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ANALYSIS OF TOPOGRAPHIC PATTERNS OF GREATER YOLA USING GEOGRAPHIC INFORMATION SYSTEM (GIS)

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Abstract:
By combination of digital elevation models (DEM) with digital geological maps within GIS environment, it is possible to detect the topographic analysis in relation to the site analysis of the study area. This technique has been demonstrated on Jimeta metropolitan DEM map. From a topographic point of view, large relief defines mountains essentially. Thus, (DEM) usually form the base data for any mountain geo-information system and any spatial model. The DEM is the digital representation of continuous changes of relief within space (Burrough 1986,). Information generated from the DEM is of critical importance within many GIS applications and is used to produce contours and many other types of information including; indivisibility, slope, profiles, watersheds, aspect and the concavity and convexity of a surface. Shuttle radar topographic mission (SRTM) help in obtaining digital elevation models on a near global scale.

Keywords: *Digital Elevation Model (DEM), Shuttle radar topographic mission (SRTM) contour, topography, hill shade*

Introduction:
A recent review of the use of Geographical Information Systems (GIS) quoted a British Government report which stated that the impact of GIS on spatial analysis was as significant as, "the invention of the microscope and the telescope were to science, the computer to economics and the printing press to information dissemination. It is the biggest step forward in the handling of

geographic information since the invention of the map." (DoE. 1988,8 in Harris and Lock 1990).

Topography is often considered as a narrow bandwidth of features covering the form or shape of the surface. After detailed study of many measurements, we consider that as well as the possibility of a dominant range of features there is always an underlying random structure where undulations in surface height continue over as broad a bandwidth as the surface size will allow. We consider this a result of many physical effects each confined to a specific waveband but no band being dominant. We invoke the central limit theorem and show through Gaussian statistics that the variance of the height distribution of such a structure is linearly related to the length of sample involved. In another form, the power spectral density, this relationship is shown to agree well with measurements of structures taken over many scales of size, and from throughout the physical universe. "R. S. SAYLES* and T. R. THOMAS". It is the shape of Earth's surface and its physical features, such as mountains, valleys, canyons, and other landforms.

Aim of the study:
This study was aimed at the following

- To identify the patterns of topography in greater yola
- To examine the physical effects that confines of spectral density of grater yola
- To prof decree of safety , security, convenience and aesthetic of greater yola

METHODOLOGY:
Jimeta, a twin city to Yola town, is the capital of Yola North Local Government and Adamawa State of Nigeria. The city is located at the bank of River Benue, between latitude 90 10' to 90 15'N and longitude 120 11' to 120 17'E. The area has a Sudan type of vegetation and a tropical climate marked by wet and dry seasons. The minimum temperature recorded is about 15^{o} C and a maximum of about 40^{o} C. The city has been experiencing an increasing population explosion since it assumed a status of Adamawa State capital in 1976. Like any other Nigerian cities, Jimeta comprises of so many land use types ranging from

institutional, commercial, and residential. The city is clearly stratified in terms of population densities (Ilesanmi, 1999).

These are low, medium and high-density areas. The low-density areas are well-planned units where government officials reside while medium and high-density areas are made up of common people with little or unplanned streets and buildings.

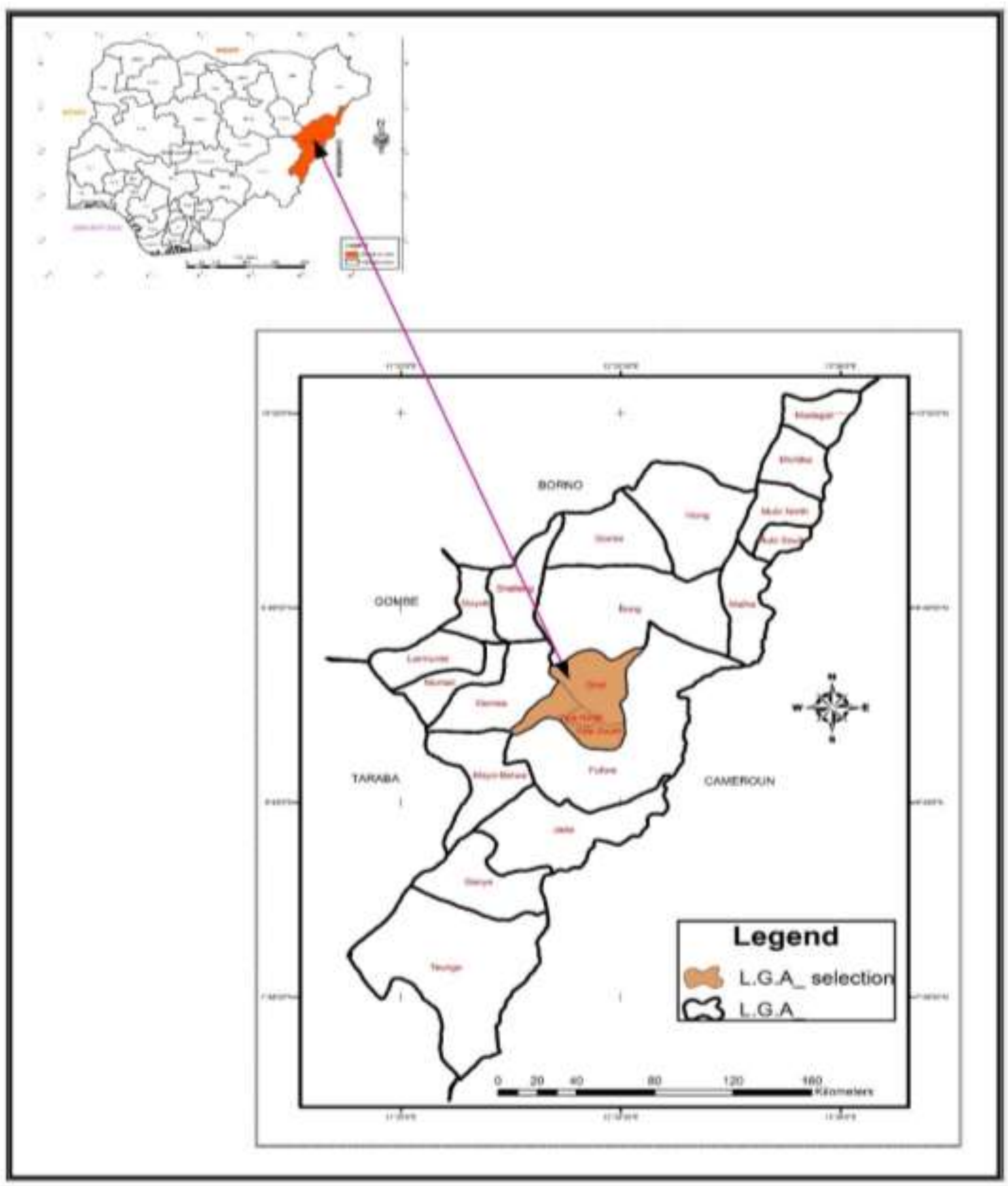

Figure 1: Map of the study Greater Yola
Source: ArcGIS 10.6 G_N Tsundass Nig Ltd

FLOW CHART

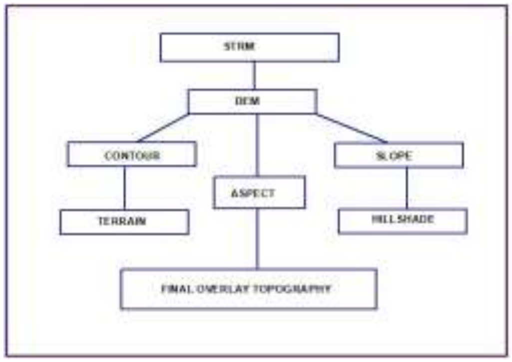

Figure 2: Flow chat of the study

Data acquisition:

In this study the data was acquired from http://www.earthexplorer.usgs.gov. http://www.gdem.ersdac.jspacesystems.or.jp/ etc. it can also be acquired manually by using google earth and tcx converter.

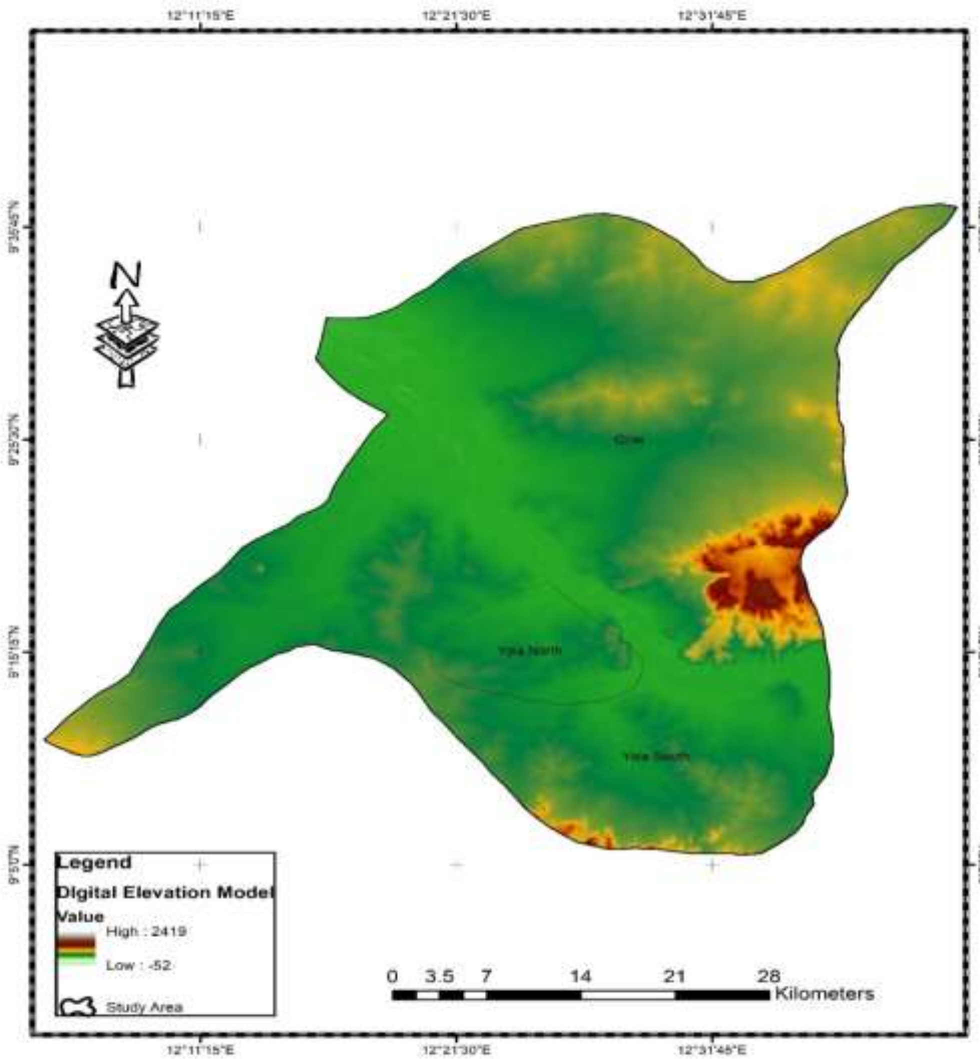

Fig. 3. Digital Elevation Model (DEM) of the study area Greater Yola
Source: ArcGIS 10.6 G_N Tsundass Nig Ltd

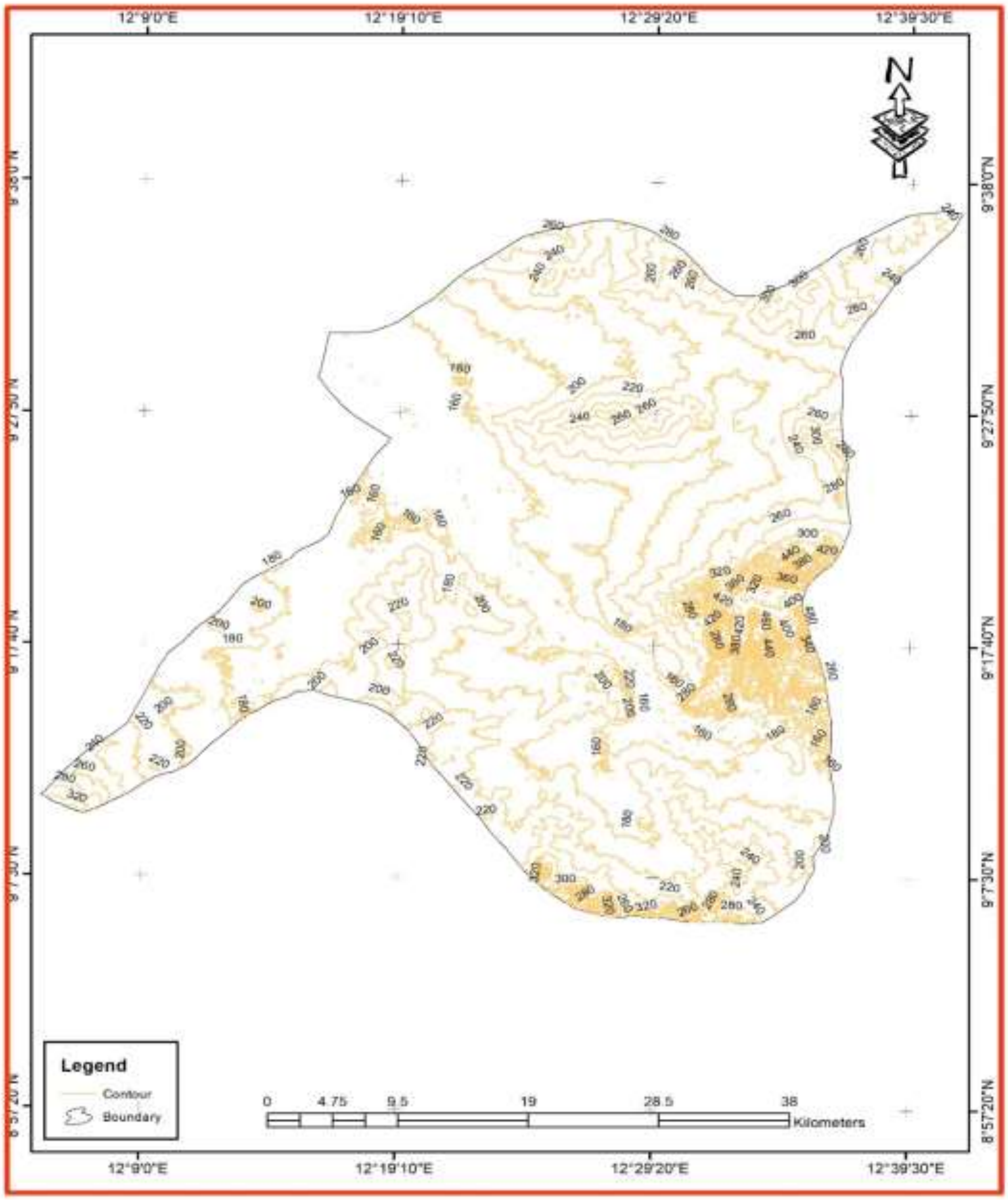

Figure 4. Map showing the contour level of the study area Greater Yola.
Source: ArcGIS 10.6 G_N Tsundass Nig Ltd

3. Contouring: Creates a line feature class of contours (isolines) from a raster surface. Contours can be used to estimate slope, aspect, and curvature alone.

Elevation can be read directly from contour labels, and the spacing or the change in spacing among contours indicates changes in slope and profile curvature, respectively. An orthogonal vector defined by two nearby contours on a map yields aspect, and the curve of the contour itself shows the change in aspect or plan metric curvature.

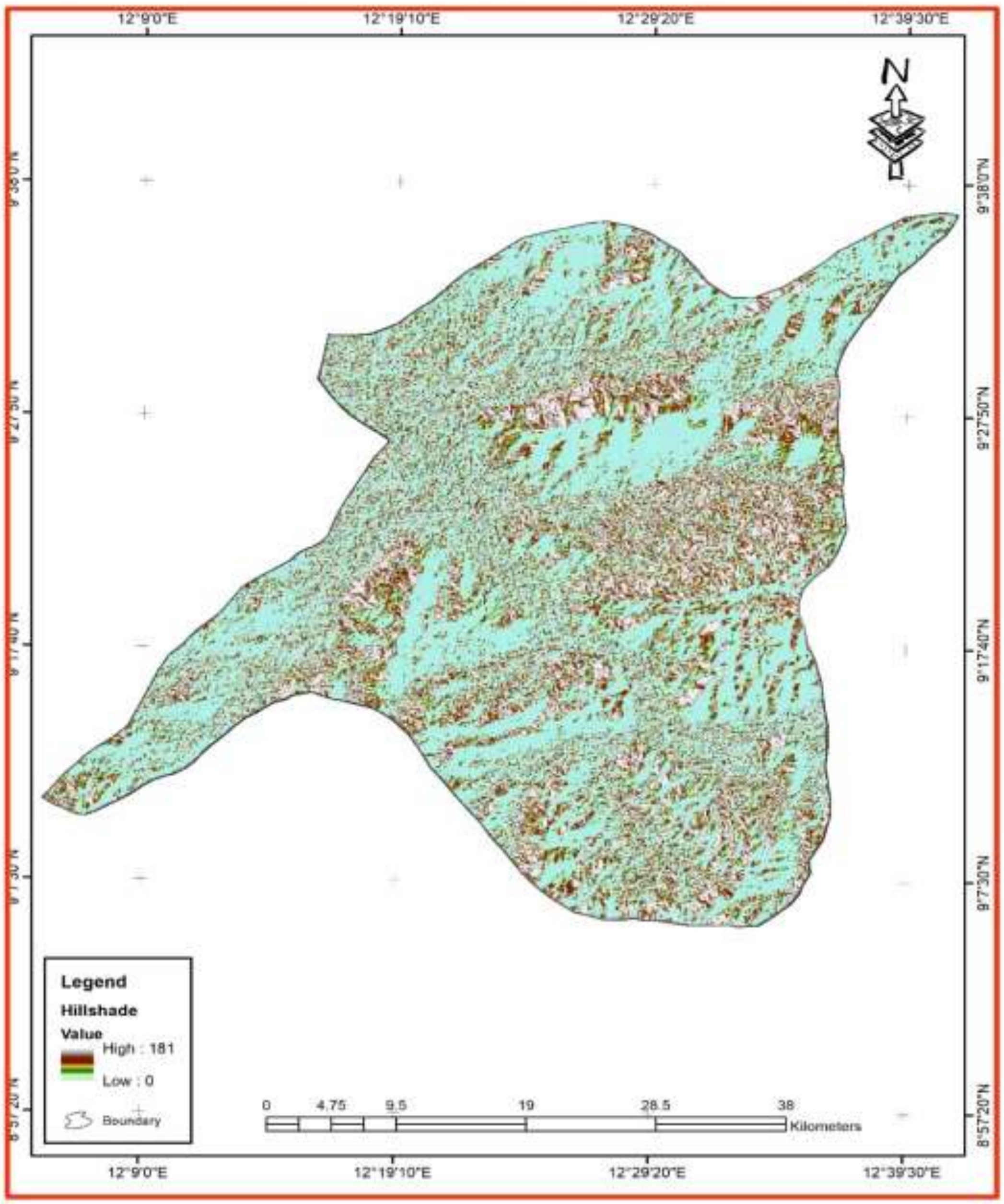

Fig. 5. Hill shade Map of the study area Greater Yola.
Source: ArcGIS 10.6 G_N Tsundass Nig Ltd

4. Creating a hill shade

A hill shade is a shaded relief raster created by using an elevation raster and setting an illumination source (typically the sun) at a user-specified azimuth (the angular direction of the illumination source, in positive degrees from 0 to 360) and altitude (the angle of the illumination source above the horizon).

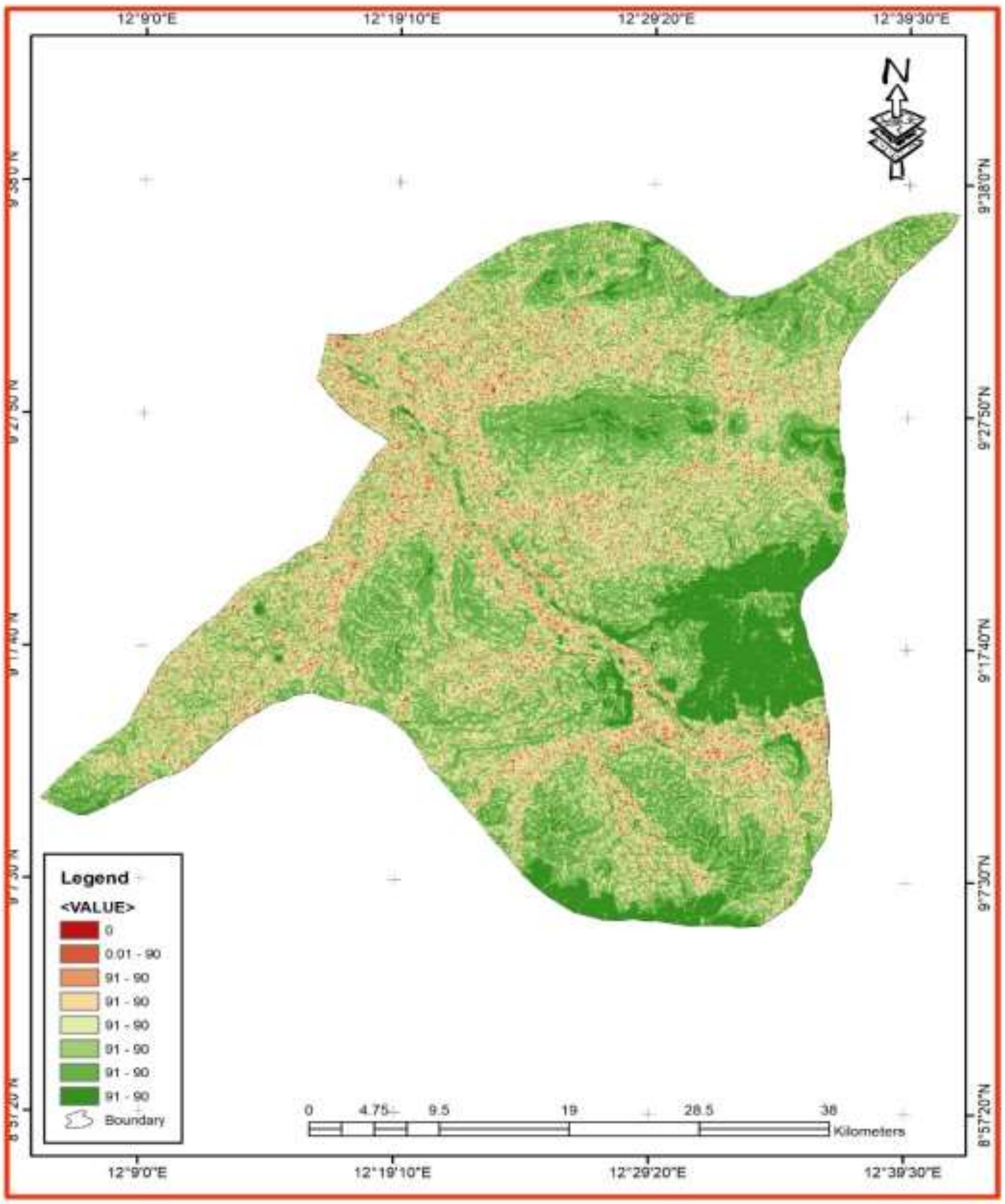

Figure 6: Map showing the Slope of the study area Greater Yola.
Source: ArcGIS 10.6 G_N Tsundass Nig Ltd

Slope: Identifies the slope (gradient, or rate of maximum change in z-value) from each cell of a raster surface.

- Slope is the rate of maximum change in z-value from each cell.
- The use of a z-factor is essential for correct slope calculations when the surface z units are expressed in units different from the ground x, y units.
- The range of slope values in degrees is 0 to 90. For percent rise, the range is 0 for near infinity. A flat surface is 0 percent, a 45-degree surface is 100 percent, and as the surface becomes vertical, the percent rise becomes increasingly larger.
- If the center cell in the immediate neighborhood (3 x 3 windows) is No Data, the output is No Data.

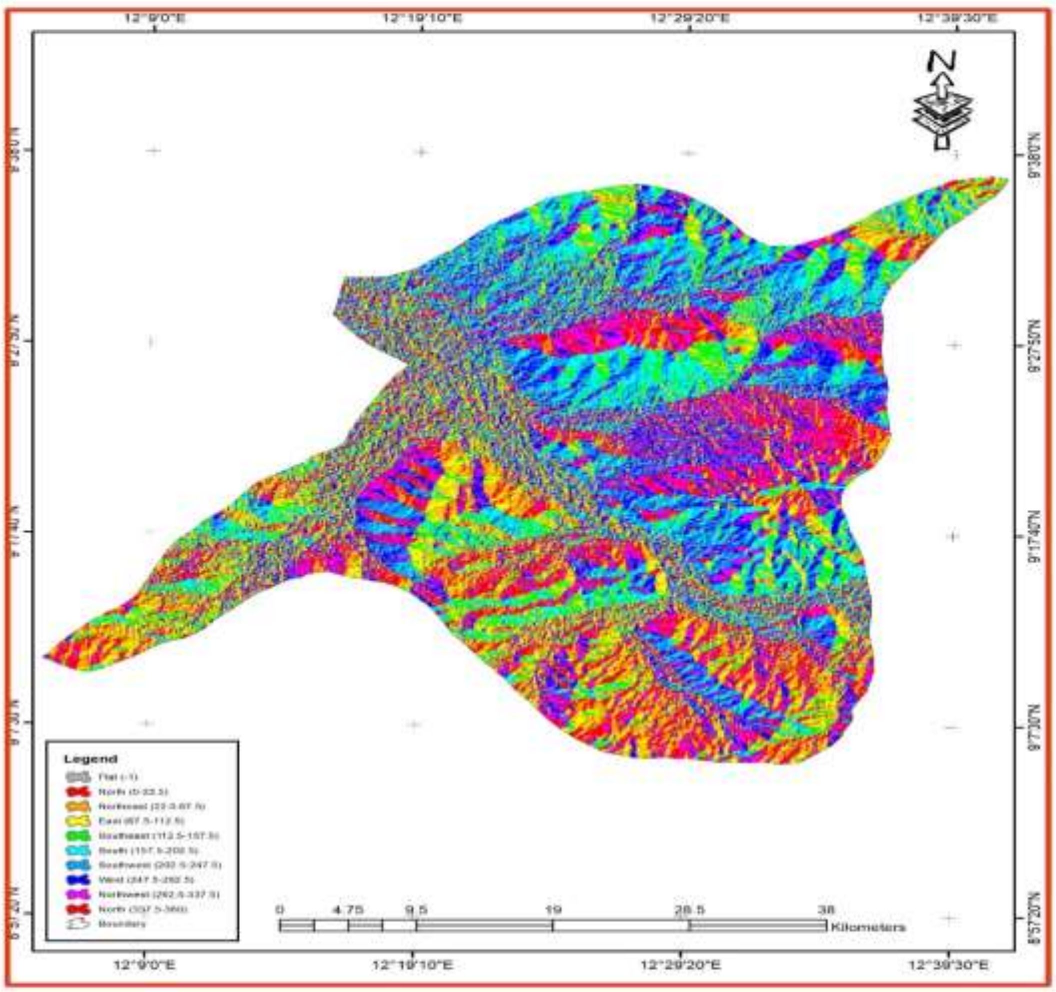

Figure 7: showing Aspect Map of the study area Greater Yola
Source: ArcGIS 10.6 G_N Tsundass Nig Lt**d**

5. Aspect

Identifies the downslope direction of the maximum rate of change in value from each cell to its neighbors. It can be thought of as the slope direction. The values of each cell in the output raster indicate the compass direction that the surface faces at that location. It is measured clockwise in degrees from 0 (due north) to 360 (again due north), coming full circle. Flat areas having no downslope direction are given a value of -1.

The value of each cell in an aspect dataset indicates the direction the cell's slope faces.

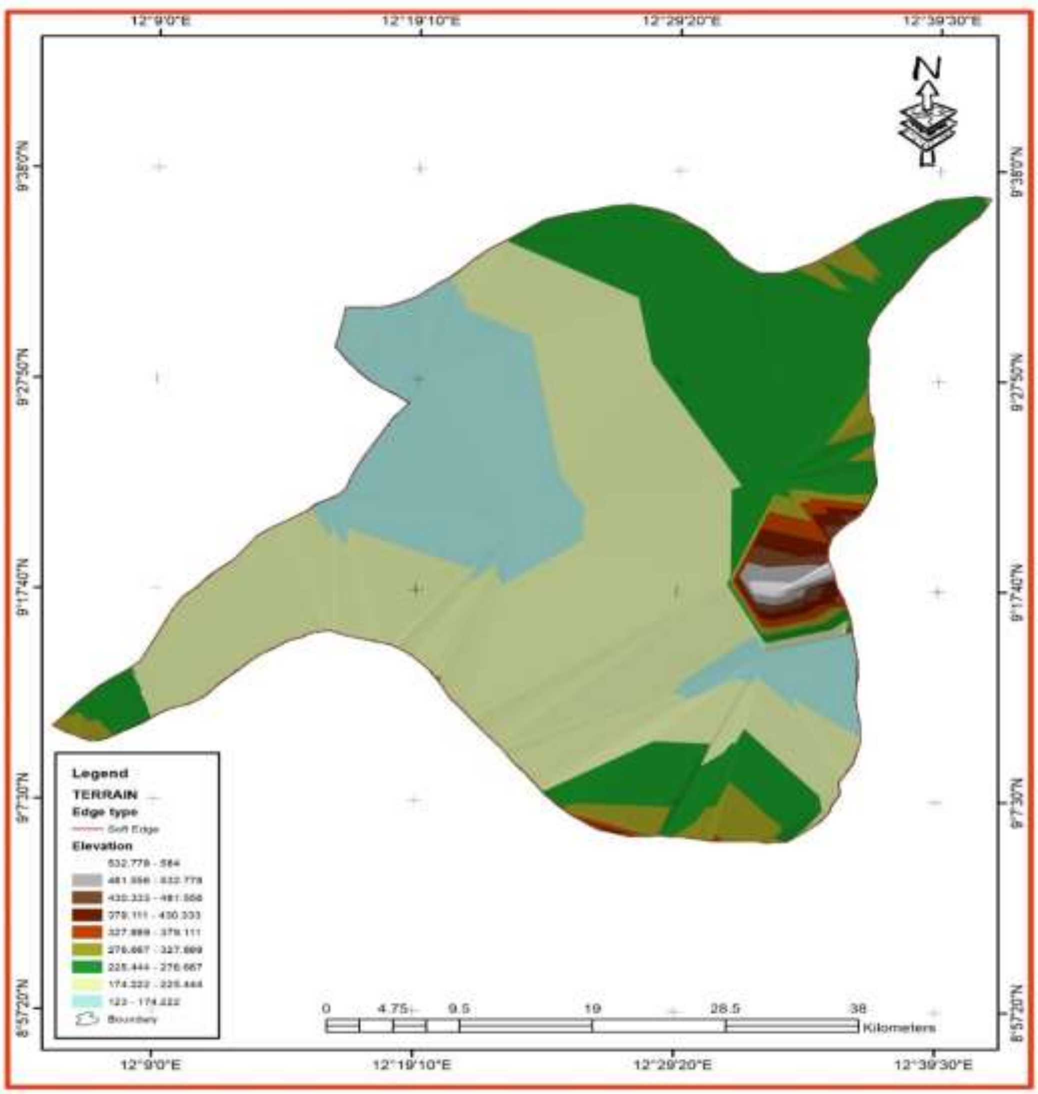

Figure 8: showing Terrain Pattern of the study area Greater Yola
Source: ArcGIS 10.6 G_N Tsundass Nig Ltd

Results and Discussion:

The result of the contour, slope and the hill shade show the site analysis and how the shape of the study area looks like. It also shows the topographical analysis of the area. The result also illustrates how the highest surface is reflected by sun; the highest surface is suitable for telecommunication mast location, for recreational activities etc. The lowest part of the city is disaster prone and it is very important to the community, because most of the activities of the city take part there. The lowest area includes residential areas, farmlands and the river Benue, which is the primary source of water supply and irrigation to farmers in the area.

Recommendations:

As a planner, there is a need to ensure maximum decree of safety, security, convenience and aesthetics. The analysis will create options for the planner to choose the best place that can accommodate, secure, and ensure security of the beneficiaries. For example, the people living in the riverine areas should be relocated to safer places that are resistant to flooding. In addition, the river basin should be used as agricultural and irrigation purposes. In addition, the area should be used as recreational purposes because of the nature of the area, also people around bachure area are at high risk zone flood due to low elevation more concentration should be given to the area in order to minimize loss of lives and biodiversity.

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