

## Research Article

## Analysis of Land Use Pattern for Tourism Management using GIS

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**Abstract** Over the past few decades Sri Lankan tourism has been a story of untapped potential. The responsible parties have been unable to expand the footprint of tourism due to the lack of vision, coordinated planning and strategic commitment to the actions undertaken to accomplish a country's goal. Beyond question, the present tourism industry occupies an integral part of the economy of Sri Lanka. As a result, the negative impact of rapid and uncontrolled tourism development has become an inevitable critical issue. Regarding the indicated facts, this paper offers a remarkable aspect of tourism management defining proper land use patterns via GIS (Geographical Information Systems) for the identified tourism destinations in order to develop the tourism industry further on a both environmentally sustainable and economical platform. The study discusses the capabilities and shortcomings that are possible to encounter, brief description on GIS contribution and also the author's perspective relating to the future tourism strategic plan. Rooted in a GIS based analysis, the author anticipates to design a general framework to evaluate the proper land use systems as well as an infrastructure in effective transformation towards eco-tourism in Welipenna area through Bentota and Meegama river along with novel suggestions in conclusion.

**Keywords** *Eco Tourism; Land Use Planning; Tourism Development; GIS; Management*

### 1. Introduction

Sri Lanka has a fast-growing tourism industry and has always been a vast attractive tourist destination over the years (Fernando, 2016). Tourism is the third largest export earner in the economy and contributes about 5% of GDP. According to the latest data released by the Sri Lanka Tourism Development Authority (SLTDA) tourist arrivals have reached approximately 2 million which is a growth of 18% over the past couple of years despite of serious setbacks such as the partial closure of the main airport which highly affected immigration, devastating floods in the southern half of the country which obstructed the access to many resort areas and dengue epidemic in the outskirts of the commercial capital Colombo which resulted an adverse international media publicity that had a negative impact on forward bookings. Except the climatic woes came across, since the cessation of the three decades lasted civil war, the clouds of threatening insecurity has been blown away, rapidly elevating the tourism industry. However, it has not yet been able to utterly unleash the potential of Sri Lankan tourism. The struggling efforts of SLTDA to develop diverse, unique and quality tourism services and products converting Sri Lanka into the Asia's foremost tourism

destination globally has not yet been quite productive although the current position that SL tourism holds in the world is somewhat satisfactory. Opportunities are not captured enough to increase investment and employment effectively. And the Hence in order to expand tourism, a long-term vision and a fruitful mission are required and should be executed not only concerning the economic benefit but also considering the environmental sustainability. This is where sustainable tourism comes on the stage. It dominates an important role in conserving the natural assets while approaching the mentioned objective in transforming the story of untapped potential into a story of utmost success.

Tourism is in fact the fastest growing and the largest industry in the world with an estimated 11.5% of world GDP (Gross Domestic Product) and employing about 12.5% of the world's work force, according to the latest studies of UNWTO (United Nation World Tourism Organization). Moreover, they believe that tourism can be the key to many global solutions for challenges like climate change, poverty reduction, and waste reduction, preserving nature and moving the world to a more sustainable planet which is unthoughtful of many people involved in the industry. Thus, more attention is paid to the concept of sustainable tourism over the past years. (Safran, September 2015)

Sustainable tourism is defined as an industry which less affects the environment and local culture without exposing the fragile ecosystems to a risk of catastrophe whilst thriving the opportunities to enhance tourism targets. The positive of sustainable tourism is to ensure an optimistic development for local people, tourism companies and tourists themselves as well. In simple words, it is the concept of visiting a place as a tourist and departing the place as it was before without any sort of disturbance.

The Global Sustainable Tourism Council is the global leader promoting sustainable tourism. The progress so far encouraging the concept is quite appreciable and noted in many parts around the world. But it is questionable how far we have contributed to this concept as a country that has been able to draw the World's attention in tourism. The foundation and the uniqueness of the Sri Lankan travel experience lie in the inherent breath-taking beauty of the nature specially in hill country and the coastline. Not concerning the very fact might lead to disastrous consequences which would put Sri Lankan tourism at stake. Certain areas in the country already experience this harmful impact due to the rapid non-eco-friendly projects performed in order to develop tourism. When launching the very concept as an actual mission, there are various conflicts to be dealt with and obstacles to overcome. Among them land issues can be considered as one of the top most affective facets in tourism development. (Van Nostrand Reinhold, 1991)

Land management is an essential factor in tourism development. It is the process of optimal use of land resources ensuring maximum utilization. Land is needed for tourism infrastructure and facilities and for tourism associated businesses and services. With the increasing tourist arrivals, there is a mounting pressure to manage land use in high tourism potential areas. Thus, one should have a broad understanding about the demand for lands in order to unravel the tourism land issue. The overall demand for land can be roughly depicted by considering the land: man ratio. With the growth of population, the land: man, ratio has gradually decreased causing a crisis between man and nature. Furthermore, it has given rise to deforestation and invasion of conserved land such as natural habitats and sanctuaries threatening the bio-diversity and biological equilibrium. Since land is used for multiple major purposes such as housing, irrigation, agriculture, etc. and there is only a limited amount of lands available it's rather a hardship to acquire lands for a minor purpose like tourism. Apart from that, lack of land use planning is also partly responsible for the shortage of lands. Land use planning is a widely followed technique mainly to improve the quality life in urban areas which helps to increase overall efficiency of the area. Since resources are limited, they have to be used wisely. Therefore, land use planning and resource allocation must be applied in tourism management as well (Dredge, 1999). Since the success of any tourism business is determined by tourism planning, tourism development and research and tourism marketing.

Geographic Information Systems is a rapidly expanding field enabling the development of applications that manage and use geographic information in combination with other media (Verka, 2008). GIS technology offers great opportunities for the development of modern tourism applications using maps. This technology integrates common database operations such as query with the unique visualization and geographic analysis benefits offered by maps. The integration of tourism data and GIS data is a big challenge for the tourism industry, today. So, using these functions, providing proper land use patterns for tourism industry is a major target of this study. There are lots of cases where GIS has been used to bring significant value in tourism land use planning. The following cases have been selected in order to emphasize remote localities or situations where tourism development is only at the consideration stage and where issues of land uses are on the planning stage at the moment. The significant value of GIS technology therefore, is in its ability to provide desk-top mapping through the graphical display and manipulation of data in order to identify patterns or relationships based on particular criteria. In this way enhanced (value-added) information becomes available for further analysis or to assist in a decision-making process. So, the main purpose of this research is to find proper land use patterns for Sri Lankan tourism industry from GIS functions by covering all tourism destinations. Access to land or a place is a primary requirement for tourism management. Land is needed for tourism infrastructure and facilities, and for tourism-associated businesses and services. So, if there are not enough public lands for tourism, we should have a proper land use management system to develop tourism industry in Sri Lanka.

When considering about the relation between tourism management issues about land use and GIS application followings can be mainly identified to be managed.

- Tourist attracted areas in Sri Lanka.
- Visitor flow management (to identify principal tourist activities within a destination or among destinations).
- Facility inventory and resources use (to identify issues of environmental justice, to identify conflicts, complementary land uses, tourist activities, natural resources).
- Assessing impacts of tourism development (to demonstrate tourism impacts on its surrounding).

GIS was used as an integrating system and analysis tool for the assessment and prediction of parcel-based land-use change. It appears that building permits and cadastral data contain timely and valid information on land use changes. They are the major alternatives of data sources for analysing changes. This is particularly important for tourist destinations, as they are often too small to be analysed using traditional land use change analysis techniques. GIS has advantages over traditional methods in integrating different data sources, performing spatial analysis, and mapping the results into land use studies. The Murrells Inlet study shows that the use of GIS in conjunction with building permits and parcel data can provide adequate information on corridor change, land use change, timing, and spatial change. It is admitted that there are some limitations of this study. These limitations are mainly due to the data constraints and parcel properties. Obtaining the status of building permits (already built or not yet built) and improving data quality are critical to deriving the accurate information of parcel-based land-use change. These things about land use planning can be identified from this report (Jeffery S. Allen, 1999).

In 2005 Bas Boers was conducted to examine the potential of STIP as a tourism planning approach to address sustainability criteria. By integrating social and natural resource data, STIP aims to plan (spatially identify) infrastructure at sustainable sites rather than planning tourism development along existing transport structures that are not necessarily sustainable. Although the generated maps for two visitor segments are the most sustainable trail development sites, some issues still need to be resolved. First, the reviewed literature shows a lack of understanding of "network morphology" and "network connectivity" in terms of visitor satisfaction in specific and sustainable tourism development in general. Further research on these topics is required to come to sustainable trail networks.

Second, there is no statistical technique to analyse visitor preferences simultaneously at a substantial, spatial and temporal coherence level. Consequently, spatial and temporal visitor preferences were not taken into account in the illustrated road networks. The integration of spatial-temporal preferences is a prerequisite for sustainable development of the trail. Third, current GIS do not allow calculation of minimum cost paths while zonal constraints are applied. Therefore, the concept of sustainability could not be fully implemented. However, this "sustainability" constraint may be resolved by adjusting the minimum cost path algorithm (McAdam, 1999)

Given the above limitations and the poor quality and availability of case study data, no conclusions should be drawn regarding the development of sustainable tourism infrastructure in SFR. This does not mean that STIP has no potential as a tourism planning tool. The STIP's three-phase GIS-based methodology allows (to some extent) the inclusion of sustainability criteria in tourism planning. Provided that identified limitations are overcome, STIP allows visitors to guide them to preferred attraction and service facilities, using routes that: consider the experience needs of visitors; minimizing adverse effects on resources; and were developed in accordance with PA development goals. Thus, a higher level of visitor satisfaction can be achieved and maintained, while development-related costs and benefits can be channeled to the right places.

Analysis procedure, using visitor survey data, rendered a 'nature' and 'culture' visitor segment. Segment specific preferences and associated behaviour served, next to natural resource conditions and managerial objectives, as input for the development of carrying capacity and visitor opportunity zones.

Also, another case study on the Land Use Pattern of Kanyakumari District- Using GIS concluded how to decide the type of field patterns and an appropriate area for profitable utilization of land cover features which leads to efficient vegetation. Thus, the work had been carried out for the land use pattern analysis in Kanyakumari District. The analysis had been carried out with the NDVI classification of the respective study area. As such the entire land use had been visualized with the help of ArcGIS mapping software. Land use is the most observable of all environmental changes and assessment of any changes in ecosystem can be observed through the analysis (Vinodhini Shanmugapriya, 2016)

In 2003 Yianna Farsari has done a literature retrieval on GIS applications in tourism has revealed that most applications are concentrated rather on recreation (resources management and planning for national parks) than tourism. Those having as object tourism are primarily focused on identifying the most suitable location for tourism development. Very little attention, if any, is paid on the management and planning needs of already developed, popular destinations. Moreover, regarding sustainable tourism, applications are rather at the side as a consequence of resources management than the objective of the application. GIS applications related to sustainable tourism are mostly concerned with social participation. There is an apparent lack of integrated systems to support planning and management for sustainable tourism. This lack is even more apparent regarding the sustainable management of mass tourism in popular destinations. So, idea of tourism destinations and land patterns using GIS can be identified from this article.

Tourist attractions within the Western region are predominantly beach and water sports oriented, apart from in the Colombo City zone. Other attractions are Urban Tourism, Beach Tourism, Resorts, Entertainment, Night life, Eco and Nature tourism as well as facilities for Golf, Fishing, Surfing, Windsurfing and other Water Sports (Sailing, Boating and Yachting; Kayaking and River Rafting Scuba Diving), Nature tourism and Cultural/ Spiritual Tourism.

It is estimated that 325,000 indirect employment opportunities had been created through tourism within the Western region in 2014. The estimated direct employment was 129,400. By 2020, it is projected that direct employment would increase to 199,200.

As mentioned in SLTDA tourism employment will be increased rapidly in hotels and restaurants sector rather than other sectors. This is well implemented from following Table 1 and Table 2 information.

Considering above literature review and facts Sri Lankan government need to focus on one eco-tourism and cultural tourism therefore, it is need to study following objectives.

(a) *Eco tourism*

- Promotion of nature tourism in the Forest City Zone
- Development of marine infrastructure in the Western Province in order to find natural transport mode.
- Development of Dedduwa river mouth and surrounding area that has many potential attractions with wetland, lakes, irrigation canals and abandoned paddy fields.

(b) *Cultural Tourism*

- The Megapolis Region possesses a vast array of tangible and intangible assets that are of an archaeological, architectural, religious and aesthetic value for tourists and for nature lovers.

## 2. Research Methodology

The methodology of the research as follows. First the literature review was done based on the tourism land use patterns. Then the common factors that affect for tourism land use management was determined. In Sri Lanka there are so many places that are popular with their attraction in tourism industry and also there are proposed projects such as Megapolis tourism development. In this study it was selected the location mostly considering on calm and quiet environment-based eco-tourist attraction. So, giving a platform for land use pattern for tourists attracted hotels near Welipenna area through Meegama and Bentota River in Kalutara district using GIS is the main idea of my study.

Following steps were followed using the collected data and the analysis was done using Arc GIS 10.3 to find suitable places where tourists are attracted for Nature and Medical cluster in Welipenna area.

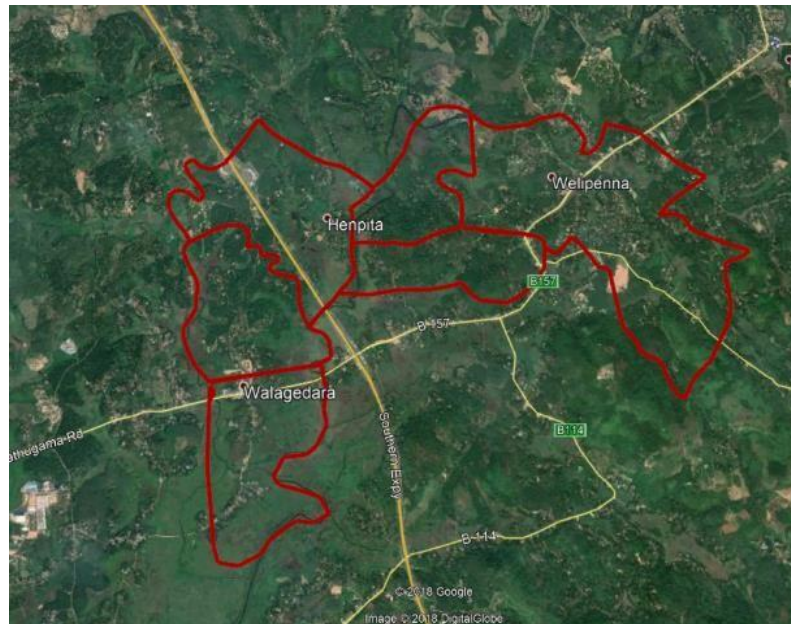
After doing the literature survey on tourism attractions, Meegama river area close to Welipenna Expressway exit has been selected according to the ease of access through the southern expressway from the Bandaranaike International Airport according to the topic related to calm and quiet environment-based attraction.

Even though a DEM map was created it is difficult to do the study for the whole area because the area is spread over a broad scope. Therefore, few locations that are suitable for tourism hotels were selected for the study and it may be considered as a case study of the area (Figure 1)

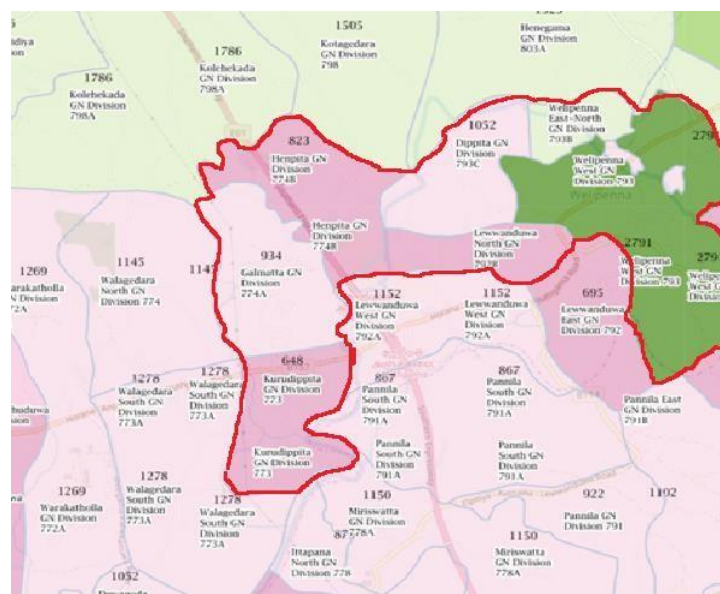
According to the 2012 census & statistics data the total population of the area is 7068 and the forecasted population of the area for 8608 is which is going to increase by 1540 within 18 years (Figure 2) and Welipenna area has poor population concentration in the Western Region (Figure 3). So, with this Eco-tourism development, we can increase the living standards of people in this area.

Most important parameters that are affected to select this location are as follows.

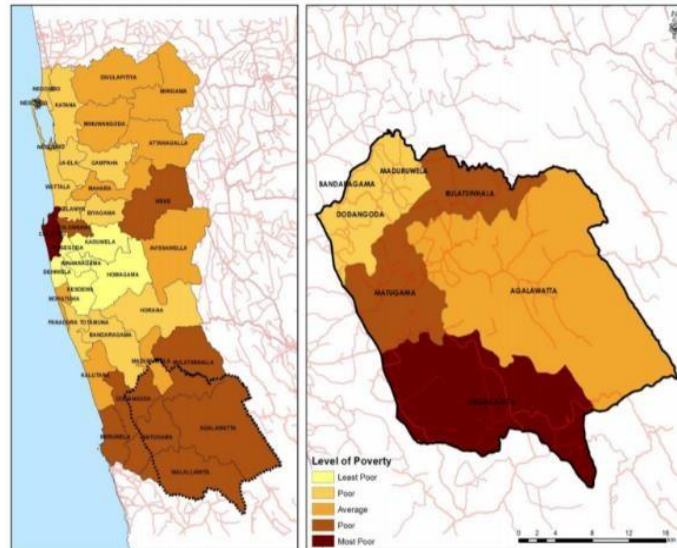
- Ease of access through southern express way to Location.
- Welipenna service area is the only highway service area available in Sri Lanka and tourist hotel agents can take them there.
- Boat rides can be provided from the Welipenna exit to hotels through Meegama River and Bentota river.
- Good connectivity between other tourist attractive destinations.
- Suitable Hotel locations have analyzed by using Arc GIS software and it was done according to selected GN districts. They are Kurudippita, Henpita, Dippita, Galmatta, Lewanduwa and Welipenna GN divisions.



**Figure 1: Selected Area for Study**



**Figure 2: Existing Human Settlement Pattern**



**Figure 3:** Poverty Level of the Area

### 2.1. Land Use Pattern

Suitable Hotel locations have analyzed by using Arc GIS software and it was done according to selected GN districts. They are Kurudippita, Henpita, Dippita, Galmatta, Lewanduwa and Welipenna GN divisions.

Most of the lands in Welipenna are occupied by the Rubber and paddy Plantation which accounted 58.16% of the total land area, which offers tremendous opportunity for high value Eco friendly development. A sizable 10.06% of the land is under Forest Cover that needs to be protected. Only 25.24% of the Welipenna area is classified under Homestead and Buildup areas (Table 3).

**Table 3:** Existing Land Use Pattern

Land Use	Area	Percentage
Rubber	777.33	29.51
Forest	264.99	10.06
paddy	754.68	28.65
Home Land	664.85	25.24
Tea	120.12	4.56
Water Bodies	36.08	1.37
Coconut	16.07	0.61

### 2.2. Proposed Hotel Developments

#### (a) Leisure and Recreational Hotels

Propose recreational activities to attract local and international visitors to the area. This will include recreational facilities such as golf, hotels and luxury residences constructed in high ground areas. Luxury and semi-luxury hotels are proposed to the areas which have capabilities to provide endemic cultural experience of the country.

- To attract and keep stay more local and international tourists to the area.
- To increase the connectivity among the tourist attracted places within the region
- To provide opportunities to experience the beauty of nature in a calm and quiet environment.

*(b) Medical Tourism Cluster*

Proposed to provide Ayurvedic and Western Medical facilities those who seek special medical treatment, which is only possible away from work and make trips to other surrounding tourism attracted places. The importance of promoting alternative medicine i.e. Ayurveda, homeopathy, acupuncture to the western market and promoting western medicine mainly to the ASIAN region.

- To become a global natural tourist attracted destination in South Asia.
- To promote Ayurvedic tourism among foreign countries.
- Benefit the local communities

### 3. Results

The optimal location was then identified via Arc GIS and the following map illustrates a glimpse of the region in Welipenna including the highway expressway exit (Figure 4). Best locations for tourism hotels are identified and Following Tables (4, 5, 6) and Figure 5 show the observed information.

**Table 4:** Collected Information

Even	Information
Population	7068
Land Area	2634.12 acres
Avg. Temperature	26.9 C
Avg. Rainfall	3610 mm per year
Warmest Month	April
Coolest Month	January

**Table 5:** Preferred location for Hotel Development

Location	Access way to boat ride	Distance from Welipenna (Km)
Kurudippita	Boat Ride	2.0
Galmatta	Road(Henpita Rd)	2.3
Henpita	Boat ride	3.2
Lewwanduwa	Road(B157)	4.3
Dippita	Boad ride	5.2
Welipenna North	Boat ride	6.8
Welipenna West	Road (B157)	4.2

**Table 6:** Derived locations and Access paths for each Hotel developments

Proposed Hotel Development	Selected G N Division	Access Way
Leisure and Recreational Hotels	Henpita	Boat Ride
Medical Tourism Cluster	Dippita	Boat Ride



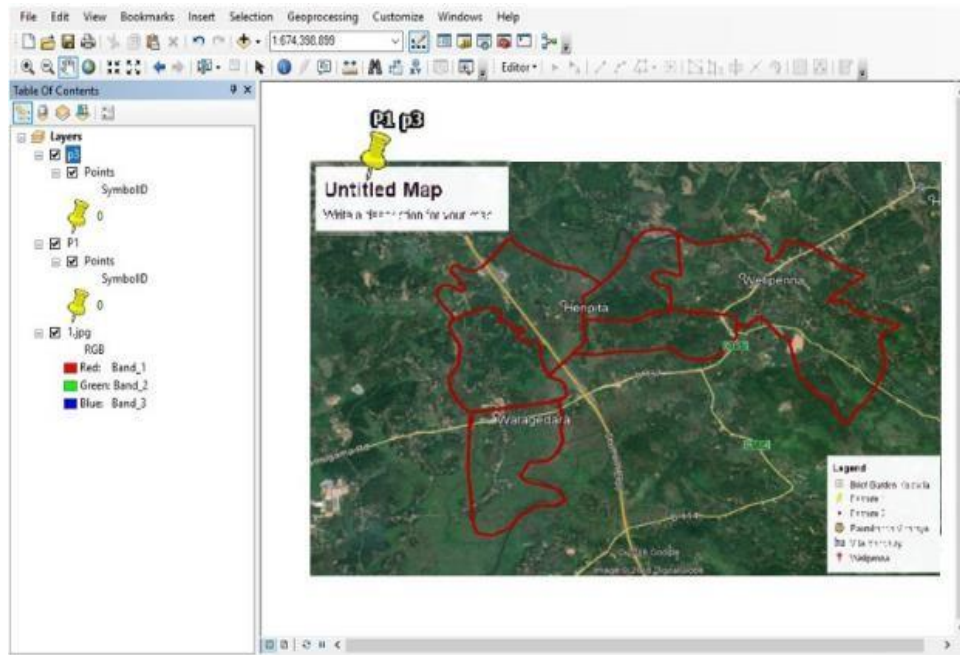


Figure 4: GIS Map Indication

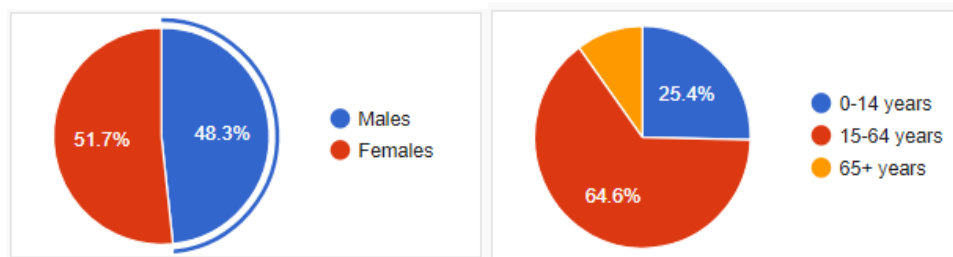


Figure 5: GIS Population Variance

### 3.1. Connectivity pattern

Road transportation is the dominant mode of travel to Welipenna area as it has no direct Railway connection to the area. Vital national Expressways is Southern Expressway. Welipenna highway exit located along these corridors and tourists can reach to hotels Using boat service through Meegama River (Table 7).

Table 7: Connectivity Pattern Distances

Origin – Designation	Distance (Km)
Bandaranayke international airport to Welipenna Highway Exit	95.1
Welipenna Exit to Megama river	0.3
Boat ride to Hotel	2-6

### 3.2. Social and Cultural Importance of the Study Area

Most of the social facilities are concentrated in to the upper part (Mathugama) of the area as rest of area mostly concentrated with the forest. Lot of archaeological sites are distributed around the area which provide high potentials for tourism activities (Figure 6)



Figure 6: Connectivity of regions

#### 4. Discussion

After identifying proposed developments and locations analysis part was done by comparing distances to the locations and access ways. Most of GN divisions have both access from by roads and through Meegama river. By considering ease of access and distances Henpita GN division is suitable for Leisure and Recreational Hotels and Dippita is suitable for Medical Tourism Cluster. Finally, We can identified that the Welipenna area is most suitable to develop calm and quite environment based eco-friendly tourist attractive places for future development of Sri Lankan tourism industry.



Figure 7: Tourism Management Style for the study

## 5. Conclusion

The GIS-based land use analysis has been applied in a variety of situations in present. The idea is to develop a method using GIS because, GIS can play a role in auditing environmental conditions, examining the relevance of sites for proposed developments, identifying conflicts of Interest and Modelling Relationships. The systematic assessment of environmental impact is often hampered by information deficiencies, but also by tools for integration, manipulation, visualization and analysis of data. So, with the help of this GIS applications, research introducing a new land use pattern for calm and quite environment-based tourism management in Welipenna in Kalutara District using GIS and its integration with the principles of Eco tourism development in Sri Lanka (Figure 7)

## Future work

- The suitability of the Land use pattern for Develop and manage tourism industry in other regions of the country.
- Possibility of using this method as well as in other tourist categories such as Urban Tourism, Beach Tourism, Resorts, Entertainment.
- Development of Eco-Tourism Hotels and activities in according to this land use pattern and tourism management style.

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