No.	Landuse/land cover types	Area (km <sup>2</sup> )	
		Landuse 1967	Landuse 2010
1	Perennial crop with settlement	19.46	20.18
2	Perennial crops	2.87	1.74
3	Paddy fields	2.74	0.27
4	Fallow land	-	2.59
5	Sacred grove	0.04	0.01
6	Cluster of hotels	-	0.09
7	Beach area	0.19	0.14
8	Built up area	-	0.26
9	Helipad	-	0.02
10	Kayal	4.32	4.32
<b>Total area</b>		<b>29.62</b>	<b>29.62</b>

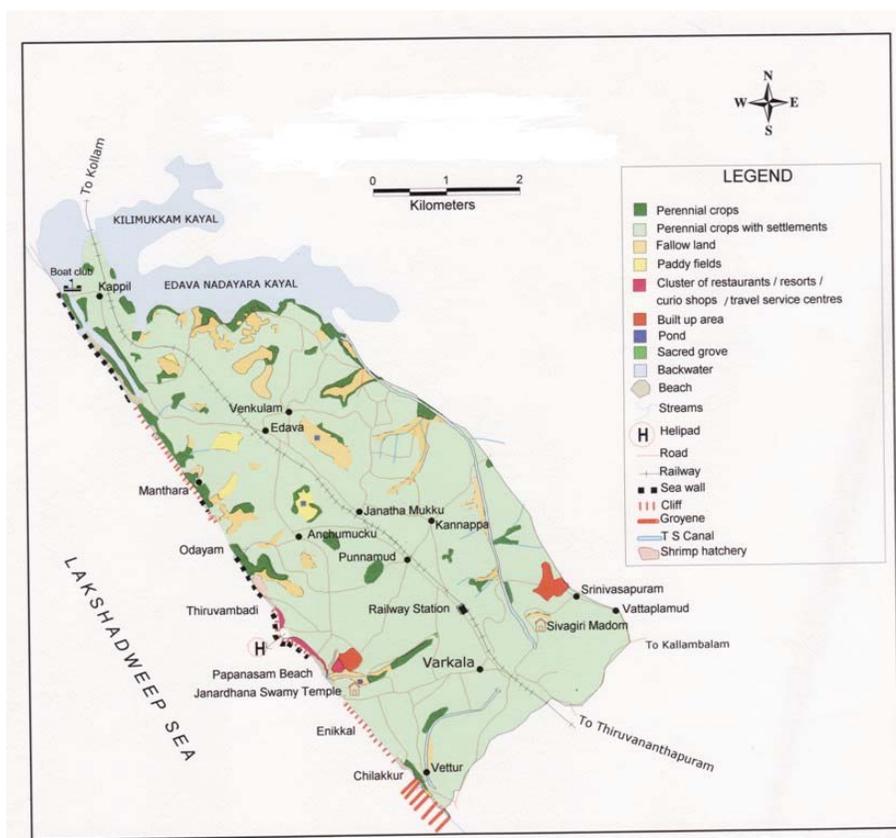
The total land area of Varkala is around 25.3 km<sup>2</sup> and the kayal area is 4.32 km<sup>2</sup> (Fig. 1, 2, 3). The present landuse/land cover pattern of the study area has been classified into 8 major types. Major portion of the area is covered with perennial crop with settlements which occupies 68.13% of the total area. Settlements are found mixed in between the croplands. Perennial crops represent mostly coconut trees and limited number of jackfruit trees mango trees. Banana plant is cultivated in between the settlement and the perennial crops. The perennial crop with settlement increased from 19.46 km<sup>2</sup> to 20.18 km<sup>2</sup> (1969 to 2010). Perennial crop area was reduced from 2.87 km<sup>2</sup> to 1.74 km<sup>2</sup>. This highlights the increase in the population of this area. The total population of the area is 67631, which was 58848 in 1981 and shows an increase of 14.9%. The paddy fields underwent drastic changes from 2.74 km<sup>2</sup> to 0.27 km<sup>2</sup>. The paddy fields are reclaimed as fallow land, built up area, perennial crop with settlement etc. The area of the sacred grove was also reduced from 0.039 km<sup>2</sup> to 0.01 km<sup>2</sup> (1967 to 2010). The difference in beach area is mainly due to the cliff erosion and seasonal variations of shorelines. All along the coast there are five intermittent pocket beaches with a total length of 1.18 km and the width variation of 10- 40 m. Except Papanasam and Chilakkur other beaches are seasonal in nature and appear during the period of November to April. Along the coast there are four fish landing sites operated by neighboring fishermen in traditional style. Major portions of the seashore are protected with sea walls.

The beach area underwent changes due to cliff erosion and seasonal variations. The average beach area in 1967 was 0.19 km<sup>2</sup>; but it reduced to 0.14 km<sup>2</sup> in 2010; whereas the kayal area in 1967 and 2010 stood the same (4.32 km<sup>2</sup>). The fallow land in 2010 is 2.59 km<sup>2</sup>, the cluster of hotel area comes to around 0.09 km<sup>2</sup>, the built up area was 0.26 km<sup>2</sup> and the area of helipad was 0.02 km<sup>2</sup> (Figure 2, 3).



**Figure-2 Map showing the landuse pattern of 1969**

A far-reaching landuse change was noticed along the 1.5 km stretch of coastal area from Papanasam towards the north. Present tourism activity is mostly concentrated within this area and very much crowded with resorts and shops. There are about 102 resorts of different class concentrated within the distance of 1.5 km from Papanasam. The questionnaire survey reveals an annual influx of about 88000 tourists in Varkala and major portion of the visits are during the peak season of November to March. At present all these visitors are supported within this 1.5 km stretch and create problems like over crowding, hygiene, environmental degradation etc. The laterite coastal cliff is slowly getting blemished largely due to the developmental activities. Proper repositioning of the present activities in the adjoining areas with potential for tourism development can preserve the main attraction of Varkala as a beautiful coastal tourism destination. More clean surroundings should be maintained. The landuse/land cover mapping and field survey has identified potential sites for tourism development towards north up to Kappil. Backwaters fringed by coconut groves, inland boating facilities, and the seashore are all offer attractive scenic beauty. By improving infrastructure facilities like accessibility, resorts, restaurants etc. tourists can be attracted towards these areas. Since the major landuse/land cover in this area is perennial crop with settlement and perennial crops and the density of settlement is very low, abundant land base is available for future developmental activities.



**Figure-2 Map showing the landuse pattern of 2010**

## CONCLUSION

The study illustrates that the coastal tourism sector in Varkala is not in the propensity of sustainable growth. Lack of planning and the haphazard developments are crafting problems. The tourism activity in Varkala started in a slow pace came to prosperity only after the 1990s. Since coastal areas are sensitive zones, tourism activities dictate proper planning and protection measures. Concentration of developments in the narrow stretch of landmass has already caused problems like overcrowding, insufficient infrastructure, environmental issues, unhealthy competitions etc. The landuse/land cover analysis demonstrated potential tourism sites towards the northern region, and sufficient hinterlands towards the east, which has to be developed through proper planning and encouragement.

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