International Journal of Research in Environmental Science (IJRES)
Volume 10, Issue 3, 2024, PP 12-26
ISSN No. (Online) 2454-9444
DOI: http://dx.doi.org/10.20431/2454-9444.1003002
www.arcjournals.org

Suitability Analysis of Potential Ecotourism Sites in some Selected States in Nigeria using Geospatial Techniques

Rakiya A. Babamaaji, Matthew O. Adepoju, Halilu A. Shaba, Olajumoke Akinola, Adeluyi Seun, Damashi Mantim Tali, Shagari S. Musa, Jagila Jantiku, Ekwe David, Unekwu H. Amanabo, Aminu Munsir, Bako Hauwa, Babankudi.A. Sadiq, Nnaedozie Nwondo , Muhammad. A. Dakpanchi, Sani A. Tswako , Hosea J. Agbutsokwa, Ajih Enenche.

National Space Research and Development Agency, Obasanjo Space Centre, Nigeria.

Corresponding Authors:** ***Rakiya A. Babamaaji, *National Space Research and Development Agency, Obasanjo Space Centre, Nigeria.*

Abstract: *Assessing ecotourism resources is crucial for identifying areas with potential for sustainable tourism development and designing effective management strategies that balance economic, social, and environmental objectives. The main goal of this study is to assess the current and potential ecotourism sites in some selected states in Nigeria using space-based techniques for economic diversification. The study was carried out in 13 states of Nigeria which included 7 northern states and 6 southern states. The northern states were Niger, Federal Capital Territory (FCT), Nasarawa, Plateau, Jigawa and Kano; while the southern states were Oyo, Ogun, Lagos, Ondo, Enugu, and Akwa Ibom. The datasets for this study were sourced from the United States Geological Survey (USGS), Office of the Surveyor General of the Federation (OSGOF) and Geo-Referenced Infrastructure and Demographic Data for Development (GRID3) portal. Geodatabase was created for the existing ecotourism sites visited during the study. The potential ecotourism sites were determined using the multicriteria decision analysis (MCDA). The evaluation criteria and factors were determined using a pairwise comparison table and they were exactly seven parameters considered in this study. The study showed the potential to spring up more ecotourism sites in Nigeria, For example, A total of 13% of the entire northern states under study, equivalent to 624275 hectares was suitable for potential ecotourism sites location 24% of the land in the southwest was identified to have key similarities with the characteristics of an ecotourism site. Likewise, while 24% suitability was identified in Akwa Ibom, 28% was identified in Enugu.*

Keywords: *Ecotourism, Potential sites, Nigeria, Northern states, Southern states.*

1. INTRODUCTION

Ecotourism offers opportunities for visitors to learn about and appreciate local cultures, biodiversity, and natural resources, while also generating income for local businesses and governments. Ecotourism generated revenue of about US$20 billion a year and contributed to 20% of global international travel in combination with nature tourism. It is regarded as one of the most significant sources of employment in the world, directly or indirectly supporting 10% of all jobs globally [1,2,3]. Ecotourism is an important component of Nigeria's tourism industry contributed 34.2 billion Naira to GDP in 2019, and is estimated to grow at an average rate of 5.4% between 2022 and 2032, significantly exceeding the three percent growth rate of the overall economy according to World Travel & Tourism Council due to Nigeria's endowment with resources of international ecological and touristic importance [4]. Though it is one of the country's important and fastest-growing industries that have the capacity to diversify the economy of the country but have not fully developed [5] and the ecotourism resources still need to be improved, enhanced and better promoted to international standards [6,7]. Ecotourism resources in Nigeria when developed, properly packaged, and promoted can provide increased benefits such as employment, revenue generation, local empowerment, foreign exchange earnings, and markets for local products [8]. Geospatial technology is used to support ecotourism, such as geographic information systems (GIS) and remote sensing (RS). GIS is a computer-based system for capturing, storing, checking, and displaying data related to positions on Earth's surface, while RS is the science of obtaining physical properties of an area without being there. These technologies are effective tools for storing, manipulating, and analysing a great variety of

spatial data with huge attributes [9]. The applications of GIS and RS have been widely discussed in environmental and resource management and also its importance in ecotourism, though it has not been widely applied in Nigeria. There have been comprehensive approaches and methods presented in recent years to assess ecosystem values [10,11,12,13]. [13] identified potential ecotourism sites in eastern India using Remote Sensing and GIS techniques. They prepared the final ecotourism capability map by overlaying the map layers of land use/land cover, soil fertility, and ecological features. [14] identified site suitability of geo-ecotourism in West Bengal, India using AHP and GIS for sustainable and resilient tourism planning. [15] used GIS to identify the most suitable area for archaeological excavations in his study on geographical Information System (GIS) and Tourism: The Prediction of archaeological sites in ljaiye-Orile, Southwestern Nigeria. [16] highlighted the implication of spatial distribution of ecotourism attractions in Anambra State using Nearest Neighbour Analysis. [17] assessed the ecotourism potential of Cross River State in Nigeria and identified the factors that could contribute to its development.

Assessing ecotourism resources is crucial for identifying areas with potential for sustainable tourism development and designing effective management strategies that balance economic, social, and environmental objectives. This research work aimed to explore the application geospatial technology in the assessment of the current and potential ecotourism sites in some selected states in Nigeria to contribute to the understanding and promotion of sustainable ecotourism development and to inform policymakers and stakeholders in Nigeria on the potential of ecotourism for economic diversification and sustainable development. While the objectives of the study are: 1.To identify the existing ecotourism sites in the selected states. 2. To identify the potential ecotourism sites.

Study area

The Federal Republic of Nigeria is located approximately between latitudes 4^{o}N and 14^{o}N, and between longitudes 3^{o}E and 15^{o}E. It lies wholly within the tropics along the Gulf of Guinea, on the west coast of Africa. It is bounded on the west by the Republic of Benin, on the north by the Republic of Niger and on the east by the Republic of Cameroon and on the south by the Atlantic Ocean [18]. The country has a total length (north-south) of about 853 km. Nigeria, which is the most populous black nation in the world, has a population of over 140 million according to National Population Commission 2006 [19]. With a total area of about 923,768.64 sq kilometres (356,669 sq miles), the country occupies about 14% of West Africa, but supports more than 60% of the population of the region. Nigeria, being one of the largest countries in Africa, has 36 states and 774 local government areas (LGAs) and Abuja as the Federal Capital city.

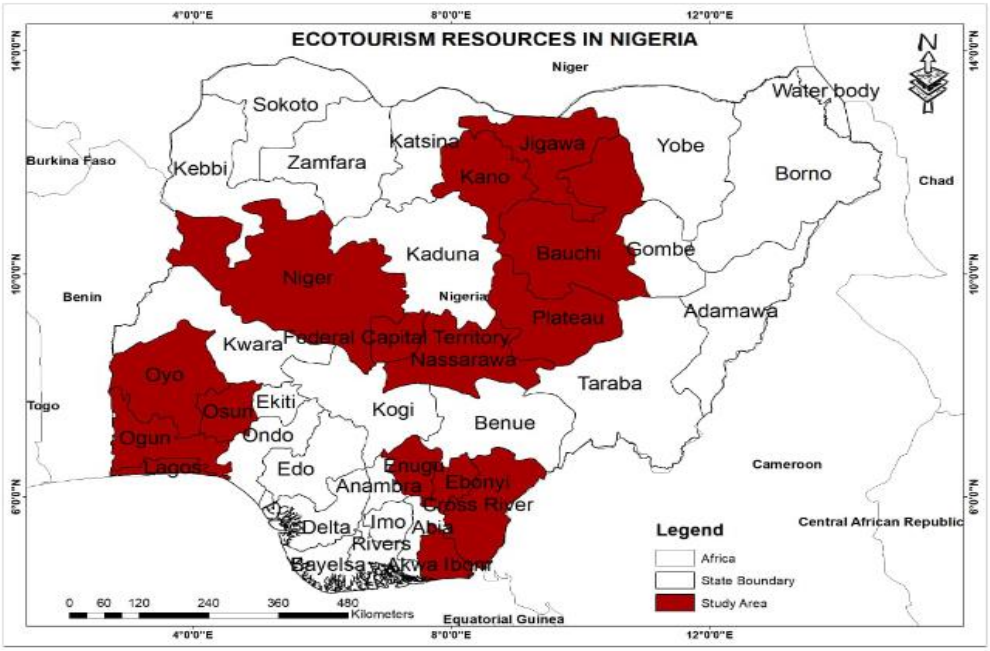

Figure1. *Nigeria Map Showing the Study area*

2. MATERIALS AND METHODS

Both primary and secondary data were collected for this study in order to achieve the identification of the existing and the potential ecotourism sites in the selected states, by obtaining the list of existing ecotourism sites from tourism board, literature reviews, location coordinates of each identified ecotourism sites using Global Positioning System (GPS) receiver and digital camera respectively through field work and acquisition of satellite imagery.

Satellite Image and GIS Data Collection

Satellite images were acquired from satellite imageries through the National Space Research and Development Agency (NASRDA), Global Land Cover Facility (GLCF), Google Earth and GRID3 Platform. These data include Sentinel 2, SRTM DEM and Sentinel-2 (NDVI). Detailed characteristics of the sources of data used for the study are shown in the table 1 below.

Table1. *Dataset and source*

Data	Year	Format	Resolution	Sources
Global land cover	2022	Raster	10m	United State Geological Survey www.earthexplorer.usgs.gov
Normalized Difference Vegetation Index (NDVI)	2022	Raster	10m	United State Geological Survey www.earthexplorer.usgs.gov
Digital Elevation Model (DEM) Slope and elevation	2021	Raster	30m resampled to 10m	United State Geological Survey www.earthexplorer.usgs.gov
Nigeria boundary shapefile	2015		Vector	Office of the Surveyor-General of the Federation (OSGOF)
Study area map				GRID[3]
Health facilities		Vector		GRID[3]
Police station		Vector		GRID[3]
Road map		Vector		GRID[3]

Work flow

The first part involved the identification and ground truthing of the existing ecotourism sites through fieldwork. A handheld Garmin GPS (global positioning system), GPS map 76CS X was used to capture the coordinates data directly by field measurement. However, the coordinates of each ecotourism site were captured as point data in a strategic location on the site. Photos of some strategic resources of the ecotourism sites were taken, including the researchers using a handheld camera. This

is to indicate the researchers' physical presence at the sites and the originality of the pictures as well as to augment the field measurements and questionnaire survey. The second part was site suitability analysis to generate the potential ecotourism sites of thirteen (13) selected states in Nigeria using a GIS based multicriteria decision making method.

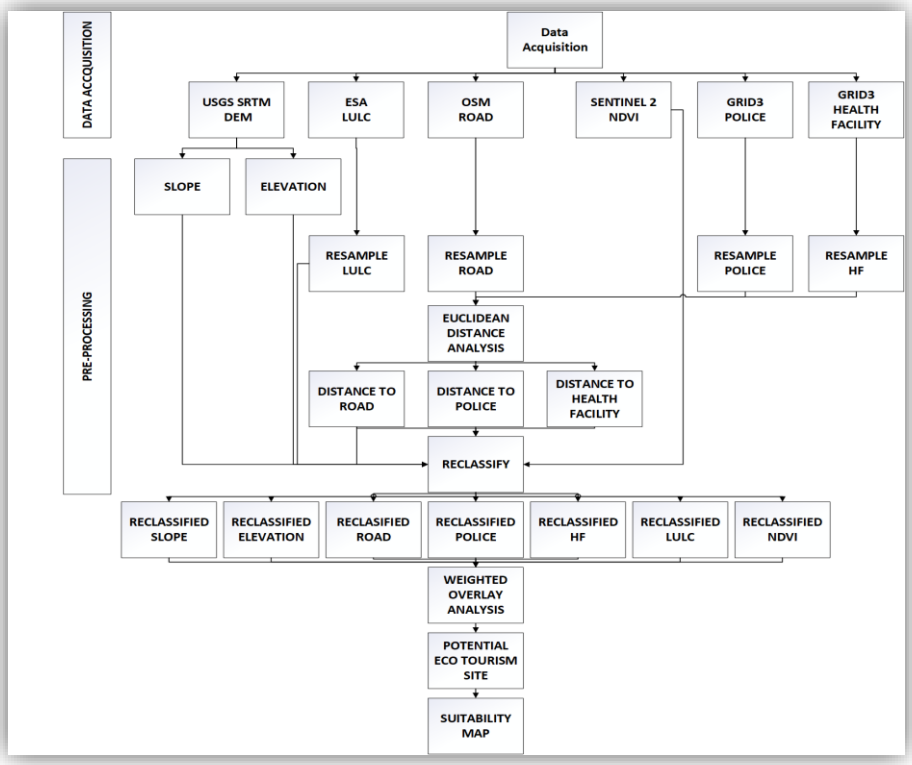

Figure2. *Methodological Flow chart for the study.*

MULTI-CRITERIA DECISION ANALYSIS (MCDA)

In this study, Analytic Hierarchy Process (AHP) which is one of the multiple criteria decision-making methods was employed to achieve the site suitability analysis for ecotourism. With regard to the factors and criteria concerned, based on the analysis of different kinds of literature relevance to the study area, seven factor criteria were identified namely: land use land cover (LULC)**,** Normalized Difference Vegetation Index (NDVI) (Vegetation), elevation, slope, distance from primary healthcare, police station and road (Accessibility). Afterward, thematic layers were prepared, in the selection of ecotourism site; natural resources are higher than cultural resources. This is mainly because natural features with great uniqueness are more attractive to ecotourists according to [20]. That is why this study was mainly concerned on the natural and physical features of the study area. As far as their suitability degree is concerned, LULC with forest and vegetation is more suitable, higher elevation and slope, minimum distances to primary healthcare, police station and road also are highly suitable for ecotourism and vice versa. By considering this, each factor map was reclassified according to Food and Agriculture Organization (FAO) guidelines for land evaluation outlined by [21], the identification of suitable land classes based on the different factors is presented as follows:

- S1 (Suitable): It indicates a land of high naturalness that is suitable for developing ecotourism, which needs to meet strict environmental regulations.
- S2 (Moderately suitable): It indicates a land of moderate naturalness that may optimize the existing ecotourism resources to properly develop mass ecotourism that can provide opportunities for mass tourists to participate in ecotourism.
- S3 (Marginally suitable): It is an intermediate level between the not suitable and moderate suitable classes.
- N (Not suitable class): It indicates a land relatively low in naturalness that is not suitable for developing ecotourism. Mostly agricultural land and settlements areas.

Weighted overlay analysis

Most past several studies on potential ecotourism site selection showed that key informant experts views are involved in the determination of attractive site and factor map ranking [21,22]. In this study, factor maps were produced, and the weight for each factor map was assigned based on their relevance through the advice of experts, some previous research investigations and field observations have all been used to acquire knowledge to determine the potential site for ecotourism. For this, a pair-wise comparison of the AHP method was used to allocate weights to each level of the criteria. Then, the ranking of factor maps (or criterion) from highest to lowest was arranged according to their suitability value for ecotourism. The significance was derived from pairwise comparison matrix which was computed in excel. The process of converting data to such numeric scales is most commonly called standardization. Standardized factors are combined by means of weighted linear combination method; that is, each factor is multiplied by a weight, with results being summed to arrive at a multi-criteria solution (ecotourism potential site map). The method also calculates a consistency ratio (CR) to verify the coherence of the judgments, which must be about 0.10 or less to be accepted [23]. Finally, the ecotourism potential map was generated using the logical formula given by [24] cited in [20] in ArcGIS weighted overlay extension tool. The logical workflow of the research is presented in (Figure3).

$S = \sum_{n=1}^{n} WiXi$; ……. equation (1)

Where; S is suitability, $\sum$ is sum. Wi is weight of factor, and Xi is criterion score factor, and n is the total number of criteria.

The suitability layer was converted to Keyhole Markup Language (KML) and exported to Google Earth Pro for validation.

Determination of Factors and Classification of Criteria

Based on the result of the assessment of the factors, land use land cover (LULC) had the highest weightage with a weight equal to 0.354 and NDVI, elevation, slope, and accessibility (distance from road, primary healthcare and police station) were all considered for ecotourism site suitability selection analysis. The Consistency ratio CR is 0.051 or 50%. CR = 0.051 < 0.10 (Acceptable). Table 2 shows the results of the hierarchy creation, the importance of the criteria, and the factors.

Table2. *Criteria and factors in land suitability analysis for ecotourism*

S/N	***Criteria***	***Unit***	***Class***	***Suitability Criteria Rating***	***Potential Class Rating***	***Weightage***
1	LULC	Level	Vegetation, Shrubland, waterbody Bare surface/ Built-up	High Moderate Marginal Not suitable	1 2 3 4	0.354
2	NDVI	Level	0.359 - 1 0.209 - 0.359 0.099 - 0.208 - 0.993 - -0.1	High Moderate Marginal Not suitable	1 2 3 4	0.259
3	Elevation	Meters	0 – 100 100 - 300 300 - 400 >400	High Moderate Marginal Not suitable	1 2 3 4	0.037
4	Slope	Degrees	0 - 5 5 - 25 25 - 35 > 35	High Moderate Marginal Not suitable	1 2 3 4	0.025
5	Distance from roads	Km	<2 2.1 - 4.9 5 - 9.9 >10	High Moderate Marginal Not suitable	1 2 3 4	0.177
6	Distance from	Km	<2	High	1	0.062

	PHC		2.1 - 4.9 5 - 9.9 >10	Moderate Marginal Not suitable	2 3 4	
7	Distance from police station	Km	<2 2.1 - 4.9 5 - 9.9 >10	High Moderate Marginal Not suitable	1 2 3 4	0.086

3. RESULTS AND DISCUSSION

Identification of the location of existing ecotourism sites in Nigeria

Figure 4 shows some identified existing ecotourism sites at the southwest, southeast and south-south regions of Nigeria comprising Akwa Ibom, Enugu, Lagos, Ogun, Ondo, Oyo, Osun and Calabar and the coordinates of each ecotourism sites respectively. It further indicated that 8 ecotourism sites were identified in Akwa Ibom, 10 in Enugu, 2 in Lagos, 3 in Ogun, 3 in Oyo/Osun and 3 in Cross River. A total of 46 existing ecotourism sites were identified in the Northern zone. Figure 4 depicts some identified existing ecotourism sites in Nigeria's northwest, northeast, and north-central regions, including Niger, Abuja, Nasarawa, Plateau, Kano, Bauchi, and Jigawa, as well as the coordinates of each site.

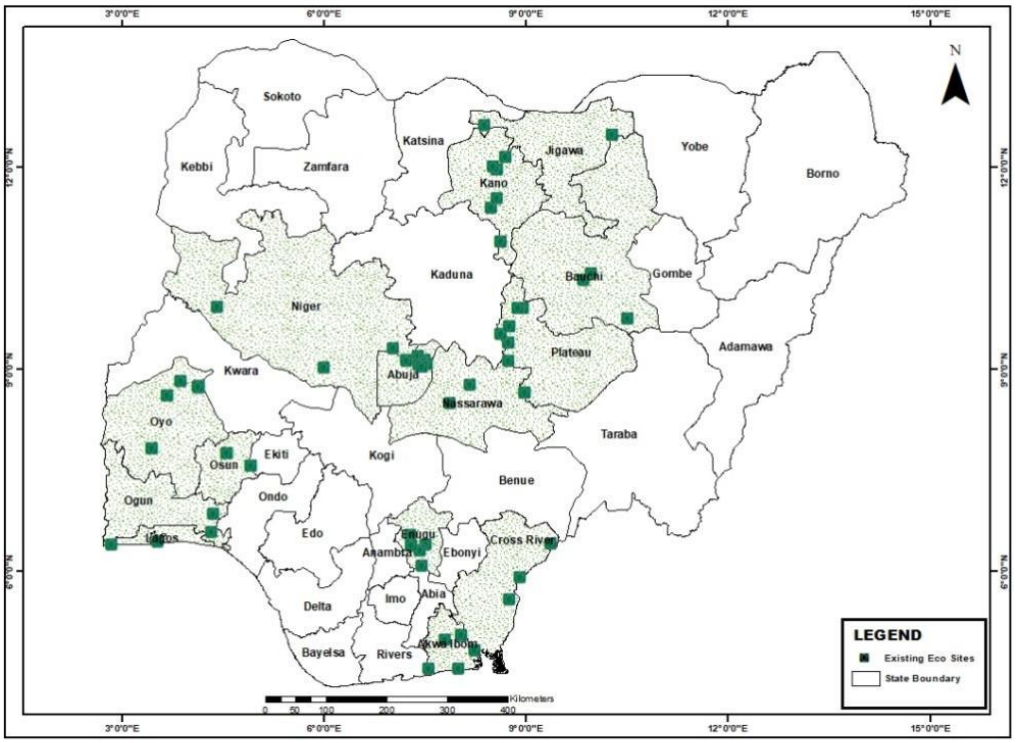

Figure3. *Some Identified Existing Ecotourism Sites in Northern and southern Nigeria*

Identification of Potential Ecotourism Sites

Figure 4 represents the 13 selected states across the geopolitical zones in Nigeria where Multi-Criteria Decision Analysis (MCDA) for each state was carried out to identify potential ecotourism locations for sustainable economic development and the class of suitability were based on Food and Agriculture Organization (FAO) guidelines for land evaluation as S1 (Suitable), S2 (Moderately suitable), S3 (Marginally suitable), and N (Not suitable class) respectively.

Criteria factors suitability Maps

The factors map for this study was derived and these maps include land use land cover, Normalized Difference Vegetation Index (NDVI), elevation, slope, distance from roads, primary healthcare, and police station. All these maps were reclassified to achieve suitability maps for each criterion factors.

Land Use Land Cover Suitability Map

Landscape is the distribution and variation of features in a given geographic area, while land use is the way humans use the land and its resources. Land cover is the physical state of a surface, and is used for resources assessment, land use planning, land evaluation, and land use/ land cover change detection. Four major land use/land cover nomenclatures were used to produce the final land use land cover suitability map of the study area which are vegetation or forest areas, grasslands, built-up and water body area. Figure 5 shows the land use land cover suitability map for the Northern and Southern region of the country.

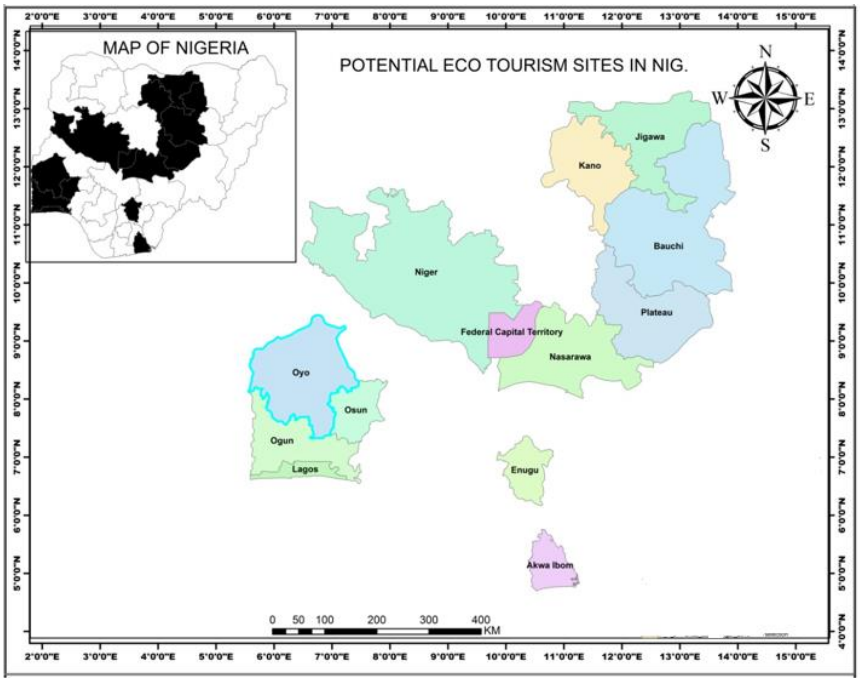

Figure4. *States where MCDA was carried out*

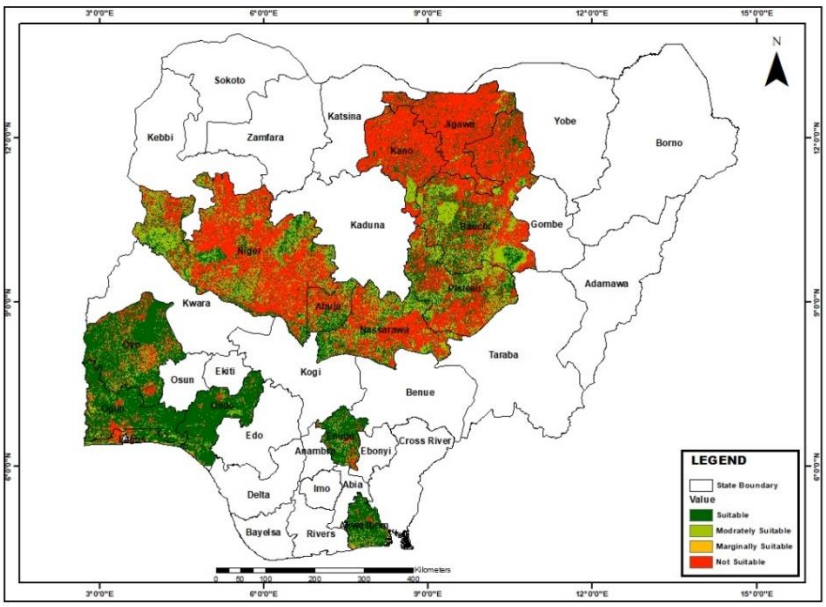

Figure5. *LULC suitability map for Northern and Southern Region*

Slope suitability map

The gradient of an area is represented by slope, which can be expressed in percent or degree. It is calculated by dividing the vertical increase by the horizontal increase. Slope can also be classified as gentle and steep slopes. Gentle slopes experience little variation, while steep slopes experience

extreme variation (Mihret and Yohannes, 2015). The slope analysis of both the northern and southern Nigeria are represented in Figure 6

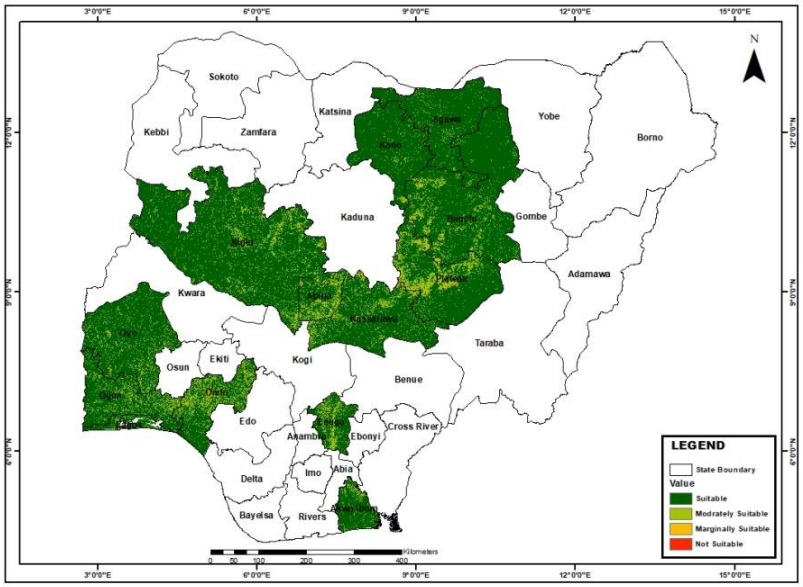

Figure6. *Slope suitability map for Northern and Southern Region*

Elevation suitability map

Some earlier studies suggested that topography/elevation is one of the most important dimensions of attractiveness in the landscape (Chernet, 2009; Rahman, 2010). The higher elevation range has a higher suitability value for scenic attraction because such land feature is usually not found everywhere, and it is attractive to human visually (Chernet, 2009; Kebede, 2010). For ecotourism suitability, the highest elevation is preferable. Accordingly, the highest rank was assigned to the highest elevation, and vice versa. Figure 7 depicts the suitability map of the northern and southern parts of the country.

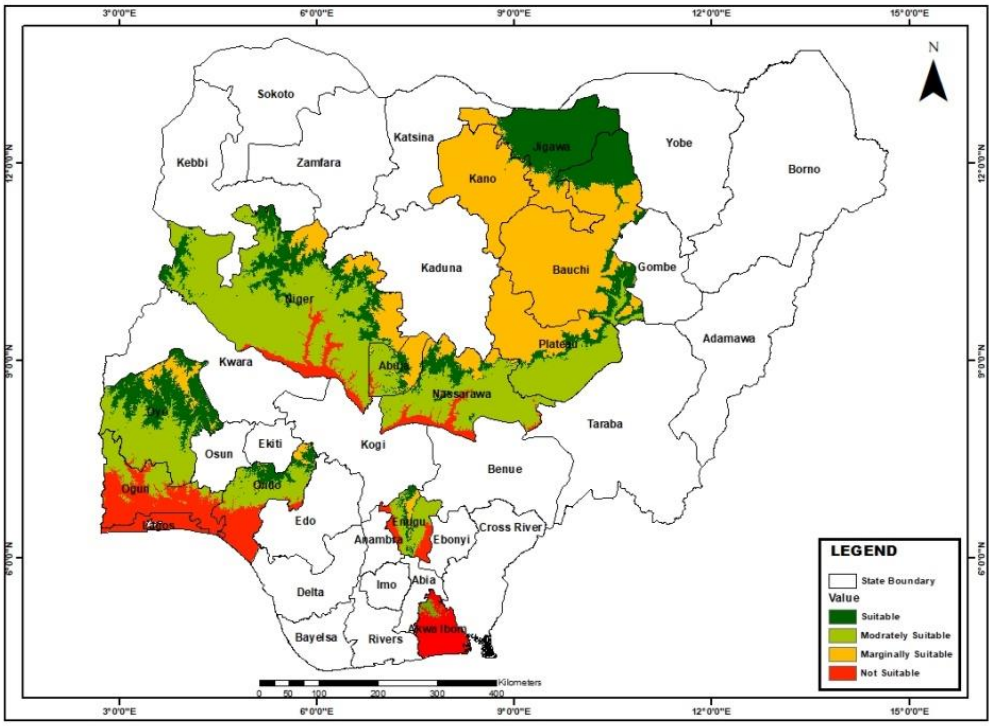

Figure7. *Elevation suitability map for Northern and Southern Region*

Normalized difference vegetation index suitability map

NDVI is an important tool for ecotourism suitability, providing critical information about the ecological health of an area, identifying areas that are particularly valuable for wildlife viewing and other nature-based activities, and helping to enhance the ecotourism experience for tourists and ecotourism planners can identify areas that are particularly well-suited for ecotourism development. This can help to maximize the benefits of ecotourism while minimizing its environmental impact. Figure 8 show the NDVI suitability map for the northern and southern region of the country.

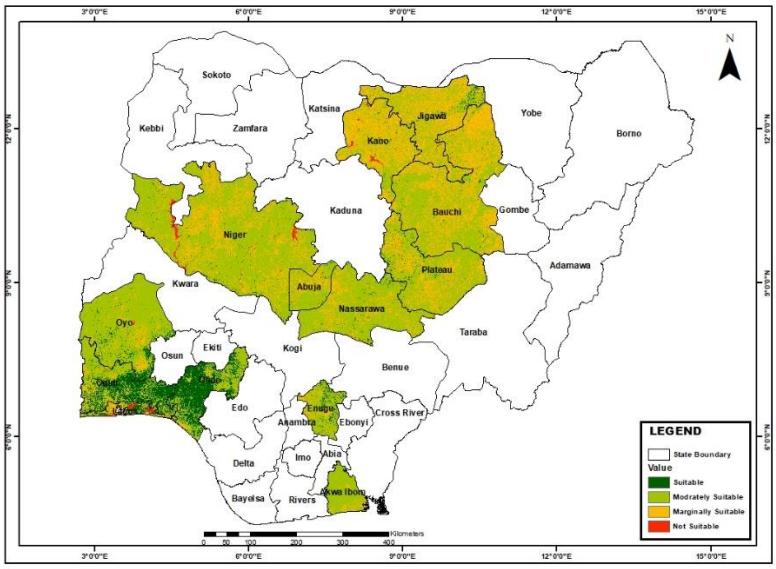

Figure8. *Normalized difference vegetation index map for Northern and Southern Region*

Distance from road suitability map

The distance from a road can be an important factor in determining the suitability of an area for ecotourism. While proximity to roads may have some advantages, such as accessibility and convenience, areas further from roads may provide a more authentic and sustainable ecotourism experience that prioritizes wildlife conservation and ecological integrity as shown Figure 9

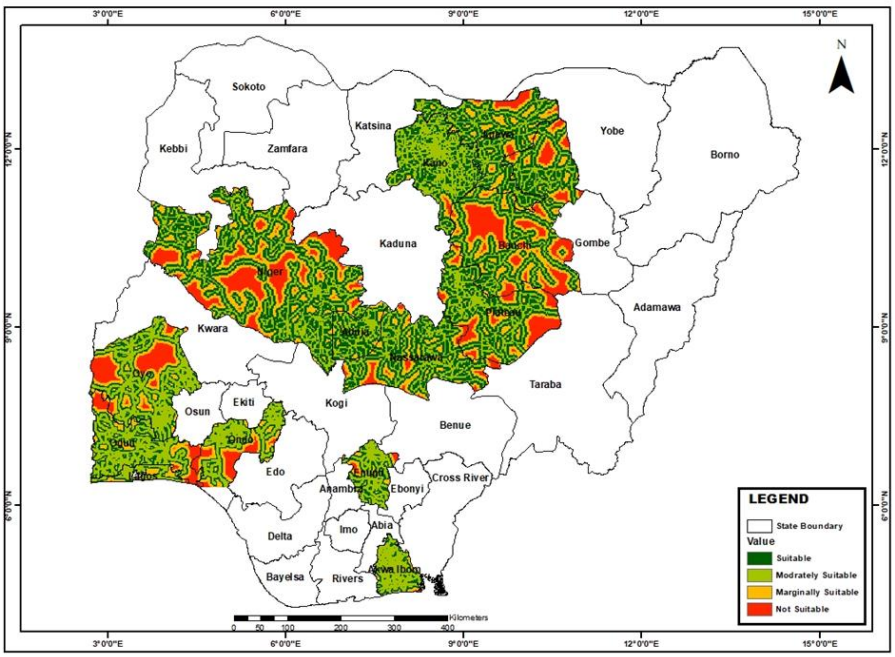

Figure9. *Distance from road suitability of southern and northern Nigeria*

Suitability Map for Primary Healthcare

Ecotourism sites that are perceived as safe and supportive of community health are more likely to attract visitors and generate positive word-of-mouth. Having a primary healthcare facility nearby can help to establish a positive reputation for an area, which can be an important factor in attracting ecotourism visitors (Figure 10).

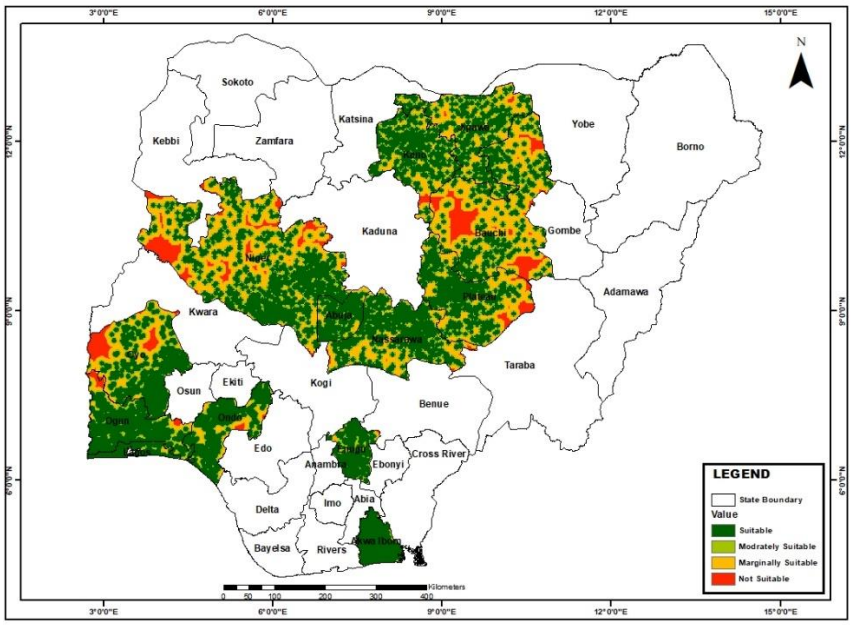

Figure10. *Suitability map for Northern and Southern Primary Healthcare*

Suitability Map for Police Station

The distance from police stations is an important factor in determining the suitability of an area for ecotourism sites. it is a critical factor in ensuring the safety and security of tourists and local communities, promoting conservation and environmental protection, and enhancing the reputation and perception of an ecotourism site. Figure 11 shows police station suitability map for the northern and southern regions.

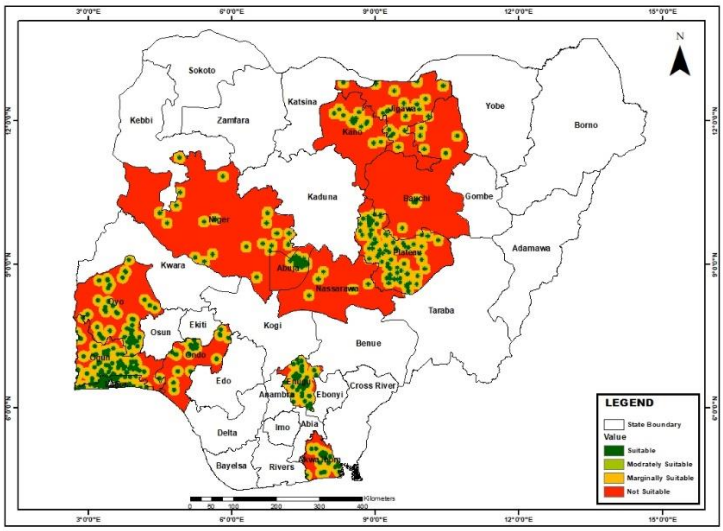

Figure11. *Suitability map for Northern and Southern Police stations*

Potential Ecotourism Site Suitability

The result in this section presents the identification of potential ecotourism sites in thirteen selected states in Nigeria (Figure 12). The result of the Northern region of Nigeria comprising Abuja, Bauchi,

Jigawa, Plateau, Kano, Nasarawa and Niger states showed that a total of 624275 hectares representing approximately 13% was suitable, while 36% was moderately suitable. The marginal was 51% and a total of 460 hectares (approximately 0%) was not suitable as shown in (Figure 13 and Table 3). The south-south region revealed that the suitable class for Akwa Ibom state was 24% representing 1406616.3 Ha of the entire land area, while the moderately suitable class had the highest percentage of 64% (3796622.91 Ha). The marginal suitability was 12% equivalent to 739724.67 Ha of the total land area of Enugu state. The class that was not suitable was only 2211.66 Ha (Table 4 and Figure 14). However, the southeast region of the country showed that the suitable class of Enugu state was 28% representing 215374.05 Ha of the total land area of the state. The moderately suitable and marginal classes were 61% and 11% equivalent to 464030.64 Ha and 79947.81 Ha respectively. Only 26.46 Ha was not suitable as shown in Table 5 and Figure 15. The result according to Table 6 and Figure 16 of southwest Nigeria comprising Osun, Lagos, Ogun and Oyo states showed percentage coverage of 24% for suitable class equivalent to 1406616.3 Ha of the total land area. The moderately suitable class was 64% (3796622.91 Ha) of the total land area while 12% (739724.67 Ha) was the marginal class. It was observed that only 2211.66 Ha of the entire land area was not suitable.

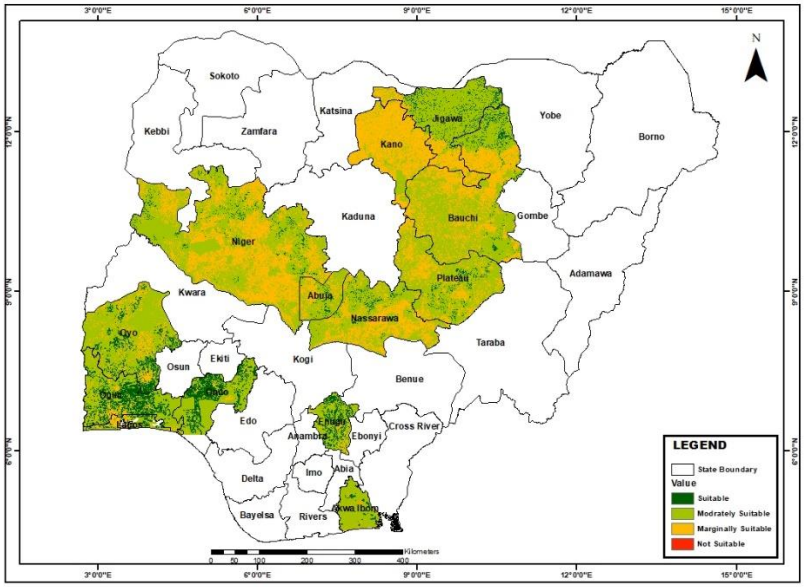

Figure12. *Potential ecotourism site suitability map for Northern and Southern Region*

Table3. *Percentage coverage of potential ecotourism sites in Northern Region*

S/No	Classes	Area (Ha)	Percentage Coverage
1	Suitable	624275	13%
2	Moderately Suitable	1759457	36%
3	Marginal	2461007	51%
4	Not Suitable	460	0.00%

Table4. *Class suitability and percentage coverage of Akwa Ibom*

S/No	Classes	Area (Ha)	Percentage Coverage
1	Suitable	1406616.3	24%
2	Moderately Suitable	3796622.91	64%
3	Marginal	739724.67	12%
4	Not Suitable	2211.66	-

Table5. *Class suitability and percentage coverage of Enugu*

S/No	Classes	Area (Ha)	Percentage Coverage
1	Suitable	215374.1	28%
2	Moderately Suitable	464030.6	61%
3	Marginal	79947.81	11%
4	Not Suitable	26.46	0.00%

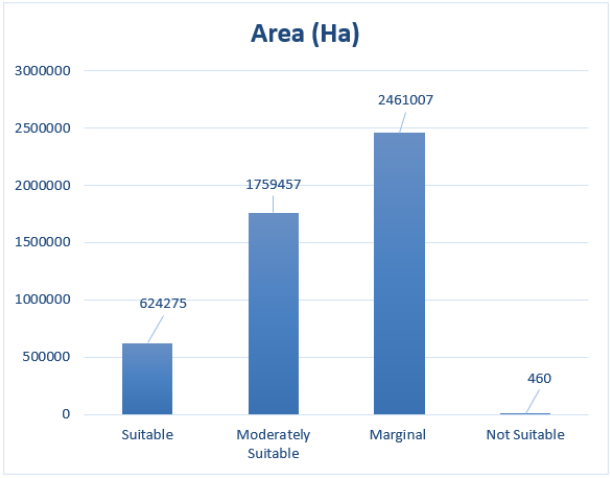

Figure13. *Bar chart showing potential ecotourism sites in Northern Region*

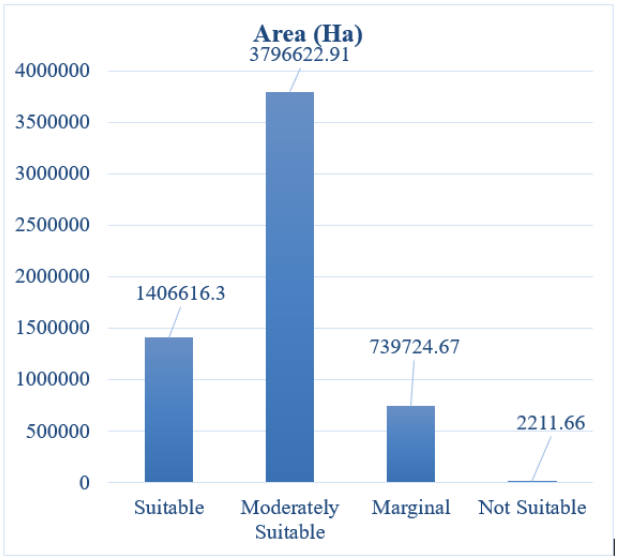

Figure14. *Bar chart showing the class suitability for Akwa Ibom state.*

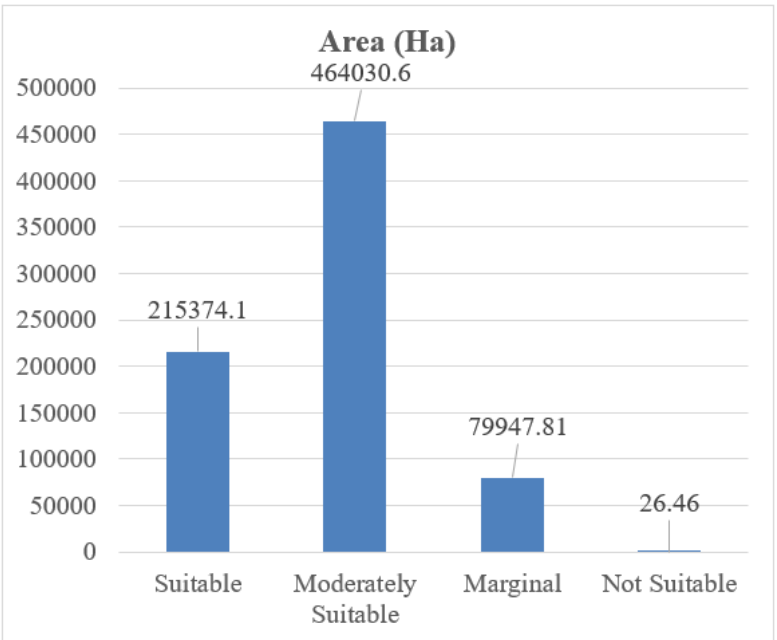

Figure15. *Bar chart showing the class suitability for Enugu state*

Table6. *Class suitability and percentage coverage of Southwest Nigeria*

S/No	Classes	Area (Ha)	Percentage Coverage
1	Suitable	1406616.3	24%
2	Moderately Suitable	3796622.91	64%
3	Marginal	739724.67	12%
4	Not Suitable	2211.66	0.00%

Potential Ecotourism Sites

The study showed the potential to spring up more ecotourism sites in Nigeria, with particular focus in the southern part of Nigeria. The diverse ecoclimatic and biogeographic spread of Nigeria provides the possibility of establishing ecotourism sites in a bid to boost the ecotourism industry in Nigeria. For example, 24% of the land in the southwest was identified to have key similarities with the characteristics of an ecotourism site. Likewise, while 24% suitability was identified in Akwa Ibom, 28% was identified in Enugu, which further implied that more investigation into the identified potential sites should be explored. In contrast, the northern state showed a 13% suitability potential for establishing of ecotourism sites. This could be attributed to the fact that the northern regions had larger land surface area with respect to the southern states (Arwolo & Deng, 2018). However, further investigation into the findings of the study is required.

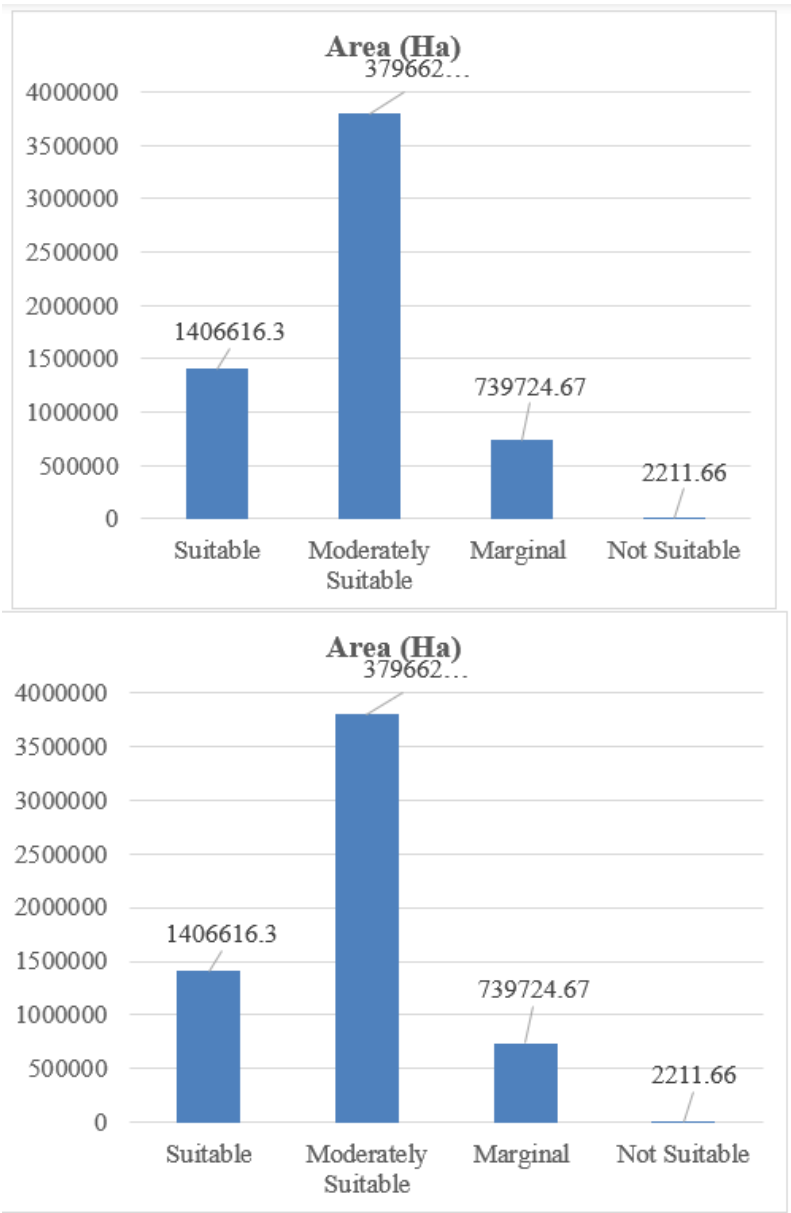

Figure16. *Bar chart showing the class suitability for Southwest*

4. CONCLUSION

This study was carried out using space-based technology to identify existing and potential ecotourism sites in some selected states in Nigeria and this buttress the importance of incorporating geospatial data in mapping existing and potential ecotourism in order to maximize the potentials inherent from the existing ecotourism sites in Nigeria and this study identified other suitable areas for the establishment and expansion of ecotourism in the country for economic diversification.

REFERENCES

[1]. Buchsbaum, B.D. (2004). Ecotourism and sustainable development in Costa Rica.

[2]. Mazengiya, M. N. (2022). Review on the Impacts of Community-Based Ecotourism on Household Financial Asset Improvement and Its Determinants in Ethiopia. *Advances in Agriculture*, 2022.

[3]. Omarzadeh, D., Pourmoradian, S., Feizizadeh, B., Khallaghi, H., Sharifi, A., & Kamran, K. V. (2022). A GIS-based multiple ecotourism sustainability assessment of West Azerbaijan province, *Iran Journal of Environmental Planning and Management*, 65(3), 490-513.

[4]. Arowosafe, F., Akinwotu, O., Tunde-Ajayi, O., Omosehin, O., & Osabuohien, E. (2022). Push and pull motivation factors: a panacea for tourism development challenges in Oluminrin waterfalls, Nigeria. *Journal of Policy Research in Tourism, Leisure and Events*, 14(1), 63-74.

[5]. Ebhuoma, E. E., & Leonard, L. (Eds.). (2022). *Indigenous knowledge and climate governance: a Sub-Saharan African perspective*. Springer Nature.

[6]. Pasape, L. (2022). A review of the role of tour operators towards sustaining ecotourism in Tanzania.

[7]. Mohammed, U. A. (2022). Ecotourism in Nigeria, challenges and prospects: a review. Gadau *Journal of Pure and Allied Sciences*, 1(1), 12-17.

[8]. Yuan, Z., Wen, B., He, C., Zhou, J., Zhou, Z., & Xu, F. (2022). Application of multi-criteria decision-making analysis to rural spatial sustainability evaluation: a systematic review. *International Journal of Environmental Research and Public Health*, *19*(11), 6572.

[9]. Eade J & Moran D. (1996). Spatial economic valuation: benefits transfer using Geographical Information Systems. Journal of Environmental Management, 48:97-110

[10]. Hein L, van Koppen K, de Groot RS, van Ierland EC (2006) Spatial scales, stakeholders and the valuation of ecosystem services. *Ecological Economic Journal* 57:209–228

[11]. Seppelt, R., Dormann, C. F., Eppink, F. V., Lautenbach, S., & Schmidt, S. (2011). A quantitative review of ecosystem service studies: approaches, shortcomings and the road ahead. *Journal of applied Ecology*, 48(3), 630-636.

[12]. Kang, N., Hou, L., Huang, J., & Liu, H. (2022). Ecosystem services valuation in China: A meta-analysis. *Science of the Total Environment*, 809, 151122.

[13]. Samanta, S., & Baitalik, A. (2015). Potential site selection for eco-tourism: A case study of four blocks in Bankura district using remote sensing and GIS technology, West Bengal. *International Journal of Advanced Research*, *3*(4), 978-989.

[14]. Acharya, A., Mondal, B. K., Bhadra, T., Abdelrahman, K., Mishra, P. K., Tiwari, A., & Das, R. (2022). Geospatial analysis of geo-ecotourism site suitability using AHP and GIS for sustainable and resilient tourism planning in West Bengal, India. *Sustainability*, *14*(4), 2422.

[15]. Olukole, T. O. (2007). Geographical Information Systems (GIS) and Tourism: The Prediction of the Archaeological Site of Ijaiye-Orile, Southwestern Nigeria. *Nyame Akuma Bulletin*, 69-74.

[16]. Jude, O. C., Iheoma, A. T., Elizabeth, A. E., & Eja, E. I. (2018). Spatial distribution of ecotourism resources in anambra state: a nearest neighbour analysis approach. *Am Int J Soc Sci*, *6*(3), 29-38.

[17]. Aniah, E. J., Eja, E. I., Otu, J. E., & Ushie, M. A. (2009). Patronage of ecotourism potentials as a strategy for sustainable tourism development in Cross River State, Nigeria. *Journal of Geography and geology*, *1*(2), 20.

[18]. Emery, K. O., Uchupi, E., Phillips, J., Bowin, C., & Mascle, J. (1975). Continental margin off western Africa: Angola to Sierra Leone. *AAPG Bulletin*, *59*(12), 2209-2265.

[19]. Fawole, W. O., & ÖZKAN, B. (2017). Identifying the drivers of food security based on perception among households in South Western Nigeria. *European Journal of Interdisciplinary Studies*, *3*(4), 49-55.

[20]. Taye, B., Gebre, S. L., Gemeda, D. O., & Getahun, K. (2019). Using geospatial techniques in the selection of potential ecotourism sites in Menz-geramidir district, Ethiopia. *Ghana journal of geography*, 11(1), 201-227.

[21]. Sahani, N. (2020). Application of analytical hierarchy process and GIS for ecotourism potentiality mapping in Kullu District, Himachal Pradesh, India. *Environment, Development and Sustainability*, *22*(7), 6187-6211.

[22]. Aneseyee, A. B., Soromessa, T., Elias, E., Noszczyk, T., & Feyisa, G. L. (2022). Evaluation of water provision ecosystem services associated with land use/cover and climate variability in the Winike watershed, Omo Gibe Basin of Ethiopia. *Environmental management*, *69*(2), 367-383.

[23]. Xu, Y., & Zhang, Y. (2009). A online credit evaluation method based on AHP and SPA. *Communications in Nonlinear Science and Numerical Simulation*, *14*(7), 3031-3036.

[24]. Roque Guerrero, J. V., Teixeira Gomes, A. A., de Lollo, J. A., & Moschini, L. E. (2020). Mapping potential zones for ecotourism ecosystem services as a tool to promote landscape resilience and development in a Brazilian Municipality. *Sustainability*, *12*(24), 10345.

Citation: *Rakiya A. Babamaaji, et.al., "Suitability Analysis of Potential Ecotourism Sites in some Selected States in Nigeria using Geospatial Techniques", International Journal of Research in Environmental Science (IJRES), vol. 10, no. 3, pp. 12-26, 2024. Available: DOI: http://dx.doi.org / 10.20431/2454-9444.1003001*