



Presented at the FIG Working Week 2023,
28 May - 1 June 2023 in Orlando, Florida, USA

FIG WORKING WEEK 2023

28 May - 1 June 2023 Orlando Florida USA

Protecting
Our World,
Conquering
New Frontiers

TOPOGRAPHIC MODEL ANALYSIS AS A TOOL FOR SUSTAINABLE LAND INVENTORY AND MANAGEMENT

Maduabughichi Okezie Divine

Njike Chigbu (Ph.D)

Chioma Gabriel

Clinton chimgozirim Chigbu (Nigeria)



Organized By



Diamond Sponsors



INTRODUCTION¹

- Achieving sustainable development in Sub-Sahara Africa depends largely on the prudent utilization of land resources.
- Topographic modelling analysis is very important process through which we can minimize the adverse anthropogenic effect on the environment, its ecology and landscape.
- Topographic modelling analysis and land use management algorithm can provide a comprehensive understanding of the physical and social characteristics of a region.
- Analysing the physical structure of our environment at a particular time helps to improve safety and well-being of the populace.

INTRODUCTION²

- Old Aba metropolis is a low-lying land that is almost a flat terrain. This condition predisposes it to flooding during the raining season.
- Absence of proper topographic model leading to a poorly developed inadequate channel/water drainage network had cause flooding within the study area. Also, lack of up-to-date topographic maps of the study area makes it difficult for planners, land use managers, to properly utilize the available land space.
- Despite the importance of topographic modelling analysis and land use management in promoting sustainable development, there is need for a comprehensive evaluation of the effectiveness of these tools.

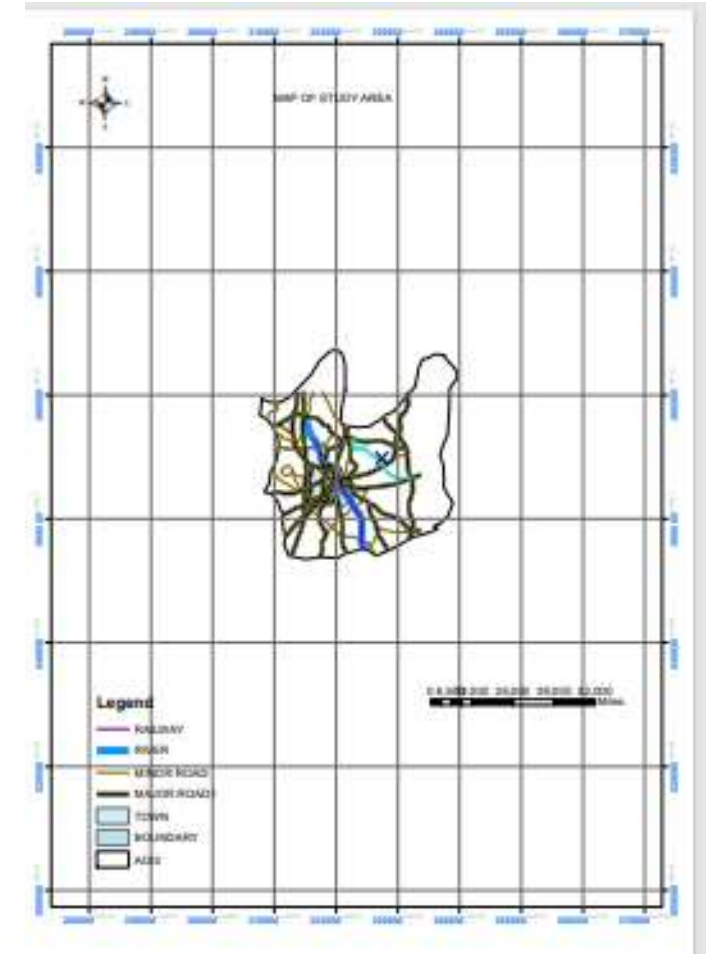
AIM AND OBJECTIVES

- This study, evaluate the effectiveness of topographic modelling (analysis) and the resultant land use management data in promoting sustainable development.
- The study investigates the place of topographic modelling, in identifying areas of high ecological value and also assessing the potential impacts of development projects on the environment, as well as the use of land use data in promoting compact, sustainable development patterns and minimizing the negative impacts of development on the environment.

DESCRIPTION OF THE STUDY AREA

The study area is old Aba, metropolis Abia state Nigeria, that comprises of Osisioma-Ngwa, Isiala-Ngwa North L.G.A, Isiala-Ngwa South L.G.A, Obingwa L.G.A, Aba South L.G.A, Aba North L.G.A, Ukwa East L.G.A, Ukwa West L.G.A, and Ugwunabgo L.G.A with a total land mass of 1,116km².

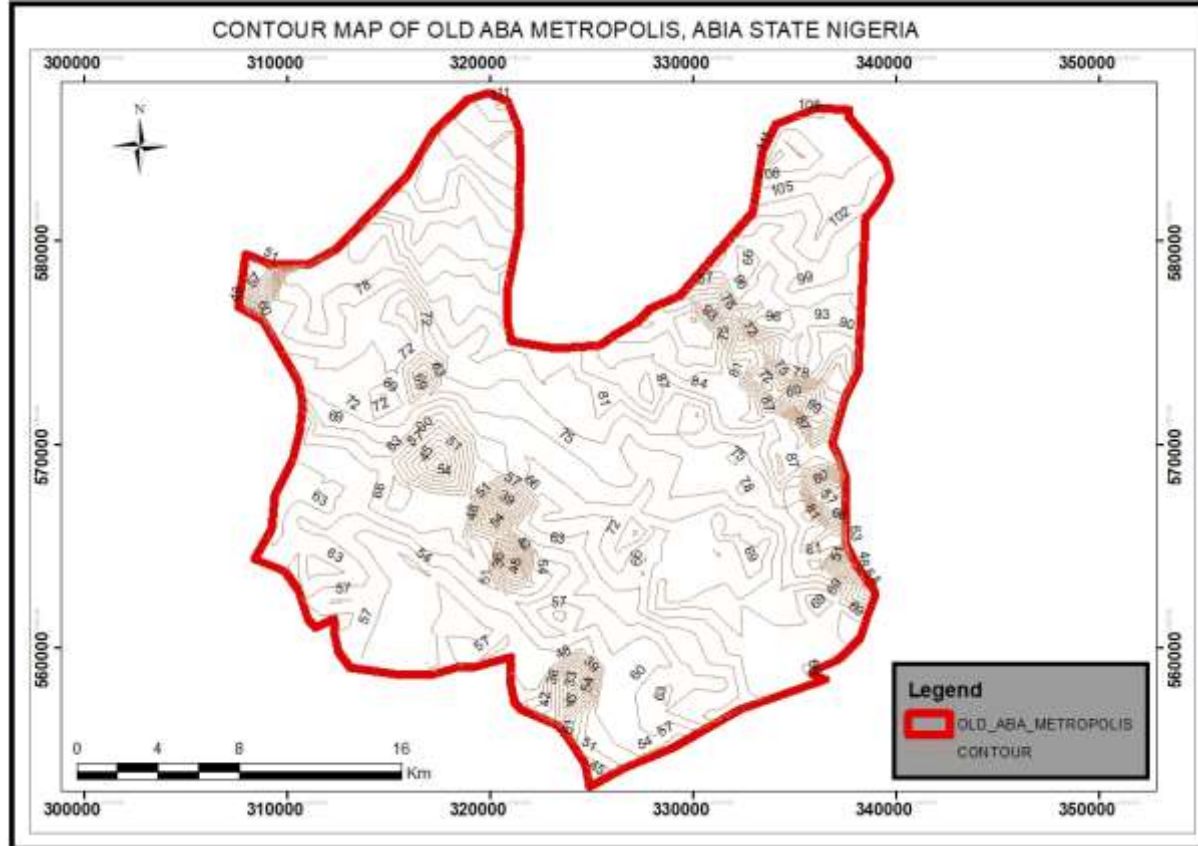
Aba is a low-lying coastal state in south-Eastern Nigeria located between longitudes 5°07'00N- 5°15'41"E and latitudes 7°22'00"N - 7°25'10"N.



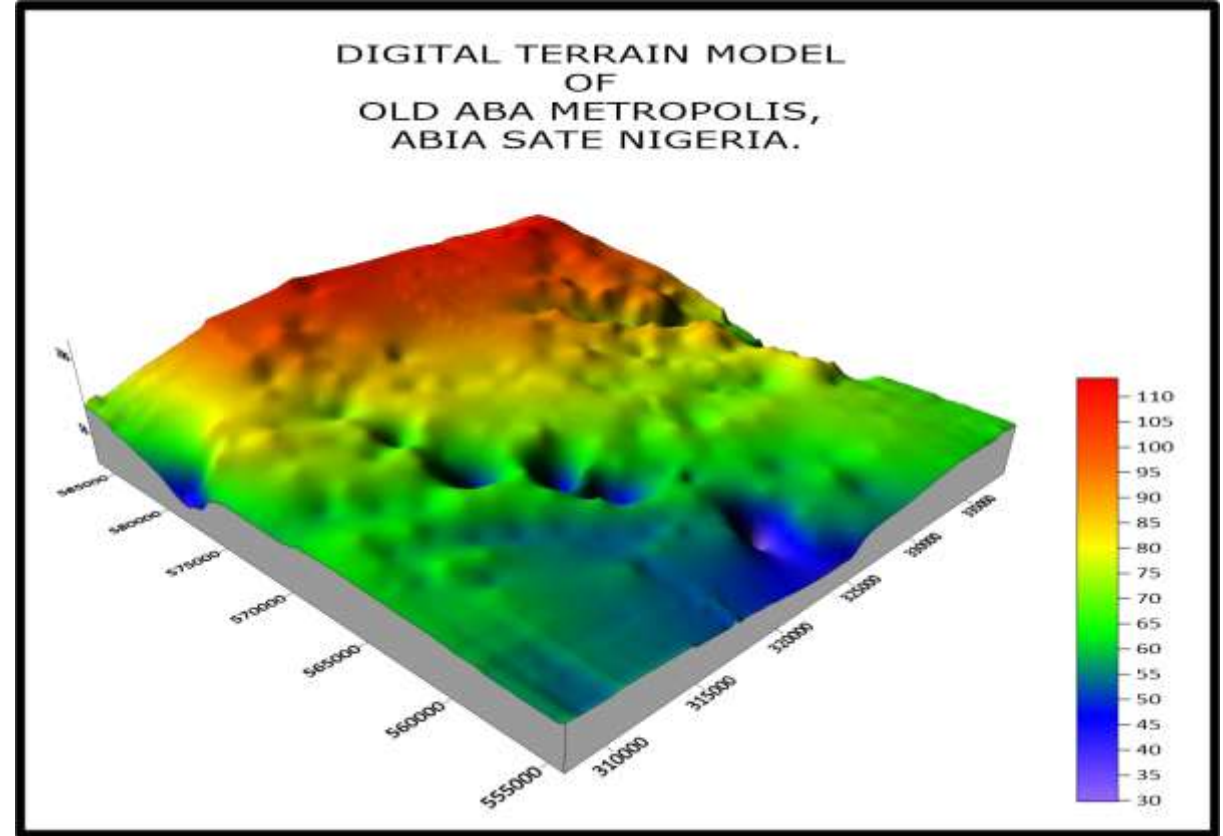
MATERIAL AND METHODS

- Sentinel 2 satellites image with 10m resolution, Google earth elevation dataset (2023), Tersus GNSS Rover data, ArcGIS 10.5 version, Surfer 11 software. Microsoft Excel, GPS Visualizer.
- To analyse the topographic configuration of the study area, the SRTM raster file was added to ARGIS 10.5 software progressively. The dataset was manipulated using spatial analysis tool. From the spatial analysis tool, contour lines, aspects, flow accumulations, slopes and digital terrain model were created. The Maximum Likelihood (MLH) method was adopted as the classification algorithm, and a total of 20 trained samples were used for each classification. The land use/ land cover themes were bare land, vegetation. Built-up areas and water bodies.

RESULTS AND ANALYSIS (I)

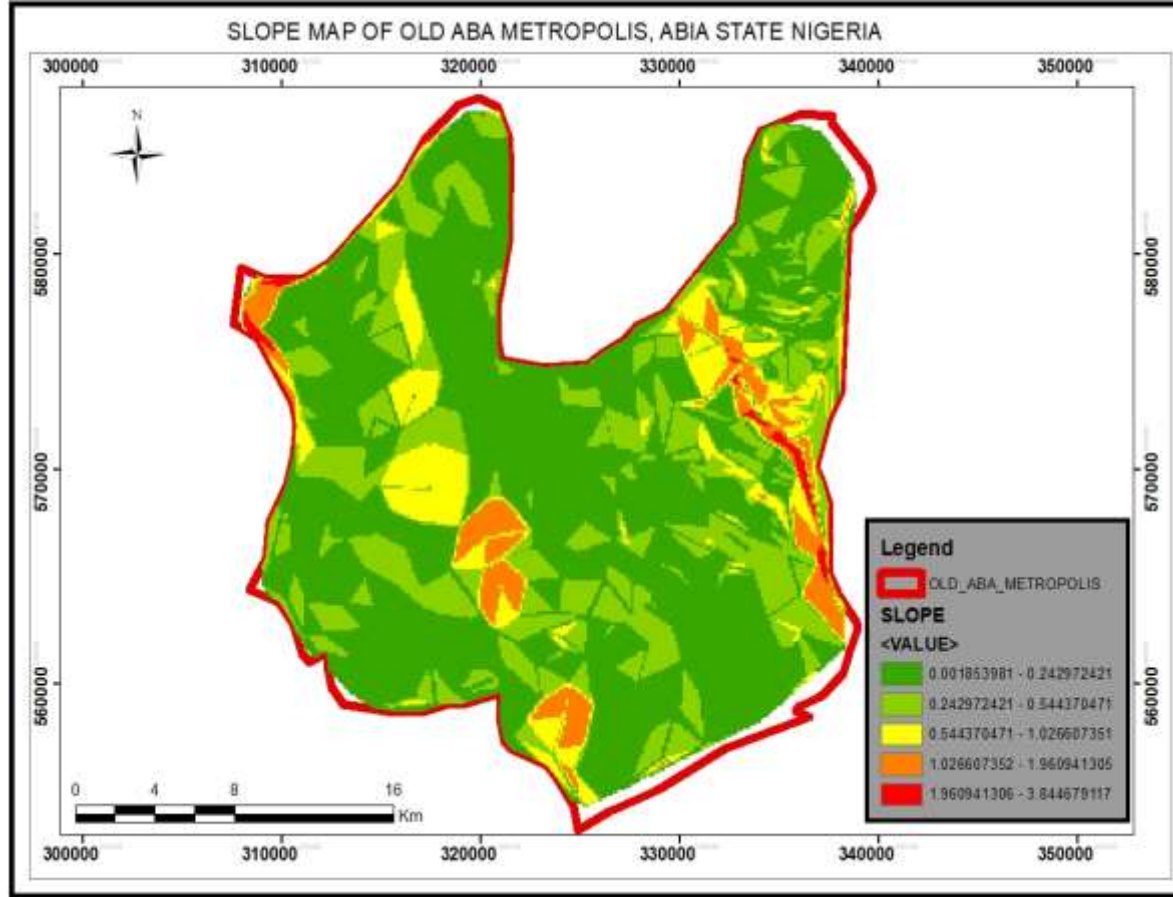


Contour map of the old Aba Metropolis. (Source. Okezie et al. 2023)

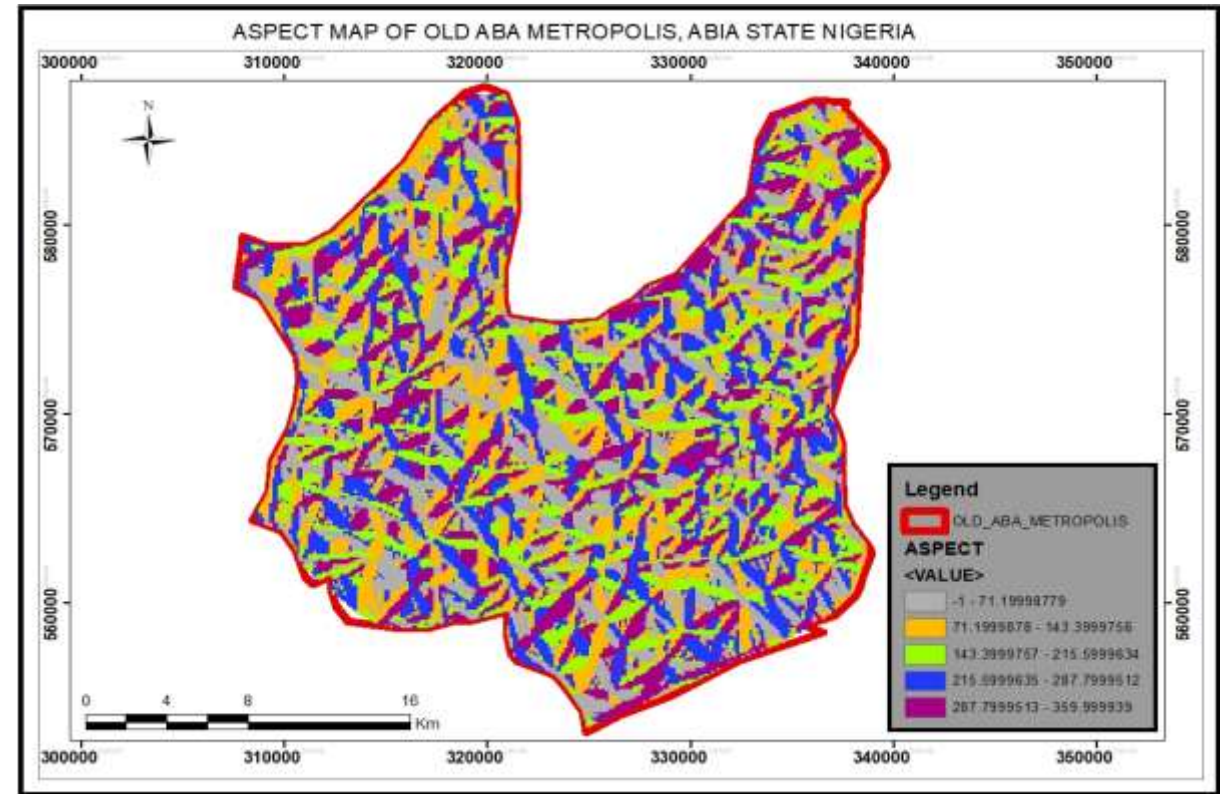


Digital terrain model of old Aba Metropolis. (Source. Okezie et al. 2023)

RESULTS AND ANALYSIS (I)

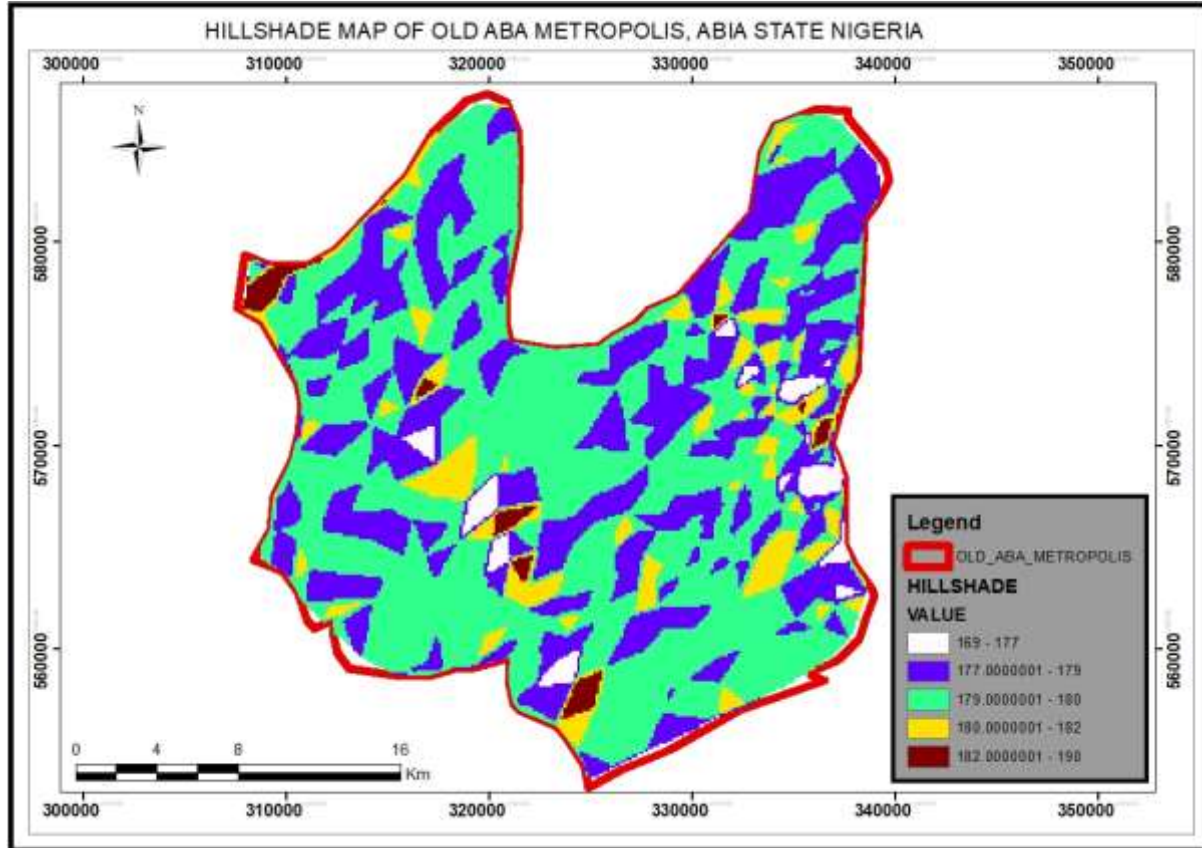


Slope map of old Aba Metropolis. (Source. Okezie et al. 2023)

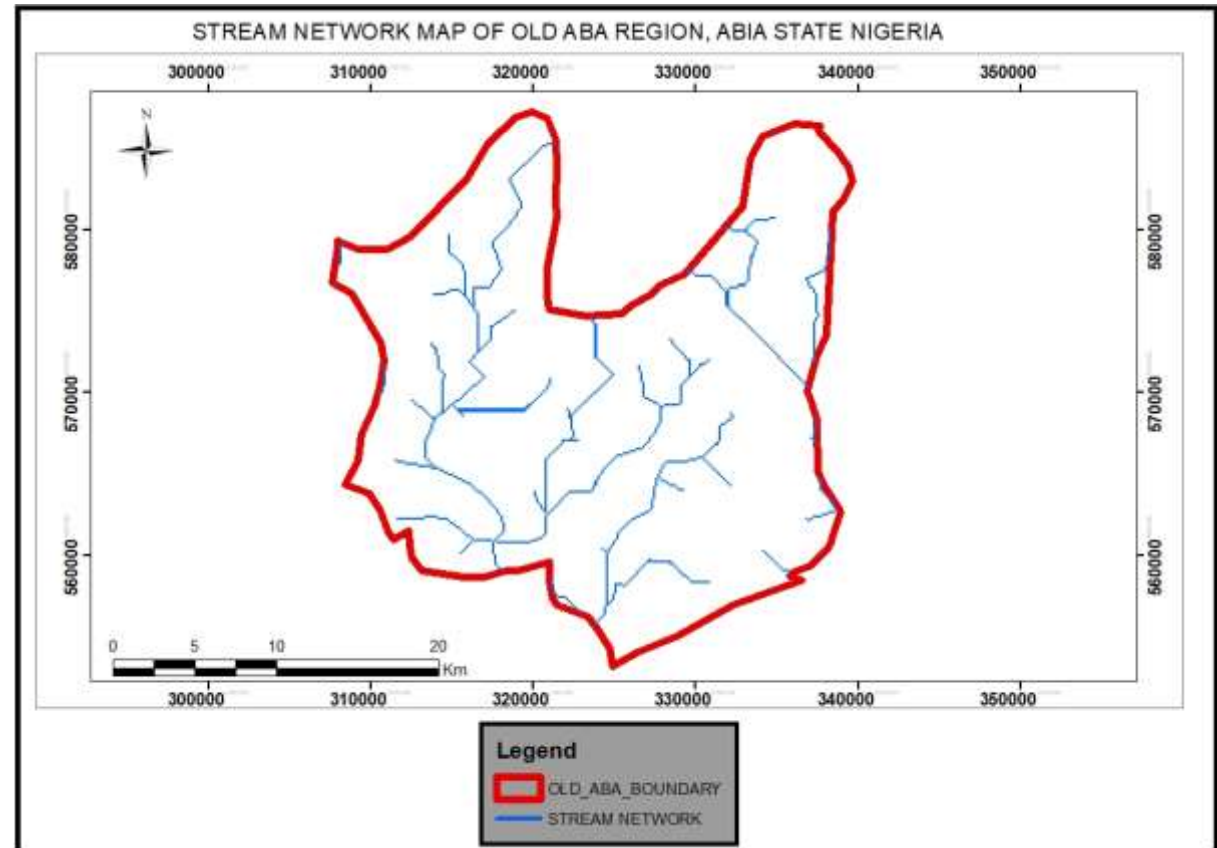


Aspect map of old Aba Metropolis. (Source. Okezie et al. 2023)

RESULTS AND ANALYSIS (I)

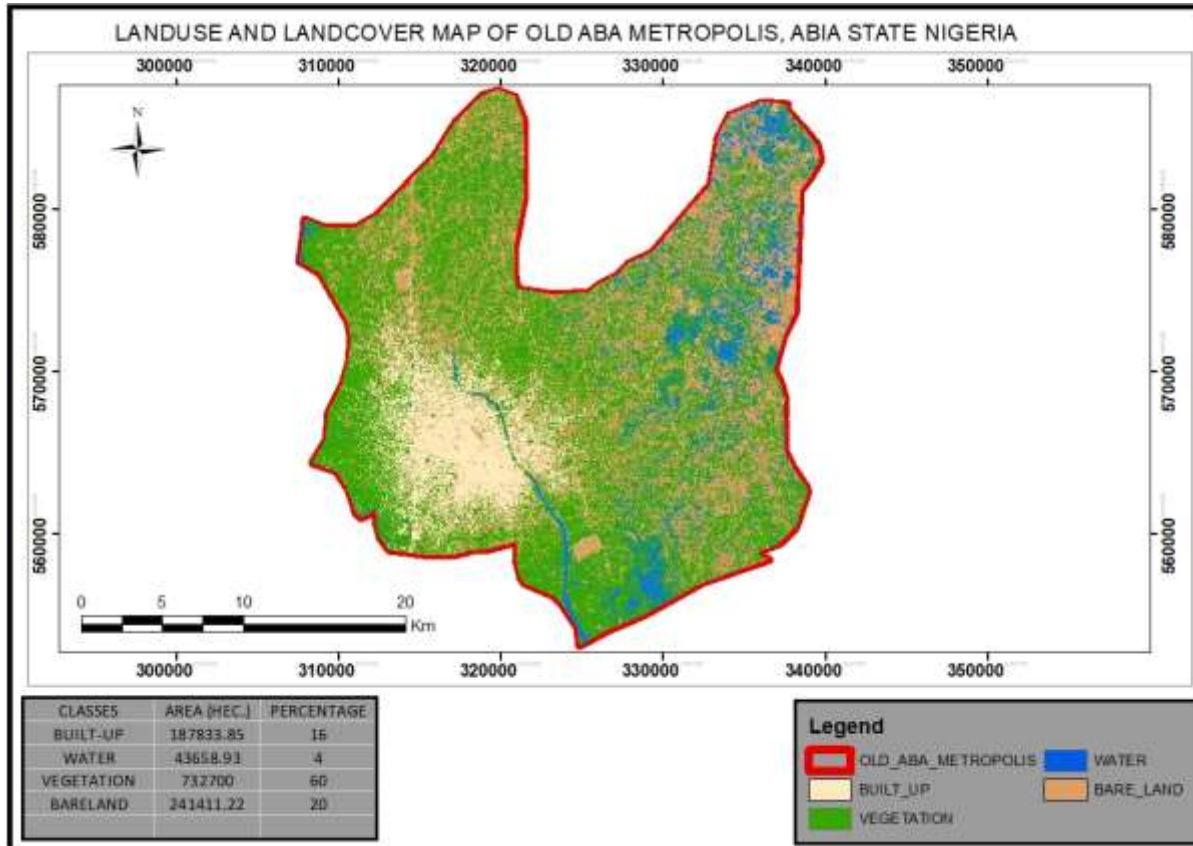


Hill shade map of old Aba Metropolis. (Source. Okezie et al. 2023)



Stream network map of the study area. (Source. Okezie et al. 2023)

RESULTS AND ANALYSIS (I)



Land use /Land cover classes	Areas (Hectares)	Percentage
Built-up areas	187833.850	16
Water bodies	43658.931	4
Vegetation	732700.080	60
Bare land	241411.220	20

Table 1 shows land use land cover analysis of old Aba Metropolis

land use land cover of old Aba Metropolis. (Source. Okezie et al. 2023)

DISCUSSION OF RESULTS

- The results obtained showed that the configuration of the landscape and undulation nature of the study area from figure 1-to figure 9, using contour, aspect, digital terrain model, hill shade, slope, land use / land cover and 3D wireframe. These digital derivatives are vital for good understanding, policy making and management of the physical environmental of the area under investigation.
- The result reveals that there is a number of streams within old Aba metropolis and all of them are connected to Aba blue River (water side).
- Figure 1.7 revealed a total of four land use classes identified within the study area. These are Built up areas, vegetation areas, bare land and water bodies. Further analysis revealed that Built up areas covers 187.833 km² (16%), vegetation areas cover 732.700 km² (60%), bare land covers 241.411sqkms (20%), water bodies cover 43.658km². (4%).

CONCLUSION

- Topographic modelling analysis and land use management algorithms are two important tools for promoting sustainable development and this is fundamental for good selfless and management of the physical milieu.
- Based on this, robust method that produces reliable result must be adopted to ensure that the right decision is made during planning.
- The use of earth observation system (EOS) technology, Remote Sensing (RS) and GIS platforms have become an integrated, well developed and dependable method in terrain analysis. The result of this study revealed the various and multi-dimensional proficiencies of integrating remote sensing data and GIS in terrain modelling and analysis.

RECOMMENDATION

- This work is recommended for those in the built industry, planners, developers, policy makers and academia. It is also served as a contribution to the body of work in terrain modelling analysis and required further investigations in order to achieve sustainable development within Sub-Saharan Africa.
- As a novel exercise, the gains of scientific study like this, cannot be over-emphasised, owing to the importance of land use/ Land cover study in the overall land inventory and planning for sustainability.
- It is necessary to recommend the incorporation of terrain analysis models of slope, aspect, DTM/DEM etc, for proper revelation of the character of the terrain or configuration of the topography, which could hamper good planning and development.



FIG WORKING WEEK 2023

28 May - 1 June 2023 Orlando Florida USA

Protecting Our World, Conquering New Frontiers

*Thanks
for listening*

Organized By



Diamond Sponsors

