ORIGINAL ARTICLE

SPATIAL ANALYSIS AND ECOTOURISM DEVELOPMENT
A CASE STUDY OF WARANGAL DISTRICT OF INDIA

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ABSTRACT

Ecotourism is an activity that creates wealth by showcasing the natural beauty of the earth's features and landscapes. The main objective of this study is to identify potential ecotourism spots in Warangal district of India's state of Andhra Pradesh. The study uses geospatial data sets through GIS analysis supported by field-verified data sets of LISS –III Satellite Image Land use land cover map preparation with suitability assessment. At the present state Warangal district's tourism is supported by the region's relevant cultural and historical elements. In the present study data sets of physical, cultural and historical tourist attraction sites were used. Additionally, relevant literature and documentation were studied and key informant interviews to different stakeholders from the infrastructure and tourism development were conducted. The study identified the sites of Lavvala and Gngavaram as having a high potential for ecotourism and those of Shanpalle and Chinna Boinapalle as of medium ecotourism potential. The four potential tourist spots identified are found within the range of the vegetation area with accessibility to road network and existing tourist attraction sites. The study concludes that the location of potential ecotourism sites is contingent on their natural vegetation and that their economic development strongly depends upon their accessibility by transport network.

Keywords: ecotourism, weighted overlay, accessibility, land use land cover, remote sensing, GIS, Warangal

INTRODUCTION

The tourist activity is defined by the World Tourism Organization (UNWTO, 1995) as people who travel on leisure, business and any other purpose away from their surroundings but not staying on the site more than one year without interruption. Tourists, thus, are those people who travel and stay as non-resident in a new place and their activity does not result into permanent residence or in any economic activity (Hunziker & Krapf, 1941). In addition, tourism is the major foreign currency earner for one third of the developing countries and is the world's largest industry (Scheyvens & Momsen, 2008). Indeed, tourism brings a large number of consumers to the southern countries, thereby becoming a potentially key market for domestic manufactures and a driving force for local sustainable economic development.

According to Robinson (1976), the attractions of tourism are to a large extent geographical in their character. Pearce (1979), in his turn, identifies six major areas of specialization from the perspective of geographical interest in the study of tourism: the spatial elements of supply, the spatial elements of demand, patterns of movement and flows, the impact of tourism, the spatial elements of resorts, and dimensions of tourist space.

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According to The International Ecotourism Society (TIES, n.d.) ecotourism is a form of tourism that involves visiting natural areas in the remote wilderness or rural environments. Ecotourism has been widely held as a form of sustainable activity that promotes a green and clean concept of tourism. At the same time, ecotourism is highly dependent on the existence of natural parks. The primary objective of ecotourism is to showcase the natural resources of the planet to different segments of the society and bring people to experiencing nature and the natural processes. Additionally, ecotourism serves as a recreation practice and propagates a message of environmental conservation. An Ethiopian eco-tourism study has shown that when the local communities are able to make of ecotourism an alternative source of income from traditional environmental resources they retreated from environmentally destructive practices (Amogne Asfaw, 2014).

As Ceballos-Lascuráin (1996) emphasized, "All tourism is directly dependent on the use of natural resources relatively in a state of underdevelopment, which may include topography, water bodies, natural vegetation and fauna". Newsome, Moore and Dowling (2002) have added that "nature tourism" includes tour involved adventures, appreciation of nature flora and fauna and ecotourism. In a study with focus on Rwanda, Michel, Etienne and Michael (2013) explored the marketing strategies for ecotourism. Accordingly, they suggested that the diversification of tourist products by operators could help the local people in bringing their own tourist products to the market by using their vernacular production techniques.

The main activities involved in ecotourism are non-consumptive such as watching birds, trekking, river rafting, nature trips, and watching of the scenic beauty of valleys, mountains, water bodies and the natural processes. Hence experiencing the landscape becomes an activity that creates wealth by supplying "green money".

The tourist sector is an industry with a great potential in developing countries and the worldwide demand for nature travel has been growing in the last decades (Zurick, 1992). The Indian subcontinent takes the lion's share in south Asia's regional tourism, with 68.5 % of tourists visiting its lands. From 1990 to 2008 India's domestic tourism has witnessed a phenomenal explosion, with an aggregate growth rate of 230 % for the whole period (World Travel Tourism Council, 2015). In addition, the contribution of travel and tourism related activities to Indian GDP was INR 6,631.6 bn (6.2% of GDP) in 2013, and in 2014 it was expected to grow to 7.3%. This share of tourism in the Indian economy is expected to rise by 7.0% annually reaching INR 13,983.0 bn (6.8% of GDP) by 2024 (World Travel Tourism Council, 2015). Within India, Andhra Pradesh, the state focus of this study, is the leading region in domestic tourism attracting 20% of the total tourist traffic of the country, with 208 million visitors in 2013. The main tourist asset of the region is the pilgrim center of Tirupati (Economic Times, n.d.).

Yet, the sector of ecotourism is poorly developed in many a developing nation, including India. Thus, tourism and economic bureaus of developing countriesrarely apply a scientific approach when trying to identify the tourist places. In the case of India, no clear method is available to identify and declare a

place as a tourist destination. Thus, whenever a place is declared of interest or it is turned into a tourist spot it is largely due to western interest or to the influence of foreigners. In the case of the region focus of this study, the tourist department of Warangal was unable to provide any guidelines concerning how they identify and declare a spot of tourist importance. This study aims at filling this gap and thus at contributing to the development of a sustainable economic resource with great potential in developing countries. The present paper presents a methodology that helps in identifying ecotourism spots in the mentioned district.

GIS APPROACH IN TOURISM DEVELOPMENT

Geographical information system (GIS) is a very popular method used in planning and problem solving in critical areas where accessibility is a challenge. Spatial technology is able to get remotely sensed data, thus avoiding or minimizing field trips and helping in quick decision-making where time is a crucial factor. For instance, GIS is currently being used in the Indian city of Goa's tourism master plan. The master plan should identify the entire major tourist places in the city, creating an inventory of its existing tourist infrastructure. The plan chiefly aims at reorganizing local tourism at a great scale, shifting the pressure of tourism from the coastal areas to the hinterlands and, thereby, exploiting the tourist potentials of less visited areas and improving the stay of the tourists and their expenditure. The plan is expected to have a multiplier effect by generating additional employment and diminishing the impact of tourism on the environment (Pandey & Chakraborty, 2001).

The Ministry of Tourism in West Bengal employed a methodology to identify the potential ecotourism areas at different levels with the help of remote sensing image as well as demographic and natural features. The Ministry prepared the overlays of population, infrastructure and forest density to identify ecotourism regions. The sustainable tourism infrastructure planning approach was presented with three segment analysis using visitor experiences, carrying capacity of the space and transportation networks by overlay method of GIS (Boers & Cottrell, 2005).

Similar projects are also being implemented in the African continent. Thus, Longmatey, Amoako-atta and Prah (n.d) developed a Geospatial database aimed at the tourism sector in Ghana. In their case, intelligent mapping and their related analytic capabilities were used for modeling and revenue generation purposes of the tourism sector in that African country.

In Nigeria there are examples of embedding other tools in GIS-related projects. Thus, a GIS-based project has been developed together with a multimedia database design. The project has proved being effective in showcasing the tourism potentials of the country and in planning and managing tourism at a global scale. The developer collected a large sample of audiovisual data from potential tourist sites of tourist places. Then they integrated them with GIS so that the internet browser would be able to take the user to the places of interest with the help of relevant spatial data (Ayeni, 2006).

STUDY AREA

The study area of this paper is Warangal, a district within the Indian state of Telangana (part of Former Andhra Pradesh state). The region derives its name from Orugallu (Ekasilanagara), which means a town built on a single stone. It has an area of 12,846 km sqand it is located between 170 19' and 180 13' N and 780 49'and 800 43' E. Warangal was founded in the twelfth century by Prola Raja of the Kakatiya dynasty. It was one of the largest districts in the previous Hyderabad State. The Warangal district is bounded by Karimnagar in the north, Medak in the west, Nalgonda in the south and in the east by Khammam districts (Know Ap, n.d.).
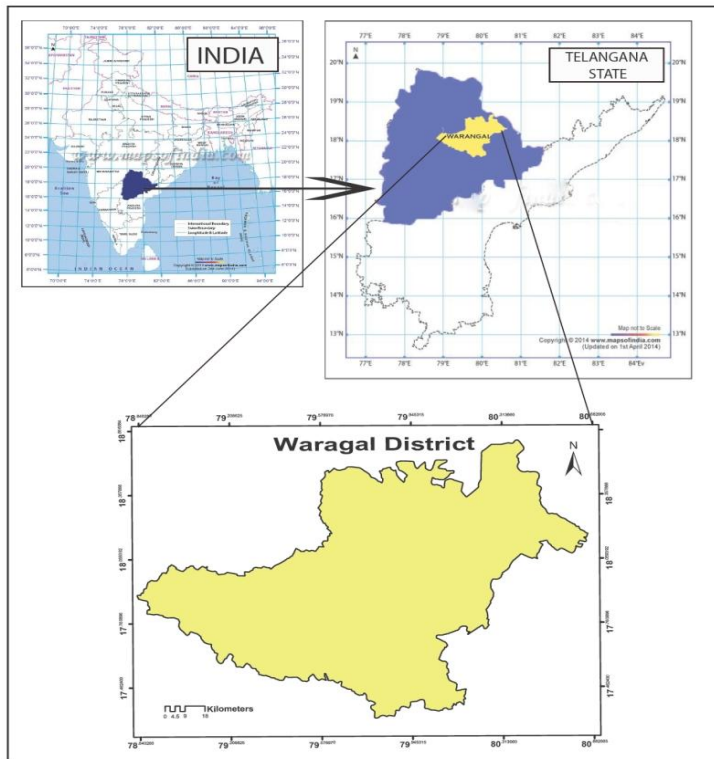

Figure 1: *Location map of Warangal district*
Source: APSRAC.

At present eighteen tourist centers of the Warangal district are in the list of State Tourism Development Corporation, the scenic Laknavaram Lake being a famous destination as an ecotourism site. Religious, historical and architecturally relevant sites such as Kolanpak, Ramappa and the Thousand pillar temple are special attractions of the district. In addition the biannual pilgrimage festival of Madaram, which lasts five days, draws millions of tourists to the region, about 11 million in 2013. In 2014 the whole district attracted 20.3 million tourists while the state capital Hyderabad alone attracted 9.2 million visitors (Office of the district tourism development of Warangal, 2014). Such numbers

alone show that the massive cultural and religious events have huge potentials for generating tourism (Getz, 1997, as cited in Ezeani, n.d.).

Figure 2: *Laknavaram Lake*
Source: Photo Satya Kurma, 2010.

METHODOLOGY

This study aims at identifying the ecotourism spots in Warangal district with the help of physical, cultural and historical datasets. The selection of the data sets was done with the help of key informant interviews, which included personnel from the regional government departments of irrigation and agriculture as well as officials involved in tourism activities (tour guides/operators), forest resources, urban development, and transportation. At the conclusion of this phase a series of maps were prepared. Overlaying various thematic maps, buffering and weighed overlay analysis was done with the help of GIS (Figure 3).

Data was collected from various sources including Survey of India, Department of Tourism Andhra Pradesh, NRSC (National Remote Sensing Center), APSRAC (Andhra Pradesh State Remote Sensing Application Center), and a field study by using global positioning system (GPS) in line with Remote sensing images and scanned topo maps.

The raster data sets were converted to vector data sets and vice versa wherever applicable. Data preparation and updating for analysis purpose was done with the program Arc GIS 9.2. Remote sensing images of LISS (Linear Image Self Scanning) III were used for land use and land cover maps which were prepared using Erdas Imagine 9.1.

The Land Use and Land Cover (LULC) maps were done with the consultation of experts from district forest, agriculture and urban development officers and appropriate ground verification with Global Positioning System (GPS).
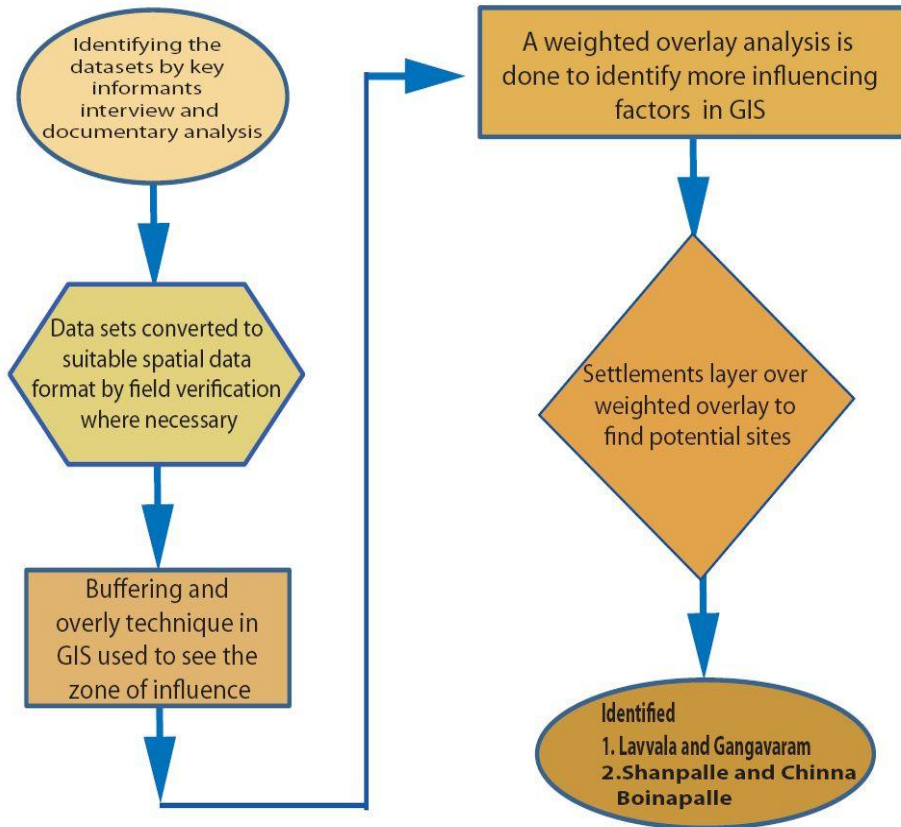

Figure 3: *Work flow*

This study is inspired by the methodology of weighted ecotourism analysis developed by Banerjee, Smriti Kumari, Paul, and Sudhakar (2002) for the region of West Bengal in India. In their study, the authors used the Normalized Difference Vegetation Index (NDVI) as a main component giving more weight to natural vegetation. Yet, since the area chosen for this study has important historical and cultural tourist spots, the NDVI approach was modified by adding a total of eight different informative layers such as surface water bodies, vegetation, LULC, graded elevation, ground water, road network, wildlife sanctuaries and existing tourist spots. For the study the opinion of experts from the district tourist, forest and agricultural departments was also consulted. The vector data sets used for buffering technique were converted to raster data sets with appropriate cell size i.e. 23.5 m which is the cell size of LULC map to achieve appropriate accuracy in cell count. With the help of the above expert

consultation group the deserved weight to each layer was assigned to carry out the weighted overly sum analysis. The outcome was an overlay table for weighted overlay analysis that helped identifying potential ecotourism spots.

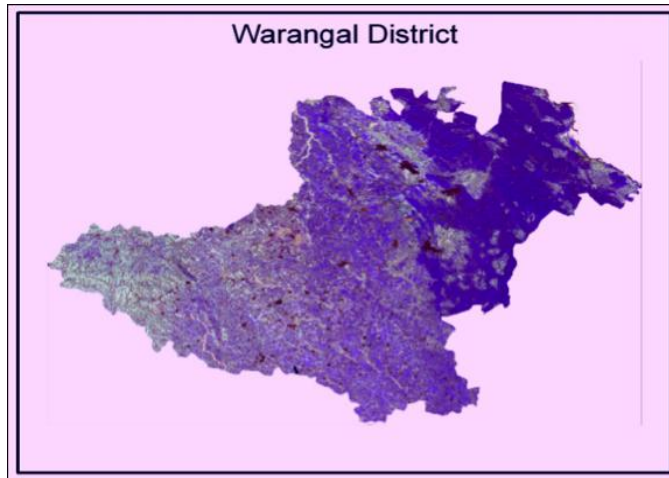**IDENTIFICATION OF ECOTOURISM SPOTS**

Figure 4: *LISS –III Satellite Image of Warangal, 2009*
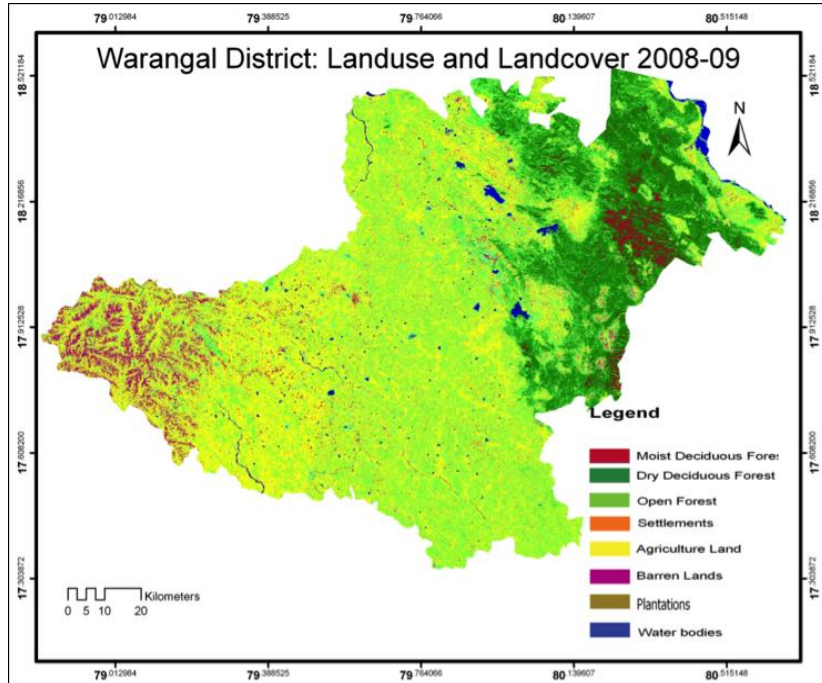*Source*: Warangal District Forest Office, 2009.

Figure 5: *Land use and land cover of Warangal district*
Source: Supervised classification and field verification, 2009-10.

Table 1: *Warangal district: Land use and land cover, 2009-10*

Type of land use	Area in hectares	Percentage
Agriculture	752,262	58.6
Barren land	50,325	3.9
Dry deciduous	287,400	22.4
Moist deciduous	32,720	2.5
Open and scrub	102,600	8.2
Plantations	2,231	0.2
Settlements	12,238	1.0
Water bodies	40,226	3.2
Total	1,284,615	100.0

Source: Satellite image analysis and field verifications, 2009-10.

Table 2: *Land use and land cover and land suitability in Warangal district, 2009-10*

Nr.	Land use	Area - hectares	Percent-age	Land suitability
1	Moist deciduous	32,720	2.5	Highly important for ecotourism, can serve as main ecotourism development site. Hence, it should be conserved.
2	Dry deciduous	287,400	22.4	Very important for ecotourism, the area needs to be managed and conserved properly to attract ecotourists as well as general tourists.
3	Open and scrub	102,600	8.2	Needs to be managed properly with possibilityfor new plantations. Important from the point of view of medicinal plantations and agroforestry scheme, and supportive services for ecotourists.
4	Agriculture	752,262	58.6	Should not be converted to other schemes. Any infrastructure development should be restricted.
5	Plantations	2,231	0.2	Should be properly monitored and protected from any encroachment, and potential for agrotourism.
6	Settlements	12,438	1.0	Suitable for ecotourist infrastructure development and support services.
7	Barren land	51,254	3.9	Suitable for ecotourist infrastructure development.
8	Water bodies	40,226	3.2	Active recreation as boating, fishing and other recreations
	Total	128,1131	100	

Source: Documents and expert consultations from agriculture and forest department of Warangal district.

As observed above, the GIS tool applied by Banerjee, Kumari, Paul and Sudhakar (2002) was used in a modified version in order to identify the eco-tourist spots.

In the present study satellite images were used to identify the land use and land cover with ground verification (Ozesmi & Bauer, 2002). The image was classified into eight types of land use and land cover types. The classified map shows a strong basis for eco tourism with vegetation cover in the north east of the study area (Figure 5).

The land use and land cover map was prepared by supervised classification method using Erdas Imagine 9.1 from Satellite Image of Figure 4 after appropriate ground verification and experts' consultation to obtain optimum level of accuracy. Land use and land cover information is very important in spatial planning as the type of the spatial utility value should be added to land in order to maximize the benefits of the land use.

In Table 1 the land use types and the area covered are provided. Table 2 shows the land use type and its expected uses according to experts' consultations. This basic data provides the background for ecotourism identification and planning.

Ecotourist spots need to fulfill a series of conditions in order to be profitable and reach the interested public. Among these conditions are transport facilities (accessibility), water resources, vegetation cover, elevation for scenic beauty and settlements nearby that provide supporting services to the site (Chakrabarty, 2011). Thus, in order to consider all these conditions the present study used eight different data sets about the Warangal district to process in GIS overlay technique (Figure 7).

During discussion with the expert consultation group the weight for each informative layer was assigned. The following values were attributed to the different informative layers: moist deciduous forest (25%), existing tourist spots (20%), accessibility to the road network (15%), elevation and dry deciduous vegetation (both 10%), surface water bodies and wildlife sanctuaries (both 7.5%), and ground water (5%). Since ecotourism needs an untouched natural environment moist deciduous forest was given the highest value. The next layer in importance was the one showing existing tourist spots, which act as additional pull forces for ecotourism development. Decreasing values were given to accessibility to the road network, elevation, dry deciduous vegetation, surface water bodies, and wildlife. The last layer in value was potential of ground water, which is nonetheless helpful in critical situations when the surface water is not available. The output image was reclassified into only two categories to simplify the process.

To identify the ecotourism spots a five km buffer (Figure 7, nrs. 3, 4 and 6) was created using the buffering technique in ArcGIS on the basis of average complimentary tour distance of the study area (Kurma, 2010). The datasets shown in Figure 7 were overlaid to develop an overview map of the buffered study area which is the basis for Figure 8.

Figure 6: *Pakal lake, an ecotourism site for Warangal district*
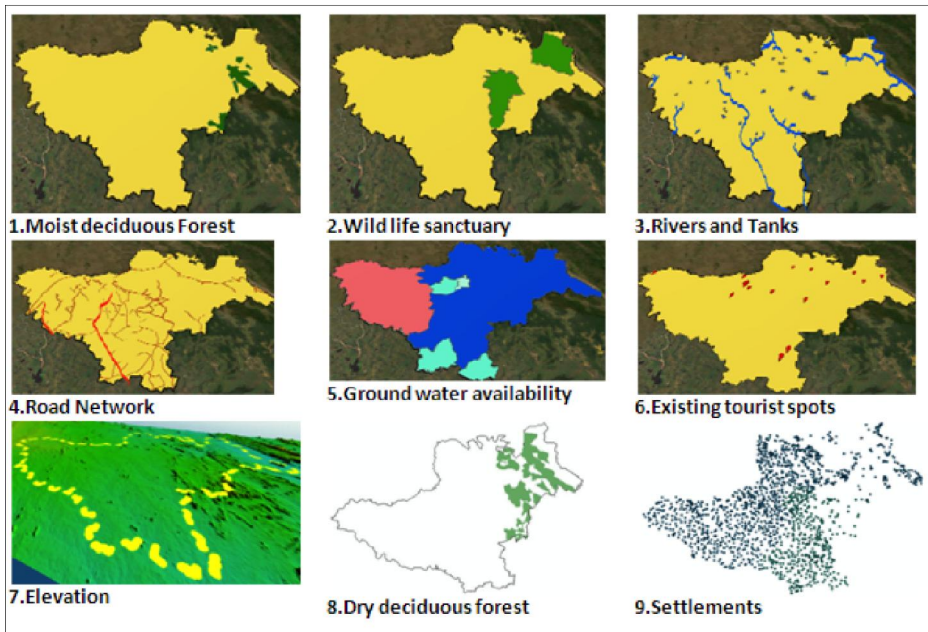*Source*: Photo Satya Kurma, 2009.

Figure 7:*Data sets for the analysis of ecotourism*
Source: 1 and 8 LULC classified map (2009); 2 District forest ranger office (2008); 3 and 4 APSRAC(2008); 5 District office of the state irrigation Board(2008); 6 State Tourism Dept and Field Survey (2009); 7 SRTM data from USGS (2009); 9 Office of the District collector (2009).
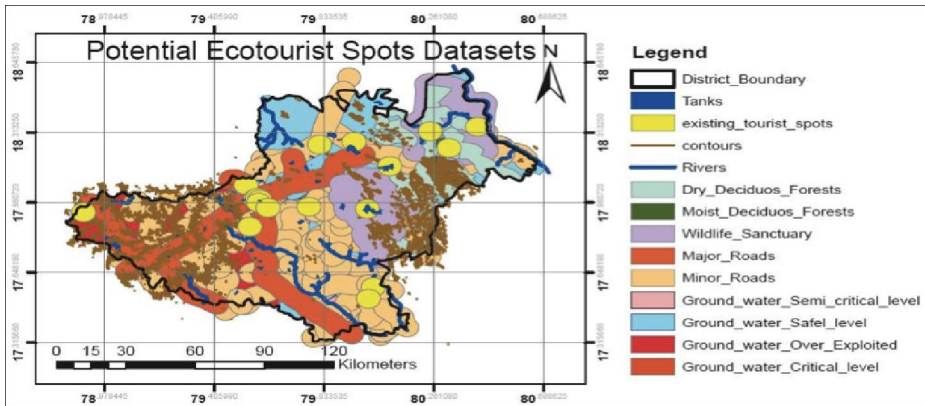
Figure 8: *Potential ecotourism vector data sets with buffered layers*
Source: GIS analysis.

The buffered maps and map from Figure 7 (numbers. 1, 2, 5, 7 and 8) were converted into raster format with appropriate cell size (23.5m x 23.5m) to maintain the scale of the LULC map. Then a weighted overlay table was created (Figure 9) and processed to get the final map (Figure 10).
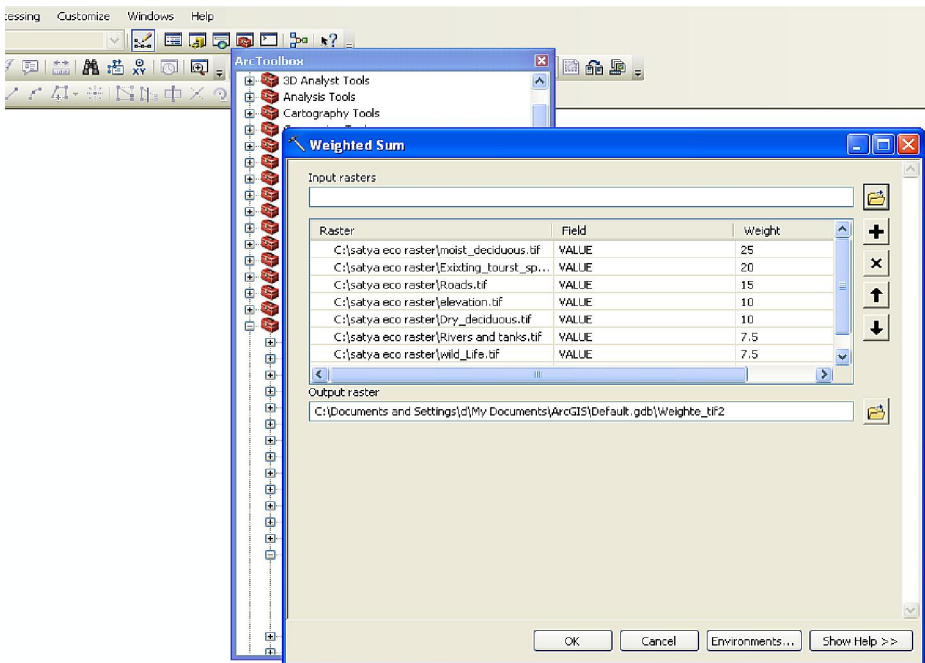

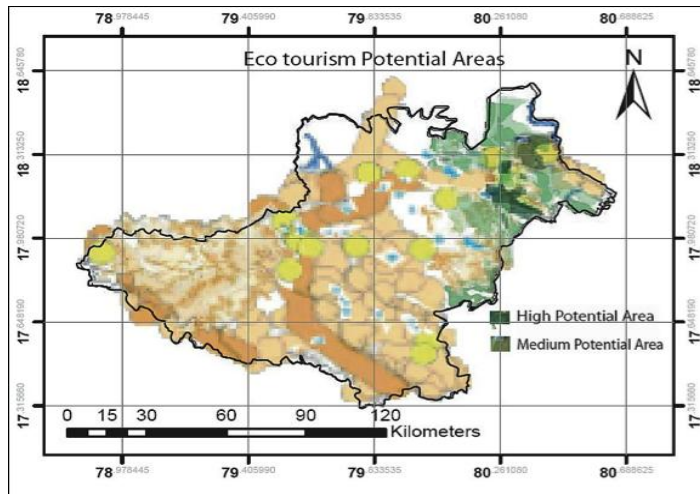Figure 9: *Weighted overlay table of the selected layers*
Source: GIS analysis.

Figure 10: *Eco tourism potential areas*
Source: Weighted overlay analysis Arc GIS 2013.

Attractive natural spots without accessibility have little to no potential to become ecotourist spots. So, in order to give location information the settlements overlay (Figure 7, nr. 9) was used. This allowed identifying the nearby settlements necessary to support tourism services. Finally, the final map of the potential ecotourism sites of the Warangal district was created (Figure 11).

The outcome map shows four potential sites that could be developed for ecotourism: two were found to have a high potential, while the other two had a medium potential to become ecotourist sites. The overlay of the settlements shows that two settlements, Lavvala and Gangavaram, are within the range of high potential cultural/spiritual tourism areas due to their proximity to major tourist spots such as Madaram. This correlates with the study carried out by Vasiliadis and Kobotis (1999) for the case of Macedonia. Using nearest neighbor analysis technique the latter study found out that tourist spots development is directly related to the geographical distance i.e concept of adjacent or distance which influences the further development of the other tourist sites. Additionally, the study found out that another two settlements, Shanpalle and Chinna Boinapalle, are within the rage of the medium ecotourism potential areas.

A principal component of ecotourism is that it is based on natural ecosystems (Khomeriki & Meladze, 2015). Yet, it has been also demonstrated that the physical infrastructure is a crucial factor in tourism and ecotourism development, since accessibility to the site will rely on it.

It bears mention that key informant interviews also supported the above results. The tour guides and forest department officials in particular expressed their concern about the problem of the deforestation around the Pakal and Laknavaram Lakes which are the main ecotourism attraction sites in the district.
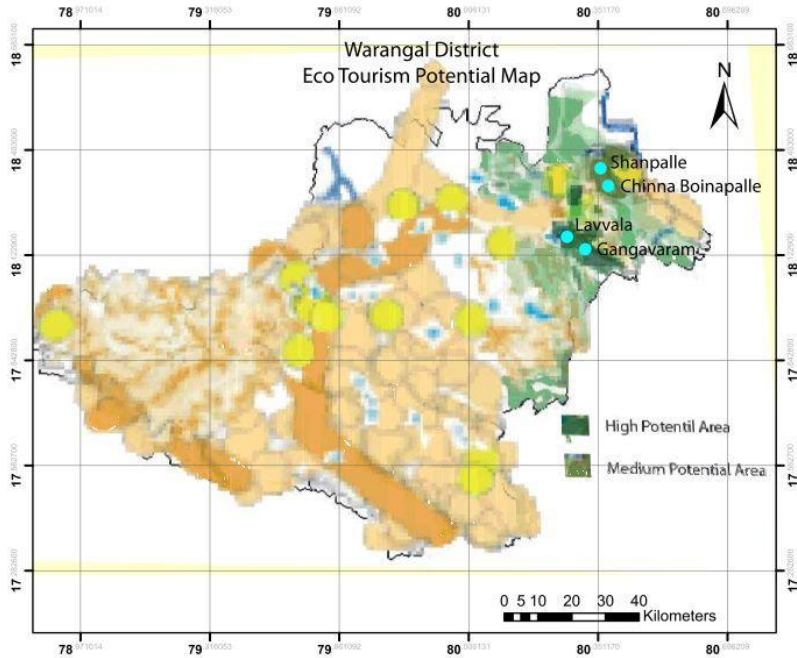
Figure 11: *Potential ecotourism map with selected settlements*
Source: GIS overlay technique Arc GIS2013.

The transport network between tourist attractions sites influences tourist destination choices (*Sustainable Accessibility to small tourist areas*, n.d.). A Hungarian case study using GIS analysis (Toth & David, 2010) established the link between the transport and tourism development. Similarly, in the case of the Warangal district in India, tour operators and government transport officials agreed with the idea that accessibility of a tourist destination is the key to attract more visitors. Yet, the district's road network is not well connected, having a road density of 0.48 km/sq km whereas the national average is 0.66 km/sq km (District Transport Authority from Warangal, 2009).

CONCLUSIONS

The result of the GIS analysis shows that the areas which are covered by vegetation have a potential as ecotourist sites. The two sites with more potential are indeed those with highest vegetation cover. Both the key informant interviews and the scientific studies support the idea that forest is the main source for ecotourism development. Yet, several parts of Warangal are affected by deforestation problems due to human activity. This was identified as being a major threat for ecotourism development. To curb this issue and protect forest resources, the authorities should initiate a series of measures, such as engaging more forest guards and closely monitoring and/or restricting the forest exploitation by the local communities.

In addition, accessibility to the sites plays an important role in tourism development in general and ecotourism in particular. Yet, in the study area the transport network is poor when compared to the national average. So it is deemed a priority that the district transport development authority should focus on resource mobilization to improve the road network. This would help tourism development as well as the overall economic development of the Warangal district.

Finally, the study supports the idea that the proximity of ecotourist sites to main tourist spots can have a positive influence on ecotourism development since it may induce tourists to visit nearby places to the main tourist spot. It is hence recommended that big cultural and spiritual festivals such as Madaram are taken into consideration by district tourism development authorities when developing ecotourism in the region.

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