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A Comparative Study on the Spatial Changes in Land-Use and Associated Environmental Impacts of Coastal Tourist Destinations: Hikkaduwa vs. Bentota, Sri Lanka

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ABSTRACT : The tourism industry is one of the main economic activities of the southern coastal belt of Sri Lanka and is closely related to land-use as it dramatically transforms the natural land into highly artificial ones. The study focuses on the analysis of the spatial contrasts of land-use and environmental impacts in two coastal tourist destinations in the southern coast of Sri Lanka: Hikkaduwa and Bentota. For this, both primary and secondary data were used. Three samples, each consisting of fifty units from the local community, tourist stakeholders, and tourists, were randomly selected. Information regarding the environmental impact of tourism-driven land-use, obtained through three types of questionnaires, underwent descriptive analysis. Detection of land-use changes utilized various tools, including topo maps, high-resolution Google Earth images, and GPS-based ground truth observations.

For the study, two areas covering a total of 36 square kilometers each in Hikkaduwa and Bentota were designated. The land-use for the years 1984, 2010, 2018, and 2022 was digitized using ArcGIS 10.8.3 software, with their extents calculated in hectares via the Geometric Calculator. To evaluate the spatial diversity of land use attributes, the designated area of 36 square kilometers in both Hikkaduwa and Bentota has been segmented into six buffer zones, each extending one kilometer from the coast inland. Identification of the change in mixed land-use diversity in the two sites over time was accomplished through the application of the Entropy Value (H) based on the land extents of digitized land-uses.

The first buffer zone in Hikkaduwa requires planned development, given its significant role in the tourism industry. Opportunities for ecotourism development lie in the second and third buffer zones, featuring tourism constructions and valuable natural resources. In Bentota, the first buffer zone is marked by beach tourism-related structures, while the Dedduwa reservoir could drive a tourist zone in the second and third buffer zones. The study also highlighted a shift in land-use patterns. Hikkaduwa transitioned from proportional mixed land-use to a dominant land-use type, while Bentota maintained a more balanced proportion of major land uses. Moreover, Hikkaduwa faced more severe environmental problems compared to Bentota, emphasizing the need for a formal and sustainable land-use plan in Hikkaduwa. The involvement of stakeholders responsible for land use, tourism development, and environmental conservation was deemed crucial for achieving this.

Keywords - Comparative study, Spatial changes of land-use, Hikkaduwa and Bentota, Environmental impacts, Entropy value, Coastal tourism industry.

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1. INTRODUCTION

Tourism has become one of the most important industries globally, generating revenues, employment, and infrastructure development for many countries [1]. This industry is diverse, encompassing accommodation, transportation, food and beverage, retail, culture, sports, and recreation, catering to domestic and international visitors [1]. The spatial distribution of tourism activities is fragmented, occurring in environments with various attractions [2], [3], [4]. Coastal areas, with their biodiversity and natural beauty, hold significant potential for tourism development [5], [6]. However, these areas are subject to high population pressure due to urbanization, making tourism a vital source of income [7]. Coastal tourism offers diverse activities, including the development of hotels, resorts, restaurants, and supporting infrastructure [8].

In Sri Lanka, with its extensive coastline, tourism plays a crucial role in the coastal region's economy and land use [8]. The demand for land for tourism-related facilities puts pressure on the environment and existing land cover [9]. The southern coastline, particularly Hikkaduwa and Bentota, has experienced significant tourism-led land-use changes [10]. Hikkaduwa is an example of unplanned land-use development, with informal sector tourism being popular [10]. The area has seen the conversion of residential houses into guesthouses and hotels, leading to environmental issues and limited coastal accessibility [10].

Bentota, on the other hand, has witnessed planned and formal sector tourism development, targeting top-class tourists [10]. These divergent approaches in Hikkaduwa and Bentota provide an opportunity for a comparative analysis of land uses, environmental impacts, and sustainable management [10].

Understanding and addressing the environmental issues arising from tourism-led land-use changes is crucial for sustainable coastal tourism development. Such insights can inform land-use planning and management strategies at a regional or national level, ensuring the long-term viability of the tourism industry [8]. In conclusion, tourism is a significant economic activity with diverse land-use requirements. Coastal areas, with their natural attractions, have emerged as popular tourist destinations. However, uncoordinated and unplanned tourism-led land-use changes have resulted in environmental issues. A comparative analysis of Hikkaduwa and Bentota in Sri Lanka can provide valuable insights into the spatial and temporal dynamics of land use, environmental impacts, and contribute to sustainable tourism-led land-use management.

2. OBJECTIVES

The main objective of this research is to comparatively analyze the contrariety of land-use changes in the tourist sites of Hikkaduwa and Bentota in Sri Lanka. In order to achieve this, several minor objectives have been identified. Firstly, the study aims to analyze the spatial changes in land-use in both sites. This will offer a thorough insight into the evolution of land-use patterns across space in these destinations. Secondly, the research will analyze the contrariety of mixed-land-use diversity in both Hikkaduwa and Bentota from 1984 to 2022. This analysis will highlight the differences in land-use patterns and diversity between the two sites over time. Additionally, the study will explore the environmental effects of tourism-led land-use changes in both destinations. It will assess the impact of tourism development on the natural environment and identify any associated environmental issues. Furthermore, the research aims to identify the challenges of implementing a proper land-use plan in the Hikkaduwa area. This will involve examining the barriers and obstacles faced in managing land-use effectively in this particular destination. Lastly, the study will provide suggestions to promote sustainable tourism development through a proper land-use plan in the Hikkaduwa area. These recommendations will aim to enhance the management of land-use in order to ensure the long-term sustainability of tourism in the region.

3. LITERATURE REVIEW

Land use involves manipulating the biophysical attributes for specific purposes. It is essentially how humans utilize the land [11]. This encompasses a range of economic and cultural activities, including agriculture, residential areas, industries, mining, and recreation, reflecting the human utilization of land [12]. Tourism, being a significant economic activity worldwide, is closely intertwined with land use [13]. However, the competition

for land in tourism often leads to conflicts between different land uses in a given area [14]. Unfortunately, tourism-led land-use changes have also resulted in environmental issues [13].

In the Asian/Pacific region, uncoordinated and unplanned mass tourism has caused degradation of coastal environmental resources, jeopardizing the long-term sustainability of tourism [15]. For instance, Hikkaduwa, Sri Lanka, and Goa, India, both popular tourist destinations, have suffered from haphazard and ad-hoc coastal tourism development, negatively impacting environmental resources [15]. Similarly, the Bentota river basin has experienced land use and land cover changes, potentially transforming the area into a large tourist development ([8]. However, these studies did not thoroughly address existing or potential environmental issues arising from these changes.

A detailed study by Bandara and Ratnayake [14] focused on conflicts and planning efforts in coastal land use for tourism in Sri Lanka. They discussed the importance of land zoning and conservation in coastal tourism planning but highlighted the challenges faced due to a lack of cooperation, funding, implementation, monitoring, and evaluation. The Ceylon Tourism Board (CTB) in Sri Lanka had the authority to acquire land for tourism projects, but this approach led to haphazard construction and ecological problems in coastal areas. Only two planned beach resorts, Bentota and Passikudah, were successful, emphasizing the need for better land-use planning and allocation.

Considering the significance of land planning and resource allocation in tourism management, Pushpakumara and Peiris [16] conducted a study in the southwest coast of Sri Lanka. Their research aimed to design a framework for evaluating land use patterns and infrastructure transformation toward eco-tourism in the Welipanna area. They proposed land zoning based on development and locational analysis, identifying suitable areas for leisure and recreational hotels and medical tourism clusters. However, the potential socio-economic and environmental costs of such developments were not addressed.

While there is extensive literature on spatial and temporal changes in land-use in coastal tourism sites, few studies have focused on the negative impact of unplanned tourism-related land uses on the environment. Additionally, land use planning has not received sufficient attention in sustainable tourism development discussions. Moreover, comparative analyses of formal and informal land use patterns in two tourist areas, such as Hikkaduwa and Bentota, are lacking in Sri Lankan research. Thus, a comprehensive comparative analysis of land use changes, their environmental impacts, and strategic plans for sustainable tourism development in these two popular destinations would greatly contribute to the future development of the coastal tourism industry.

4. METHODOLOGY

4.1. Study Area

Hikkaduwa is located on Sri Lanka's southwestern coast in the Hikkaduwa DSD of the Galle District. It is approximately 100 km south of Colombo and 15km north of Galle, at latitude 6009'N and longitude 80008'E. The area is highly urbanized with extensive development along the coastal zone corridor of Galle Road. A commercial fisheries harbor exists within this corridor. The selected study area covers 36 sq. km, including the Hikkaduwa Municipal Council area, to analyze the coastal area and land use changes. Within this area, there are 46 Grama Niladhari Divisions (GND), with 36 belonging to Hikkaduwa and 9 to Gonapinuwala. The GNDs range in size from 0.1 sq. km to 2.2 sq. km.

Bentota, a tourist paradise in Sri Lanka, stretches 9.5 km along the Galle-Colombo main road. It covers a large area with resorts and hotels parallel to the coastal boundary and Bentota River. The selected study area covers 36 sq. km, including 30 GNDs, with 28 belonging to Bentota DSD and 2 to Mathugama DSD. The GNDs range in size from 0.49 sq. km to 9.32 sq. km.

(a) (b)

Figure 1: Selected 36 square km area in Hikkaduwa (a) and Bentota (b).
Source: 1:500000 Digital data from Survey Department of Sri Lanka, 1999

4.2. Data Collection

Three different structured questionnaire surveys were conducted with 150 respondents at each tourist site, including local and foreign tourists, local communities, and tourism stakeholders. The surveys aimed to gather information on various aspects, such as tourist satisfaction, environmental problems, and proposed solutions. 10 semi-structured interviews were carried out with officers of the institutes related to the topic, and the observation method was used to examine changes in land caused by the tourism industry, identify difficult-to-detect land uses, and assess the severity of environmental problems.

Researchers collected secondary data from journals, organization records, annual statistical reports, and documents. Additionally, topographic maps, digital data from ArcGIS, high-resolution satellite imageries, Landsat satellite imageries, and various indexes and models were used for map analysis and creating visuals for the study. For the study, high-resolution satellite imagery from Google Earth Pro software was downloaded for the years 2010, 2018, and 2022. This imagery was used to analyze land-use changes in the study areas over time. The verification of the accuracy of digitized land-use maps for the Hikkaduwa and Bentota tourist areas is anticipated through the application of the Systematic Point Sampling (SPS) method, utilizing gridded classified images. Initially, the size of the area for point sampling was determined, and the corresponding number of point samples was established. Subsequently, a grid, consisting of 200m x 200m squares, was created over each selected 6km x 6km area. Within this grid, 300 sample points were systematically arranged, excluding every two squares (Fig.2). The X and Y coordinates of these sample points were then tracked using a GPS device to identify the current actual land use in those specific locations.

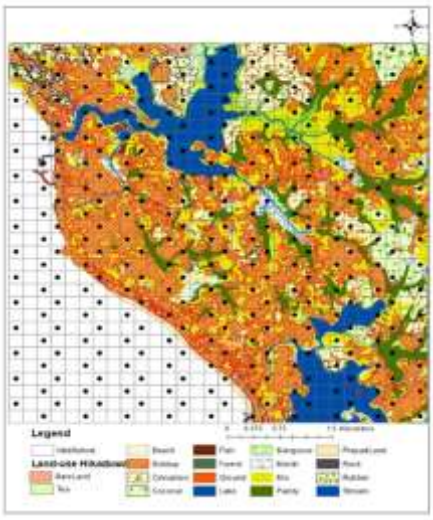

Figure 2: Systematic point samples within 36km2 of the area in Hikkaduwa
Source: Google Earth Images, 2022

Table 1: Method of calculating the ground-truth verification of the land-uses of Hikkaduwa

Land use	No. of Points in the map	(*1) Estimation	No. of points in real	(*2) Estimation	Difference (*1 &*2)
Bare Lands	1	0.3333	0	0.0000	0.3333
Beach	2	0.6667	1	0.3333	0.3333
Buildup	79	26.3333	70	23.3333	3.0000
Cinammon	16	5.3333	14	4.6667	0.6667
Coconut	16	5.3333	16	5.3333	0.0000
Ground	1	0.3333	2	0.6667	0.3333
Magrows	10	3.3333	8	2.6667	0.6667
Mix Vegetation	55	18.3333	65	21.6667	3.3333
Ocens	62	20.6667	63	21.0000	0.3333
Paddy	20	6.6667	21	7.0000	0.3333
Rubber	2	0.6667	1	0.3333	0.3333
Rock	1	0.3333	1	0.3333	0.0000
Tea	1	0.3333	0	0.0000	0.3333
Water	34	11.3333	33	11.0000	
SWMP	0	0.0000	5	1.6667	1.6667
	300	100.0000	300	100.0000	11.6667

Source: Google Earth Images and GPS Survey, 2022

Ground truth verification, conducted with 300 GPS points, indicated an accuracy of 88.3% for digitized land-use features in Hikkaduwa (Table 1) and 79.3% in Bentota.

4.3. Sample

The survey included 3 separate questionnaires for each tourist site. Respondents were divided into 3 purposive categories: tourists (local and foreign), stakeholders representing various businesses in the tourism industry, and members of the local community such as fishermen, farmers, flaked lime workers, and residents. 50 questionnaires were randomly distributed to selected respondents from each category.

4.4. Data Analysis

The study utilized high-resolution Google Earth images and topographic maps from multiple years to classify land use in two study areas. The 36 sq km area was divided into four equal parts and separate Google Earth images were downloaded for each part. Geometric correction was done by establishing at least 10 well-distributed Ground Control Points (GCPs) using topographic maps as references. Various land-use categories were defined, including built-up lands (urban areas and buildings), water bodies (oceans, streams, rivers, and lakes), roads (major and minor roads, railways), paddy and coconut lands (for agriculture), mangroves (coastal trees and shrubs), swamps and lagoons, and bare lands (unused or difficult to use). All identified land-use features were digitized using ArcGIS software and their extents in hectare were calculated in hectares using the Geometric Calculator tool.

The development of tourism leads to changes in land-use demands and patterns, which are complex and dynamic in tourist cities [17]. Therefore, “mixed land-use” patterns are commonly observed in many tourist cities in developing countries]18]. To identify the change of mixed land-use diversity of Hikkaduwa and Bentota during the last four decades, the “Entropy Value” for land-use patterns of the two sites in 2010, 2018, and 2022 was calculated considering the types of land-use as construction lands, water bodies, roads, paddy lands, coconut lands, mangroves, and un-used lands. The entropy value (1) was calculated by applying the following formula developed by Cervero & Kockelman [19] to assess the similarity and diversity of land use types of the areas.

$$H = -1\left[\frac{\sum(P_j) * \ln(P_j)}{\ln(K)}\right]$$

Equation 1: Entropy Value (H) formulae
Source: Cervero & Kockelman, 1997

Where H is the entropy value, and K is the number of different types of land use in the area. Pj indicates the proportion of the total land area in the jth land use type and ln is a natural logarithm using e (approximately 2.718) as its basis. Entropy values range between 0 and 1, with 1 representing the equal proportion of each land use type and 0 representing the presence of a single dominant land use [8].

5. RESULTS AND DISCUSSIONS

5.1. Growth and present status of the Hikkaduwa tourism industry

Hikkaduwa is well-known for its coral reef and marine environment, which have been major attractions for tourists. The tourism industry in Hikkaduwa began to flourish after the discovery of the coral reef by Sir Arthur C. Clarke and Rodney Jonas. Initially, the only accommodation available was the Hikkaduwa Rest House, which was later renovated into the Coral Garden Hotel, the first hotel in the area. Following the 1970s, more hotels such as Blue Coral and Coral Sands were established.

Before the rise of tourism, the local economy relied on cinnamon cultivation, coral mining, lime production, toddy tapping, and the coir industry based on coconut cultivation. However, fishing, tourism, and coral mining have now become the main sources of income for the local population. The growth of the tourism industry in Hikkaduwa occurred without proper planning, leading to haphazard development along the coastline [10], [14], [15], [20], [21].

During the 2004 tsunami disaster, many tourism-related buildings were damaged but were subsequently restored. Hikkaduwa currently offers a range of hotels, from five-star to one-star establishments. According to statistics from Sri Lanka Tourism Development Authority (SLTD) and Urban Development Authority (UDA), there were approximately 46 hotels and guest houses operating along the beachfront in 2007. By 2020, there were 65 tourist hotels and resorts, as well as 113 guest houses in the Hikkaduwa division. Overall, Hikkaduwa's natural beauty and coral reef have attracted both local and foreign tourists, contributing to the growth of the tourism industry in the area.

5.2. Growth and present status of the Bentota tourism industry

Bentota is an important tourist town in Sri Lanka, known for its pristine beaches, mangrove walks, and tranquil environment. It has two tourism zones: the Bentota National Holiday Resort (NHR) established by CTB in 1969 to preserve the area, and the zone with businesses run by local people outside the resort. The resort occupies about 100 acres of land on the beach frontage and comprises 1-star to 5-star hotels, restaurants, banks, shops, and transport services. The tourism industry in the area took off around the 1970s, and the resort area was planned from the beginning. The Bentota NHR mainly attracts affluent foreign tourists, while budget tourists stay in guest houses and homestays outside the resort.

All businesses within the resort are owned by outside investors, and until recently, people from outside areas were hired as workers for those businesses. This has caused job opportunities for locals to be lost. However, the situation has changed slightly, allowing locals to reap some economic benefits from the businesses within the resort.

5.3. Spatial changes of land-use

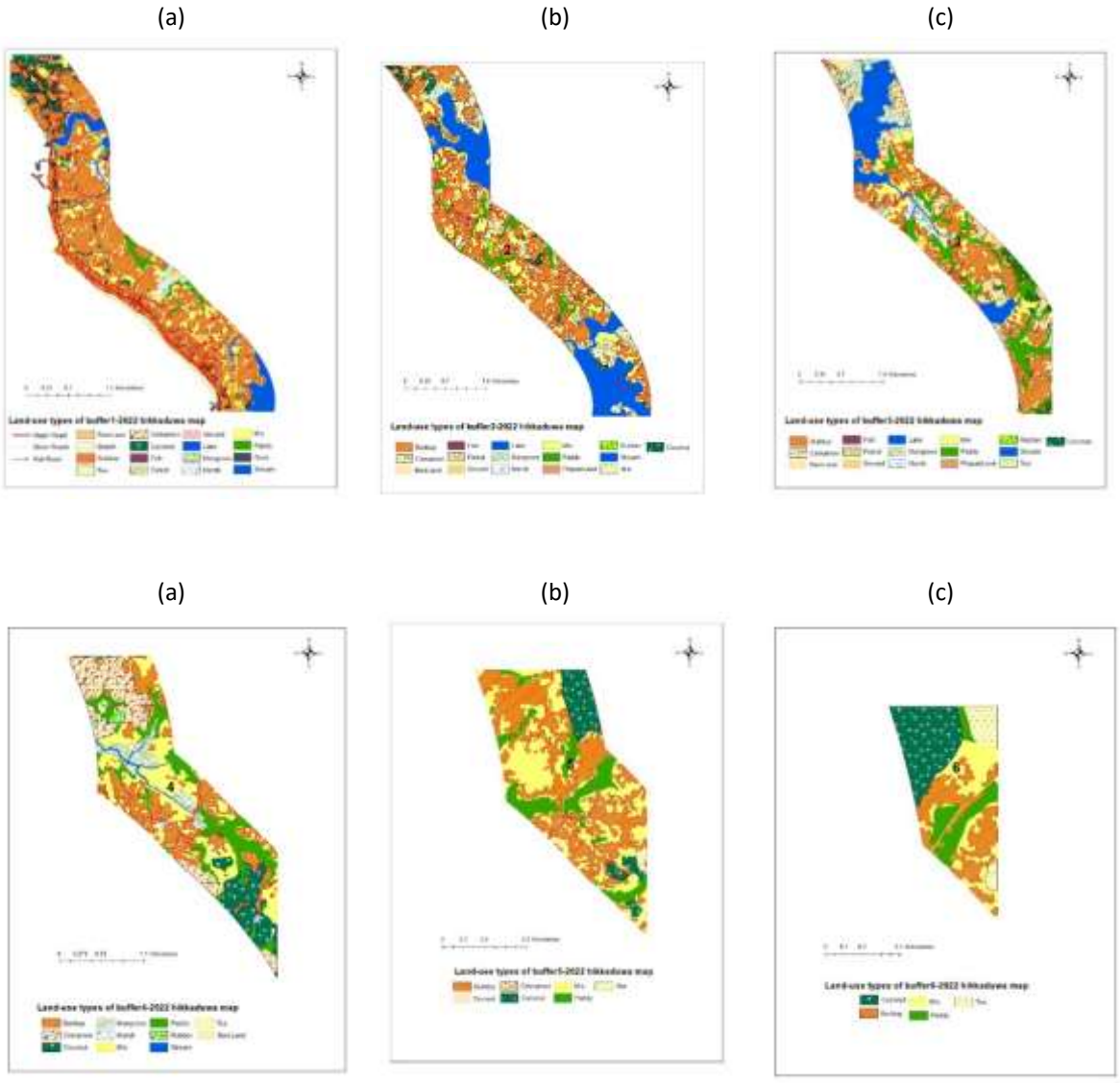

Figure 3: Spatial land-use changes in Hikkaduwa. Buffer zone 1 (a): Boundary: Inland by one kilometer from the coastline, Buffer zone 2 (b): One kilometer into the interior from the boundary of the first buffer zone, Buffer zone 3 (c): One kilometer into the interior from the border of the second buffer zone, Buffer zone 4 (d): One kilometer into the interior from the border of the third buffer zone, Buffer zone 5 (e): One kilometer into the interior from the border of the fourth buffer zone, and Buffer zone 6 (f): One kilometer into the interior from the border of the fifth buffer zone.
Source: Prepared by the author based on geometric calculations of the digitized land-use types, 2022

The spatial analysis of land use in the Hikkaduwa area in 2022 (Fig.3) reveals that built-up land dominates the first buffer zone, while the second buffer zone exhibits a mix of built-up land, mixed vegetation, and water sources. Mixed vegetation prevails in buffer zones 3, 4, 5, and 6. Tourism-related land use is prominent in the first and second buffer zones, with the first buffer zone identified as a key area for planned development due to its significant contribution to the tourism industry and rich coastal ecosystems. The abandoned buildings along the main road in this zone also offer potential for tourism or urban development.
The second and third buffer zones, characterized by tourism constructions and abundant natural resources like water sources and mangroves, present opportunities for ecotourism development. Ecotourism in mangrove

areas focuses on the pillars of ecology, sustainable economy, and empowerment of local communities. Activities such as boat rides, camping, educational and research programs, bird watching, and meditation can be implemented with minimal environmental impact, following legal regulations and environmental certifications. Businesses in ecotourism must be mindful of potential risks to the mangrove environment, and commitments to protection, restoration, and promotion should be mandatory. It's noteworthy that tourism has not significantly influenced land use activities in the remaining buffer zones.

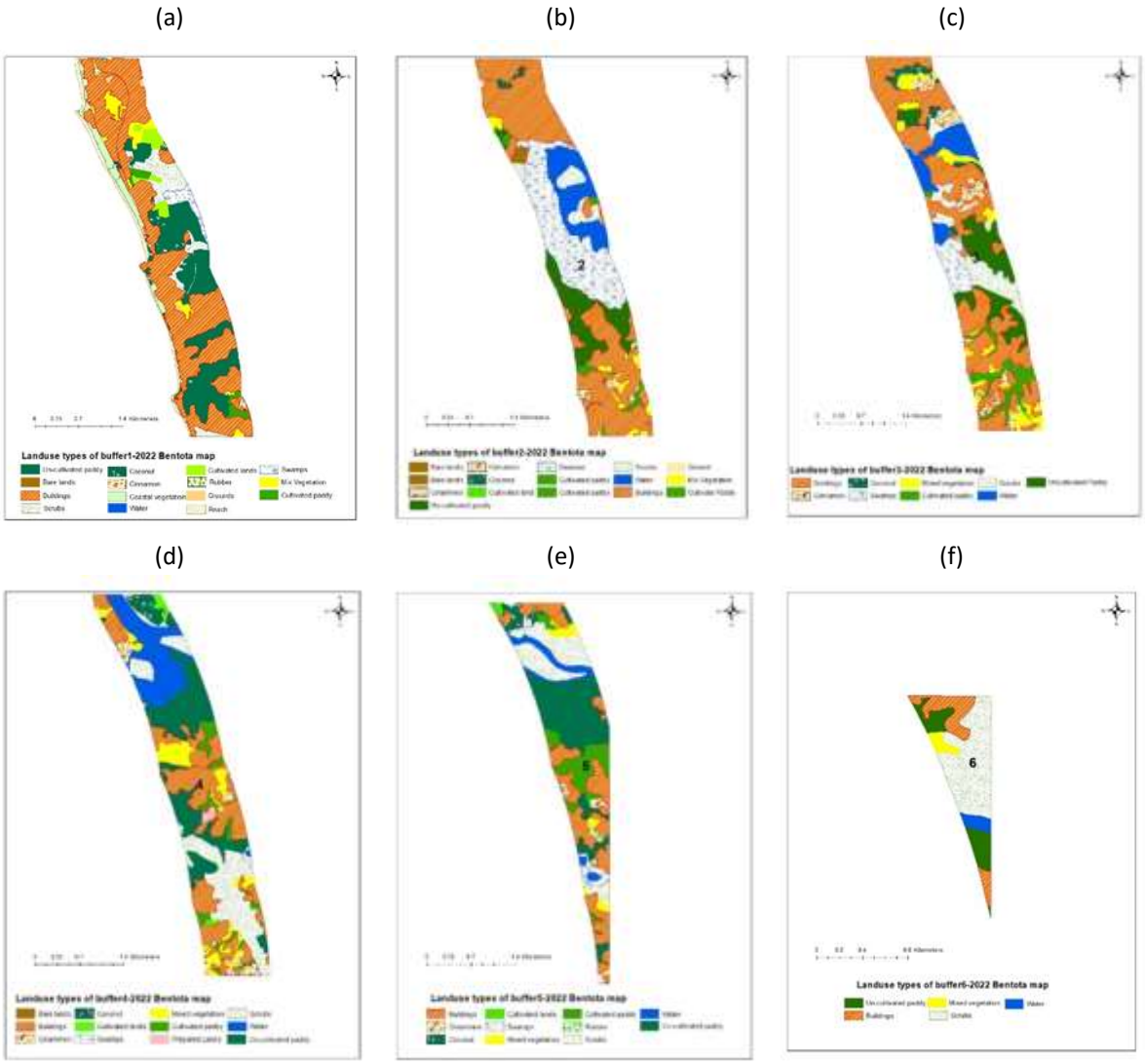

Figure 4: Spatial land-use changes in Bentota. Buffer zone 1 (a): Boundary: Inland by one kilometer from the coastline, Buffer zone 2 (b): One kilometer into the interior from the boundary of the first buffer zone, Buffer zone 3 (c): One kilometer into the interior from the border of the second buffer zone, Buffer zone 4 (d): One kilometer into the interior from the border of the third buffer zone, Buffer zone 5 (e): One kilometer into the interior from the border of the fourth buffer zone, and Buffer zone 6 (f): One kilometer into the interior from the border of the fifth buffer zone.
Source: Prepared by the author based on geometric calculations of the digitized land-use types, 2022

In the spatial analysis of land use in Bentota in 2022 (Fig.4), built-up areas dominate buffer zones 1, 2, and 3, with the first buffer zone featuring buildings and business premises for beach tourism. Buffer zones 2 and 3 exhibit tourism-related constructions, especially near Dedduwa Lake. The northern part of the first buffer zone is fully developed, while the central and southern areas show unused land suitable for construction. If a tourist

zone is initiated based on the Dedduwa reservoir, the second and third buffer zones are deemed most suitable, aligning with SLTDA plans.

The first buffer zone, representing one kilometer inland from the coastline in both regions, is primarily characterized by built-up areas for tourism, residential, business, and government purposes. Compared to Hikkaduwa, Bentota's first buffer zone offers more land for potential tourism or other purposes. The built-up area in Bentota's second buffer zone is 22.69% less than Hikkaduwa's first buffer zone due to the significant presence of water sources. The built-up area in the third buffer zone is 10.45% less than the second buffer zone. Unlike Hikkaduwa, where built-up areas decrease substantially from the first to the fourth buffer zone, Bentota shows a less pronounced decrease from the first to the third buffer zone. Nonetheless, both areas' second and third buffer zones exhibit potential for tourism due to specific characteristics. Overall, urban features within the first kilometer of both areas gradually decrease as one moves inland.

5.4. Mixed land-use diversity in Hikkaduwa and Bentota areas

The calculation of entropy values relies on geometric computations involving the digitized land extents of Hikkaduwa and Bentota sites spanning from 1984 to 2022. The entropy values calculated for the years 1984, 2010, 2018, and 2022 in the selected area of Hikkaduwa were 0.767, 0.744, 0.704, and 0.694 respectively (Table 2). An entropy value of 1 represents an equal proportion of each land use type while 0 represents the presence of a single dominant land-use of the area [8].

Table 2: Land use change from 1984-2022 in the Hikkaduwa area and entropy value calculation for land use types in 1984

Type of Land use	1984					2010		2018		2022	
	Extent (hec)	%	$l(P_j)$	$\ln(P_j)$	$(P_j)*\ln(P_j)$	Extent (hec)	%	Extent (hec)	%	Extent (hec)	%
Mix vegetation	1070	37.85	0.378	-0.973	-0.368	767	27.07	508	17.94	496	17.51
Swamp	10	0.35	0.004	-5.521	-0.019	65	2.31	58	2.04	42	1.49
Beach	32	1.13	0.011	-4.510	-0.051	22	0.78	15	0.54	18	0.64
Rock	0	0.00				3	0.10	3	0.10	4	0.14
Rubber	92	3.26	0.033	-3.411	-0.111	25	0.87	16	0.55	12	0.41
Paddy (cultivated)		0.00	0.00	0.00	0.00	0.00	0.00	217	0.00	0.00	0.00
Paddy (Un-cultivated)		0.00	0.00	0.00	0.00	0.00	0.00	26	0.00	0.00	0.00
Paddy (Total)	482	17.05	0.170	-1.772	-0.302	365	12.88	243	8.59	238	8.40
Bare Lands	0	0.00	0.00	0.00	0.00	34	1.19	52	1.83	27	0.95
Grounds	0	0.00	0.00	0.00	0.00	5	0.19	2	0.07	7	0.25
Buildings	271	9.60	0.096	-2.343	-0.225	598	21.11	990	34.95	1053	37.17
Cinnamon	113	4.00	0.040	-3.219	-0.129	195	6.88	214	7.56	249	8.79
Coastal vegetation	0	0.00	0.00	0.00	0.00	8	0.28	4	0.15	0	0.00
Coconut	350	12.38	0.124	-2.087	-0.258	257	9.06	219	7.72	209	7.38
Grass Lands	0	0.00	0.00	0.00	0.00	2	0.05	41	1.44	0	0.00
Mangroves	0	0.00	0.00	0.00	0.00	125	4.40	110	3.87	151	5.32

Shrubs	0	0.00	0.00	0.00	0.00	66	2.31	56	1.99	0	0.00
Water	390	13.81	0.138	-1.981	-0.273	298	10.51	290	10.24	304	10.73
Tea	0	0.00	0.00	0.00	0.00	0	0.00	3	0.11	15	0.53
Forest	16	0.57	0.006	-5.116	-0.029	0	0.00	9	0.30	7	0.25
Fish	0	0.00	0.00	0.00	0.00	0	0.00	0	0.00	2	0.07
Total	2827					2833		2833		2833	
Entropy Value (H)	***0.7674***					***0.7448***		***0.704***		***0.6914***	
Ocean	774					767		767		767	

Source: Created by the author based on land extent calculations from the geometric calculator in Arc GIS 10.8.3.

According to the H values obtained for the years, the land-use is gradually shifting from a proportionally mixed land-use pattern to a single dominant land-use pattern. This may have been due to the rapid development of the tourism industry in Hikkaduwa.

On the other hand, the Entropy values for the selected land area of Bentota for the years 1984, 2010, 2018, and 2022 were 0.728, 0.798, 0.718, and 0.729 respectively. As in Hikkaduwa, no discernible gap between the Entropy values can be discerned in Bentota. All values being close to 1 reveal that the major land use types in the area are mixed in equal proportion.

5.5. Environmental impact due to tourism related land-uses changes in Hikkaduwa

The informality of land use for tourism in Hikkaduwa has created some serious environmental problems.

5.5.1. Unclean beach and land areas

Hikkaduwa faces significant issues with unclean beaches, littered roads, and land areas, which are commonly observed in the area. The community attributes this problem to multiple parties. Firstly, local tourists are identified as a primary contributor to the pollution of the beaches and land. Secondly, businesses associated with the tourism industry, including hotels, restaurants, and temporary shops, are also held accountable. Lastly, individuals from outside Hikkaduwa city are seen as another responsible party.

Figure 5: Irregularly dumped waste on the beach
Source: Field observations, 2022

5.5.2. Obstructive beach access

In certain areas, the access roads to the beach are narrow, causing difficulties in reaching the beach freely, especially during the peak tourist season. Temporary booths constructed along the road further obstruct the access. Additionally, due to the high density of buildings, tourists are forced to navigate through very narrow paths between two structures in order to reach the beach. Furthermore, the natural beach views are significantly hindered by large walled buildings that have been erected between the beach and the main road.

Figure 6: Paths to access the beach in Hikkaduwa
Source: Field observations, 2022

5.5.3. Coastal Erosion

Coastal erosion is a significant problem in Hikkaduwa, resulting in damage or loss of coastal structures, loss of valuable land, and disruption of human activities like fishing and recreation. Some people believe that the erosion has reached its maximum level and there is no more beach left to erode. As a result, it is difficult to find a clear, uneroded coastline from Hikkaduwa to Narigama for promoting coastal tourism. The community has noted that compared to the past, Hikkaduwa has smaller, scattered, and narrow beaches with no wide, continuous coastline.

Figure 7: Coastal erosion in the north section of the Hikkaduwa beach
Source: Field observations, 2022

The Coast Conservation Act No 57 of 1981 states that anyone planning "development activities" within the coastal zone, which extends 300m inland from the mean high-water mark, must comply with permit requirements regulated by the CCD. Due to the significant economic contribution of Hikkaduwa tourist town, the institutions responsible for coastal conservation have relaxed the rules and regulations surrounding tourism development activities on Hikkaduwa beach to some extent. However, this leniency in institutional regulations has resulted in informal land use practices and severe coastal erosion along the Hikkaduwa coast today. The beachfront length (in meters) of tourist establishments, shops, and private houses located in the coastal strip of Hikkaduwa is depicted in Fig. 8.

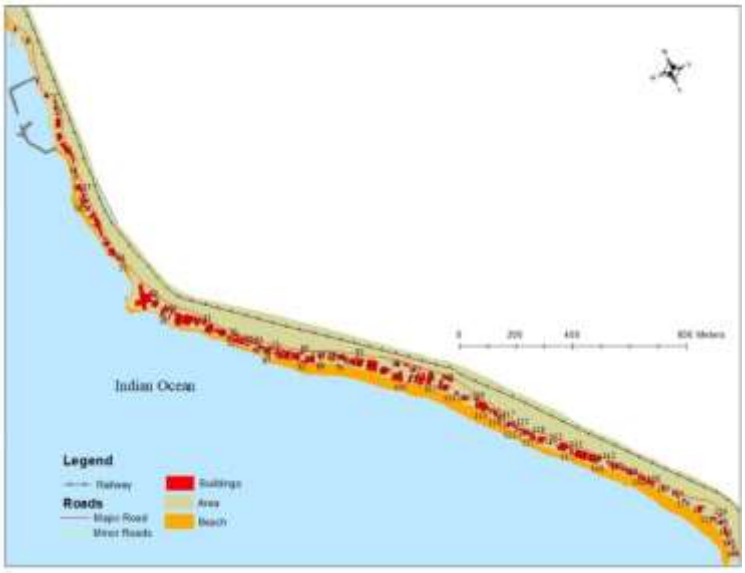

Figure 8: Beach access and land use by tourist establishments, shops, and private houses in the coastal strip between the main road and sea
Source: Prepared by the author based on Google Earth Images, 2022

In the Hikkaduwa beach area, out of the 166 establishments identified, around 73.4% (122 establishments) have a beachfront area of fewer than 50 meters. Unfortunately, there is severe erosion along the beach, stretching from the Coral Sands Hotel in the north to the Citrus Hotel in the south. To combat the erosion, hoteliers have been constructing retaining walls and filling the areas between the buildings and the walls with sand. This has led to a reduction in the available beach area for visitors and recreational activities. In some cases, such as at the Coral Reef Hotel, Mama's Beach Restaurant, and Coral Rock by Bansei, there is no beach remaining due to the encroachment and construction efforts.
There is a growing opinion among stakeholders, particularly tour guides, that the long, uninterrupted beaches extending from Kahawe Junction to Akurala in the north of Hikkaduwa, as well as Narigama beaches in the south, are becoming increasingly popular among tourists. As a result, there seems to be a tendency for future tourism to shift towards these areas.

5.5.4. Pedestrian traffic

The lack of a sidewalk on the A2 road has posed significant challenges, particularly in a tourist hotspot where thousands of tourists frequent. The absence of a sidewalk has resulted in a large volume of pedestrian traffic on the road, which is quite unsafe considering the presence of buses, trucks, and lorries. Unfortunately, accidents involving tourists have occurred multiple times on this stretch of road. Compounding the issue is the limited space available due to buildings constructed close to the main road, making it impossible to widen the road and construct a sidewalk.

Figure 9: Absence of a sidewalk near Hikkaduwa beach on Galle-Hikkaduwa main road
Source: Field observations, 2022

5.5.5. Pollution of inland waterways

One of the major environmental concerns in Hikkaduwa is the pollution of inland waterways that eventually connect to the sea. Within the study area of 36 km2, there are two canals, namely the Tuduwegoda Canal and the Mawakada Canal, which serve as outlets for excess rainwater to flow into the sea through the Hikkaduwa municipality. The Thuduwegoda Canal joins the Thelwatta ganga (Molapu oya) and empties into the sea from Wavulugoda west GND, while the Mawakada Canal flows into the sea near Hikkaduwa beach, where most tourist activities take place at Pannamgoda GND (Fig.10). These canal outlets are periodically obstructed by sandbar formations throughout most of the year, exacerbating the issue (Fig.11 & Fig.12).

(a) (b)

Figure 10: Outlets of Tuduwegoda canal (a) Mawakada canal (b) are filled with sand

Figure 11: Mawakada canal is connected to the sea by cutting the sandbank

Figure 12: Dirty water from the canal has accumulated in the sea near Hikkaduwa beach
Source: Field observations, 2022

5.6. Environmental impact due to tourism-led land-use changes in Bentota

In comparison to Hikkaduwa, a small number of problems related to land-use were identified in Bentota.

5.6.1. The problem of waste disposal

Waste from the Bentota resort and town area is collected once a day by the Bentota Pradeshiya Sabhawa. In particular, the waste in the tourist resort area is collected by the garbage collectors of the SLTDA and collected in one place to be given to the tractor of the Bentota Pradeshiya Sabhawa. Although the waste collection is regular in the area, it has been difficult to find a permanent place to dispose of the accumulated waste. Apart

from this, non-segregated garbage from hotels and houses in Varahena and Atawalawatta GNDs, where there are more hotels and tourist accommodations in the area, has also become a big problem

5.6.2. Pollution of inland water sources

Among the inland water sources in the study area, the Bentota River has been the most environmentally affected. One of the sources of river water pollution is the discharge of sewage pipes from houses and hotels located on the banks of the river (Especially the hotels in the Pitaramba and Yatramulla GN Divisions). Dumping and burning unseparated garbage from urban areas like Alutgama to land very close to the river is another reason that can cause a big environmental problem in Bentota river. According to the residents of the area, water pollution is also happening due to the waste getting stuck in the nets drawn for shrimps in small streams of Bentota.

5.6.3. Coastal erosion

The community and stakeholders believe that the main reason for the erosion of the Bentota coast is the effect of natural sea waves rather than human factors. As shown in the Figure 10, most of the tourism-related establishments concentrate in the north-end and south-end of the coastal strip. The north end comprises tourism establishments inside the resort while the south -end is with establishments near Induruwa beach. All hotels within the resort are constructed following the building regulations of CCD, CEA, and other relevant authorities. Therefore, the size of the beach frontage of the hotels built within the resort area along the coast from Pahurumulla GND to the north section of Varahena GND is at least 50 meters or more (Fig.13).

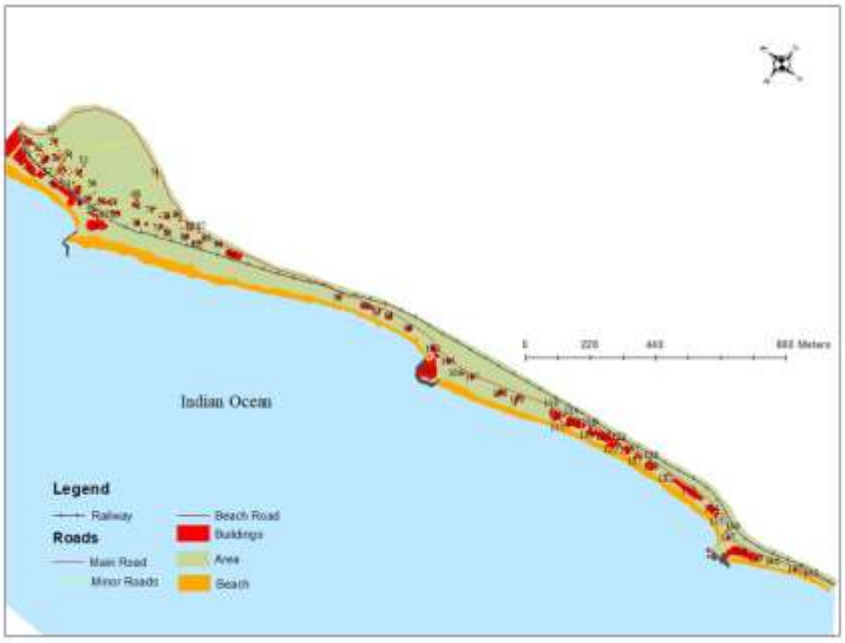

Figure 13: Beach access and land use by tourist establishments, shops, and private houses in the coastal strip between the main road and sea
Source: Google Earth Images, 2022.

5.7. Challenges to implement a proper land-use plan to Hikkaduwa.

Hikkaduwa has a tourism industry that was started by local and foreign investors with the strong objective of making a profit from the tourism industry. In 1979, for the first time, the CTB, CCD, and the UDA focused on controlling the growth of tourism in the coastal areas to preserve Hikkaduwa's coastal resources through joint administrative institutional measures [22]. The relatively low level of environmental problems associated with tourism-led land-use in the Bentota NHR indicates that the existence of the environmental sector of the tourism industry is sustainable.

Even though so many plans have been prepared to improve the physical and human environment of Hikkaduwa, there are still many problems related to land use due to the deficiencies in the preparation and implementation of those plans.

5.7.1. Issues in Planning and implementing

i. Institutional issues

a) The existence of multiple institutes responsible for the management and conservation of land and coastal resources creates conflict between them in the preparation and implementation of plans.

b) Distance between state and provincial level institutions and community relations.

c) Inability to make quick decisions as per the situation

The lack of intervention and indifference from land conservation institutes and the tourism industry after the 2004 tsunami has led to ongoing environmental challenges in Hikkaduwa. The collapse of the informal tourism industry after the disaster presented an opportunity for sustainable reconstruction, but due to short-sighted decisions and the failure of institutions to take action, an informal tourism industry emerged instead.

ii. Legal Issues

a) Lack of enforcement of existing regulations

b) Deliberate relaxation of existing regulations in ordinances from time to time by certain institutions

iii. Funding related issues

Not only in Hikkaduwa, but in the whole of Sri Lanka, the main problem that arises in the implementation of institutional plans and projects is the difficulty of securing funds for them. Many projects proposed to manage waste in Hikkaduwa have stalled due to difficulty in securing funds. Also, large-scale development projects such as the project to create the bypass have been limited to the proposed level for decades due to problems such as the difficulty of securing funds.

iv. Social issues

a) Problems related to the attitudes of the people

Community involvement in land use planning is crucial, but there are instances where measures have been withdrawn due to obstacles raised by certain public parties. For example, protests against increasing the capacity of a sewage treatment plant and objections to the construction of the Hikkaduwa Bypass.

b) Strongly tied to economic activities associated with coastal resources

Implementing a coastal zoning plan in Hikkaduwa has proved challenging due to the reluctance of coastal residents to relocate from their current economic activities, such as fishing and tourism, which heavily rely on coastal resources. Despite the benefits that coastal zoning can bring in regulating land use, providing alternative land and convincing people to leave their usual jobs has been met with resistance. This situation has hindered progress in the implementation of an effective coastal zoning plan in Hikkaduwa.

v. Other Issues

To facilitate the preparation and implementation of a formal land use plan in Hikkaduwa, it is crucial to address the prominent issue of old informal buildings near the coastline. Many of these structures have deteriorated over time and are no longer suitable for use. Thus, a necessary step would be to remove these dilapidated buildings and replace them with new constructions that adhere to the formal land use plan. By doing so, Hikkaduwa can ensure a more organized and regulated coastal development.

6. CONCLUSION AND RECOMMENDATIONS

A noticeable transformation in land use is observable in both tourist regions, marked by evident adverse effects in Hikkaduwa. The governance exercised by the CTB over the Bentota tourist resort has shielded it from environmentally detrimental land use. Conversely, the Bentota area exhibits environmental impacts stemming from tourism activities conducted by the general public outside the resort. Upon comparison, it becomes evident that the Hikkaduwa tourism industry falls short in achieving environmental sustainability, despite past measures.

Various challenges, including institutional, legal, provision-related, and social issues, impede the formulation and execution of organized development plans.

The proposition of coastal zoning, entailing the displacement of residents, encounters resistance from individuals reliant on coastal resources for their economic activities. Additionally, the A2 main road constrains tourism development in Hikkaduwa to a narrow strip between the coast and the road. Stakeholders propose closing the road and constructing a bypass to transform Hikkaduwa town into a tourist hub unhindered by road limitations. Both locations extensively use land within a one-kilometer distance from the sea for tourism-related purposes. Although tourism-related land use is noticeable in the second and third buffer zones in both areas, there remains an opportunity to strategically plan and implement sustainable tourism development in these zones. Ultimately, an effective and expeditious physical plan is imperative to address the challenges prevalent in Hikkaduwa.

7. REFERENCES

[1] C. Y. Gee, & E. F. Sola, International Tourism: A global Perspective. 1st edition, World Tourism Organization, Madrid, Spain, 1997.

[2] M. Marcovic, A. Satta, Z. Skaricic, and I. Irumbic, Sustainable coastal tourism: An Integrated planning and management approach (UNEP), 2009 [Online] Available: https://wedocs.unep.org.

[3] UNEP, Sustainable Coastal Tourism: An integrated planning and management approach, 2009. [Online] Available: https://wedocs.unep.org.

[4] M. L. Miller, J. Auyong, N. P. Hadley, Sustainable Coastal Tourism: Challenges for Management, Planning, and Education, 2011. [Online] Available: https://www.researchgate.net.

[5] Journal of Coastal Zone Management. (n.d). Coastal Region/ Coastal Area. [Online] Available: https://www.longdom.org.

[6] L.A. Mukherjee, Impact of tourism in coastal areas: Need of sustainable tourism strategy, 2021. [Online] Available: http://www.coastalwiki.org.

[7] L. Y. Burke, K. Kura, C. Kassem, M. Revenga, D. Spalding, and McAllister, Pilot analysis of global ecosystems: coastal ecosystems. Washington, DC, USA: World Resources Institute. Coastal Tourism: Opportunity and Sustainability, 2001. [Online] available at: https://www.researchgate.net/publication/247184150_Pilot_analysis_of_global_ecosystems_Coastal_Ecosystems.

[8] R. U. K. Piyadasa, and G. Ranasinghe, Exploration of recent land use and land cover changes of the Bentota River basin in Sri Lanka, 2017. [Online] Available: https://www.researchgate.net.

[9] S. Gössling, The consequences of tourism for sustainable water use on a tropical island: Zanzibar, Tanzania. Journal of Environmental Management 61(2), 2001. 179-91.

[10] M. R. Gunawardana, and H. L. G. Sanjeewani, Planning Implications and Sustainability of Tourism: A Comparative Study of Hikkaduwa and Bentota, Sri Lanka. Journal of Tourism, Hospitality & Culinary Arts, 2009, 67-85.

[11] W. B. Meyer, and B. L. Turner, Changes in Land Use and Land Cover: A Global Perspective (Cambridge University Press, Cambridge, UK, 320–342, 1994).

[12] U.S. Environmental Protection Agency. Report on the Environment: Land use, 2021. [Online] Available at: https://www.epa.gov/report-environment/land-use.

[13] J. Wang and Y. Liu, Tourism-Led Land-Use Changes and their Environmental Effects in the Southern Coastal Region of Hainan Island, China. Journal of Coastal Research. 29 (5), 2014, 1118–1125

[14] H. M. Bandara, and I. Ratnayake, Coastal Land Uses for Tourism in Sri Lanka: Conflicts and Planning Efforts. Sabaragamuwa University Journal. 14(1), 2015, 41-57.

[15] G. Tantrigama, Coastal Resource Management and Sustainability of Tourism: A Comparative Study of Hikkaduwa, Sri Lanka and Goa, India, 2017. [Online] Available at: https://nsgl.gso.uri.edu/washu/washuw99003/9-Tantrigama.pdf.

[16] T. D. C. Pushpakumara, & W. M. S. K. Peris, Analysis of Land Use Pattern for Tourism Management using GIS. International Journal of Advanced Remote Sensing and GIS. 9(1), 2020. 3446-3457.

[17] Y. Gao, Y. Liao, D. Wang, and Y. Zou, Relationship between urban tourism traffic and tourism land use: A case study of Xiamen Island. Journal of Transport and Landuse. 14(1), 2021.

[18] R. Bordoloi, A. Mote, and P. P. Sarkar, and C. Mallikarjuna, Quantification of Land-use Diversity in the context of mixed land-use, Procedia-social and Behavioral Sciences, 104, 2013, 563-572.

[19] R. Cervero, and K. Kockelman, Travel demand and the 3ds: Density, Diversity, and Design, 1997; Cited in: G. Ranasinghe, and R. Ratnayaka, A Study to Compare the Level of Walkability in Two Urban Neighborhoods of Sri Lanka. International Journal of Engineering Research and General Science, 2016. 4(1).

[20] K. Nakatani, A. Rajasuriya, A. Premaratne, and A. T. White, The Coastal Environmental Profile of Hikkaduwa, Sri Lanka. Coastal Resources Management Project, Colombo, Sri Lanka, 1994.

[21] USAID SCOTIA-SL. Hikkaduwa Restoration Task Force (HRTF): Formation of an inter-agency committee and action plan for the restoration of Hikkaduwa, Sri Lanka, into a resilient community and sustainable coastal tourism destination, 2007. [Online] Available at: https://media.clemson.edu/cbshs/prtm/research/international-conservation/Hikkaduwa-Restoration-Task-Force-Final-Report.pdf.

[22] Central Environmental Authority, (1984). Environmental Impact Assessment of Tourist Development at Hikkaduwa. [Online] Available at: https://core.ac.uk/download/pdf/52178639.pdf*gmt. Tech. 2019; 1(4): 22-40.*

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