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A CARTOGRAPHIC PORTFOLIO PRESENTING SPATIAL DISTRIBUTION OF NATURAL AND MANMADE FEATURES IN PARTS OF AFRICA

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Abstract: Maps from several projects can be digitally made and organized in a GIS portfolio. Map making has evolved over the years from a simple descriptive and traditional form of data collection and representation to the use of modern sophisticated tools and methods such as Geographical information systems (GIS). The aim of this paper is to visually convey spatial information in a way that is approachable, natural, and generally simple to explore, perceive, and analyze. It offers maps at every scale, from the level of a continent to a sub region and all the way down to the street level. The techniques examine how ArcGIS was used to make all the displayed maps and the steps required for geographic visualization. Shape files were gathered from free data sources such as the College of Education Akwanga, Diva GIS, and free GIS data online. Roads, waterways, regional and national boundaries are all included in these shape files, Google Earth was also utilized to derive map elevations for contour mapping.
Keywords: Cartography, portfolio, GIS, Visualization, shape files

INTRODUCTION

Over time, the creation of maps has progressed from a straightforward descriptive and conventional way of data collecting and representation to the use of cutting-edge advanced technologies and techniques like Geographic information systems (Silayo, 1997). Cartography is the art of making maps. It is the science of representing geographical information in a graphical form on plane surfaces presented as maps or charts (Britannica, 2017). It comprises of the entire process of creating maps; from gathering, evaluating, and processing source data to graphic designing drawing, and producing the final output (maps). One crucial aspect of cartography is map visualization, which is the primary focus of a cartographer. This is because of the strive to adequately represent geographic features in time and space (Franges et al., 2007). GIS tools are widely used by cartographers today to enhance modern-day map making and representing data in an advanced visual style e.g. the use of choropleth maps, isopleths, cartograms, and 3D Elevation Models among others (Merwe, 2003). A good map visualization depends on the layout, colour, and symbolism of the map being properly represented.

Map Layout and Element: A map layout is a collection of map components that are arranged and shown on a page. This map element is what completes a map, and it consists of the title, the Data Frame, Legend, North Arrow, Scale, Citation, and Inset Map.

Map Colour: Cartographers use colour on a map to represent certain features. On a single map, the usage of colours can be uniform throughout several map formats produced by various cartographers or publishers. Distinctive correlations exist between various map colors and geographic features on the ground. For example, rivers and lakes are always represented by blue colours (Kirtiloglu and Gundogdu, 2007).

Symbology: The symbols, letters, or other visual representations used on a map to denote a physical object or attribute is known as map symbolization. For example, the traditional colour scheme for topographic maps shows contours in brown, bodies of water in blue, boundaries in black, and grids and highways in red. These symbols can be coloured to indicate many categories of information.

AIM

This cartographic portfolio explores the use of GIS to produce maps that accurately portray the actual natural and physical landscape, with an emphasis on Africa. The overarching goal is to visually convey spatial information in a way that is approachable, natural, and generally simple to explore, perceive, and analyse. It offers maps at every scale, from the level of a continent to a sub region and all the way down to the street level

METHODOLOGY

The techniques examine how ArcGIS was used to make all of the displayed maps and the procedure required for geographic visualisation. Shape files were primarily obtained for free from websites like Diva GIS, Free GIS Data, and College of Education Akwanga. Roads, waterways, regional boundaries, and other features are included in these shape files. After that, all shape files were coordinated and overlaid so that the map visuals could convey clearly. The subheadings and figures below further characterize and present detailed procedures.

Administrative boundaries in Africa:

This simple thematic map aims to introduce the African continent by showing the different nations. It displays distinctive qualities by name and classifies the nations according to their administrative divisions and colors. The map is presented in a study area map style which was produced in Arc GIS, and it utilized the Arc Catalogue to combine data and the layout view to display the two maps to make a visually appealing presentation. The inset map shows the location of the African continent in the globe while the larger area contains the intended map of concern. The notable map Elements that can be seen are the Data frame, title, north arrow/cardinal point symbol and the scale. A legend is not included because the map presents a single feature which is properly labelled, distinctively coloured and easy to understand.

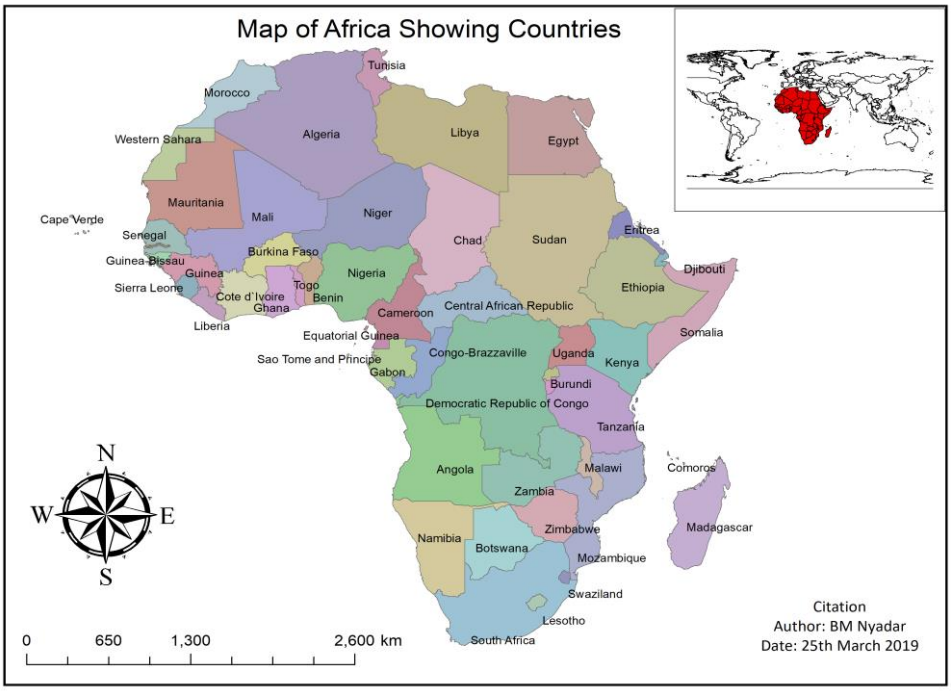

Figure 1: Map of Africa showing countries and boundaries

African sub-regions, rivers, and lakes

The whole representation of the African continent is shown on this map. It concentrates on portraying Africa's six sub regions, its rivers, and its lakes that are currently extant. The map was generated using ArcMap software, where a collection of GIS datasets was integrated and standardized. These datasets were then processed within the ArcMap environment to accurately depict map characteristics in the form of lines and polygons. The map making process focuses on the layout, the colouring and the symbology. The title introduces the map users to the general idea of what the map is all about while the map labels indicate names of the individual features presented on the map, for example, the West African Region and the rivers Komoe and Benue found within. The Legend is included here to better inform the map users of the features represented on the map, for example, the legend clearly points out that the blue coloured lines and polygons represent waterways or rivers. The chosen colour scheme aims to evoke the viewer's intuition regarding the map's content through a quick visual assessment. The colours were thoughtfully chosen to provide a suitable depiction of the map's elements. The red colour is a typical indicator and it is used in the inset map to indicate the African continent and the background light burnt orange colour enhances the brightness of the other colours of the other map features. Additionally, Africa is known for its wildlife and safari so the inclusion of a picture of the sunset and shadow cast of trees and animals gives beauty to the map by giving it an African safari touch. The cartographic elements employed in this map consist of lines and polygons, which are well-suited for depicting rivers, lakes, and boundaries.

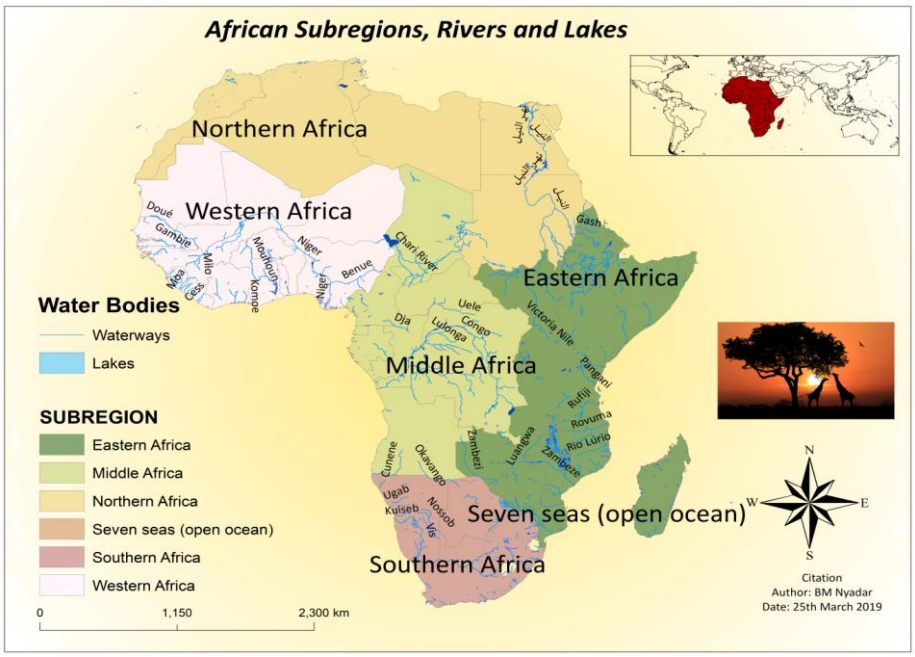

Figure 2: Map of Africa showing sub-regions, rivers, and lakes

West African Sub-region, Countries, Land Area, Population, Roads, and Railways:

The West African sub-region is situated in the western portion of the African continent. The region under consideration comprises about seventeen nations and spans an estimated area of 6,143,000 square kilometres (Africa et al., 2019). It is also home to the most populous country in the African continent (Nigeria). This map presents the West African sub-region with a focus on the land area of each country, the human population estimate, existing railways and Roads. The map is made in the style of a choropleth map so that it is easy to see how the land area is measured and how it changes across West Africa, as well as how different each country is from the others. The population is shown by a proportional dot symbol, which shows how many people live in each part of the area. Roads and railways are shown by line symbols. The colour green is distributed in a gradient, ranging from lighter to darker hues. This gradient is used to visually illustrate the relative sizes of various countries' boundary areas, with the larger countries being depicted by the darkest shades. This information is conveyed through a portion of the legend. The utilization of points was employed to represent the population estimates throughout the region. The sizes of these points were varied in accordance with the

proportion of the population residing in a specific area. Various lines are employed to depict the presence of extant railway tracks and road networks throughout the region. The selection of the overall colour scheme was conducted with meticulous care in order to achieve a harmonious combination that effectively portrays the distinctive characteristics of the map, hence creating a visually captivating presentation. Additional cartographic components, such as the inclusion of a title, serve the purpose of providing users with an initial understanding of the map's subject matter. The legend, on the other hand, offers more comprehensive information on the map's content and is presented in a manner that allows for the inclusion of all pertinent details. The inclusion of a scale on the map serves to provide a suitable depiction of the map's dimensions in relation to the actual ground surface. Additionally, the presence of a north arrow serves to indicate the direction of the map.

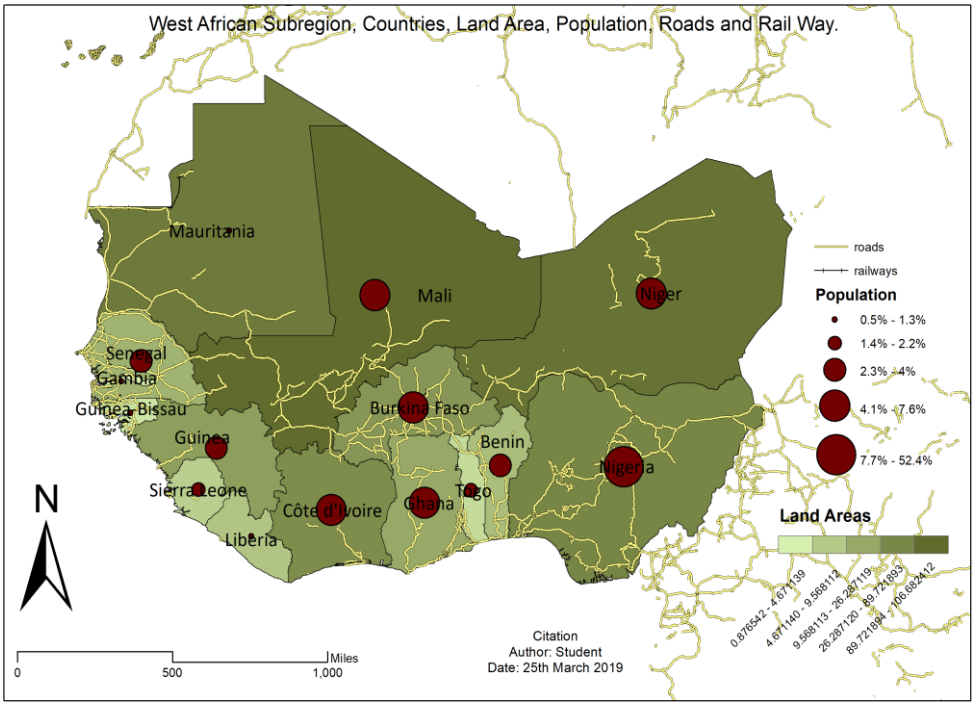

Figure 3: Map of West Africa sub region, countries, land area, population, roads, and railway

West African Train stations, Air and Seaports

The correlation between economic growth and transportation is well-established, since transportation plays a crucial role in facilitating the efficient functioning of the economy. It accomplishes this by effectively integrating the various inputs utilized in the manufacture of goods and services, as well as ensuring the timely delivery of outputs from the manufacturing process to customers (Fang and Han, 2000). The provided map illustrates the spatial distribution of airports, seaports, and train stations across the West African region, along with their respective host countries and the corresponding estimates of Gross Domestic Product (GDP). Google Earth served as the principal means for determining the coordinates and positions of the ports and stations depicted on this map. The geographical features were identified, marked, and extracted from Google Earth, and subsequently transformed in ArcMap. Each point was then allocated appropriate symbols to accurately represent their corresponding characteristics in the physical environment. The African base map served as a point of reference for the layover. The map exhibits a distinct shading technique that effectively represents the variations in GDP. Additionally, a lighter shading is employed to provide visual contrast to the diverse symbols utilized throughout the map. Countries are appropriately designated with clear labels to effectively communicate to map users the identities of the countries and the associated characteristics they possess. The map can be readily and efficiently deciphered by utilizing the map legend, which provides a comprehensive and illuminating comprehension of the map. Furthermore, the map is oriented towards the north, adhering to the standard practice observed in (GIS) maps. Additionally, the map is accurately drawn to scale, ensuring proportional representation of the depicted features.

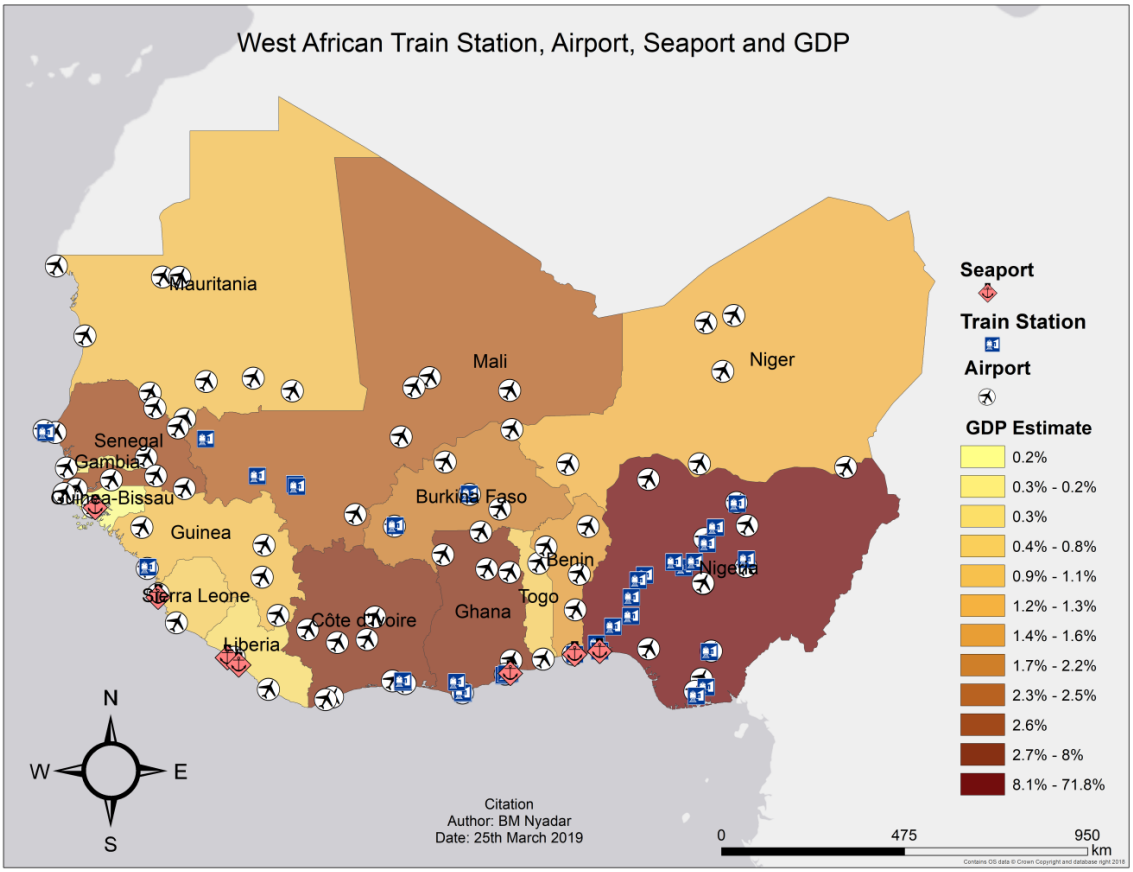

Figure 4: Map of West Africa presenting known train stations, airport, seaports, and GDP

DigitalElevation Model of FCT, Nigeria.

The process of mapping land surface elevation plays a crucial role in the fields of planning and development. It facilitates a comprehensive understanding of many natural phenomena, including vegetation distribution, valley formations, water bodies, and surface water runoffs. This knowledge serves as a valuable resource for making informed decisions on land use and allocation (Kobrick and Lulla, 2001). The provided map represents a Digital Elevation Model (DEM) showcasing the topographical characteristics of the Federal Capital Territory in Nigeria. It serves the purpose of illustrating the elevation of the ground surface within the specified region. The primary data source utilized in this study was Google Earth. The methodology involved extracting data points from Google Earth, which included their respective longitudinal and latitudinal coordinates as well as altitude. These data points were subsequently converted into a CSV file format and imported into ArcMap. Once imported, the data points were added to the existing FCT base map as x and y coordinates. The Inverse Distance Weight (IDW) method was employed in ArcMap, utilizing the Spatial Analyst and 3D Analyst tools. This facilitated the calculation of the IDW values, which were subsequently used to generate contours of the measurements. Finally, the contours were labelled to create the ultimate map. The map legend displays a range of altitudes, spanning from 120 to 960 meters above sea level. These altitudes are represented by black curvilinear lines and are differentiated by varying shades of green, light brown, and purple-grey. The dark green colour symbolizes lower elevations, maybe indicating grassland areas. Conversely, the lighter brown and purple-grey shades reflect higher altitudes, potentially denoting elevated rocky terrain or mountain peaks. The boundaries of the six districts of the Federal Capital Territory (FCT) are depicted by the red boundaries.

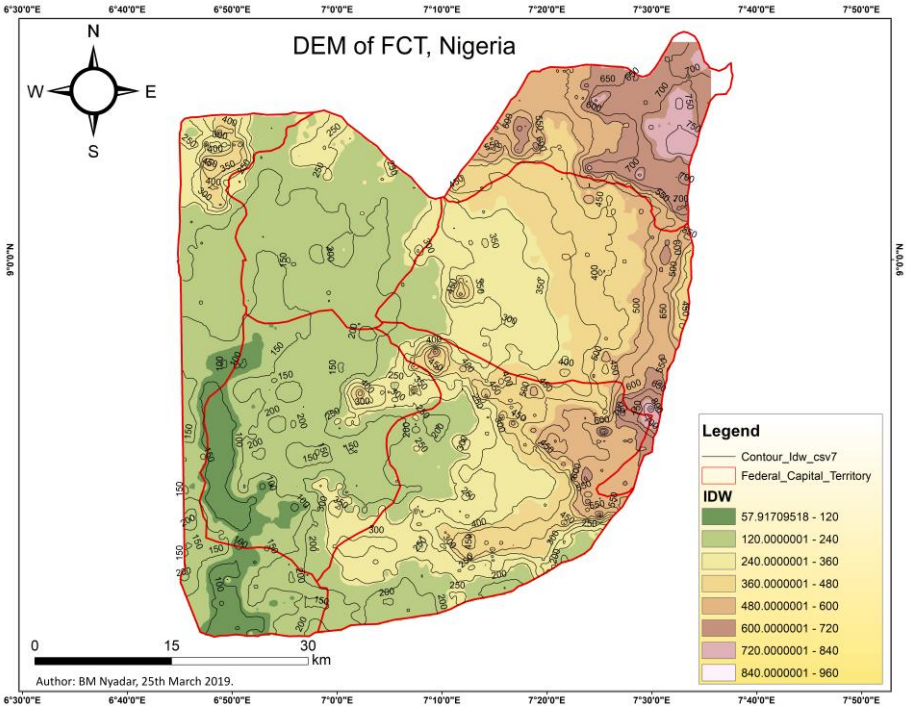

Figure 5: Elevation map of the Federal Capital Territory, Nigeria (source: Birmah MN, 2019)

Street Map of Wuse District Abuja:

This map shows a simple street view of a part of The Wuse District Area in Abuja, Nigeria. It was created to show the Location of banks, federal establishments, hotels, schools, waterways, green parks and gardens. This was done by extracting alike features unto different layers from Google map and then importing them into Arc map. Following, a street base map was added for proper location and geo-referencing as base maps are commonly used for location purpose and to share all variety of data, including narratives, associated with places (Caquard, 2014). Points were then allocated different symbols and colours to differentiate the features, the polygons representing the parks and garden were shaded green to depict natural representation as it is on the ground and the line which represents waterway was shaded blue. Thereafter, adequate labelling was done. The map title clearly introduces the map and the legend shows a detailed structure of the map features for easy reading and understanding.

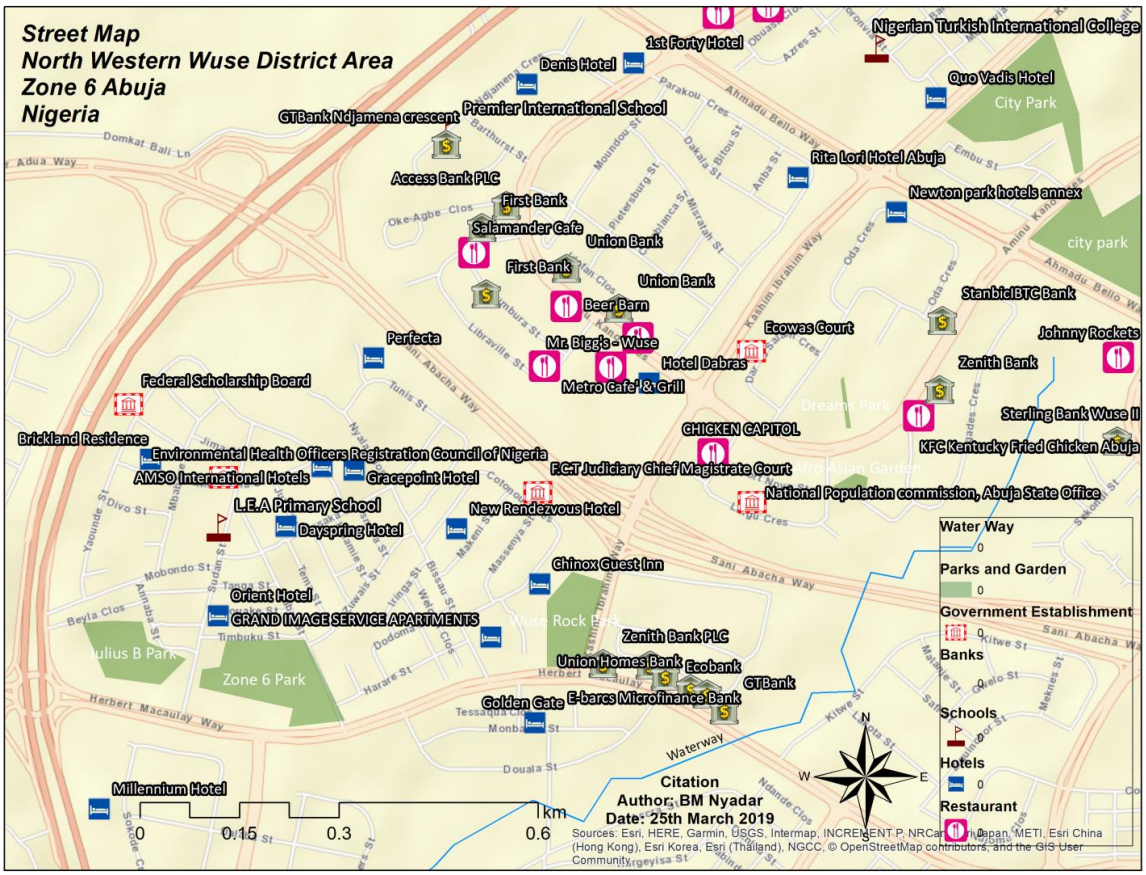

Figure 6: Street Map of Northwestern Wuse district area, Zone six, Abuja (source: Birmah MN, 2019)

Land surface Permeability Volume

The Federal Capital Territory (FCT) in Nigeria is now experiencing significant urban growth and expansion. This phenomenon has resulted in substantial changes in land use and land cover within the region. Consequently, these adjustments have had notable effects on several environmental processes, particularly hydrological processes such as surface runoff and groundwater dynamics. The provided map serves to illustrate the amount of land surface permeability in the 3-armed zone region within the Abuja Municipal region Council. It leverages Google Earth to obtain a satellite picture of the area and categorizes the different land cover types based on their multispectral features. There are seven distinct classifications of land cover that have been defined based on their varying degrees of surface permeability, ranging from the least permeable to the most permeable. The legend effectively illustrates the varying levels of surface permeability, with areas characterized by tree cover, bushes, grasses, and exposed soil exhibiting high permeability, while pavements, rocks, and rooftops exhibit lesser permeability.

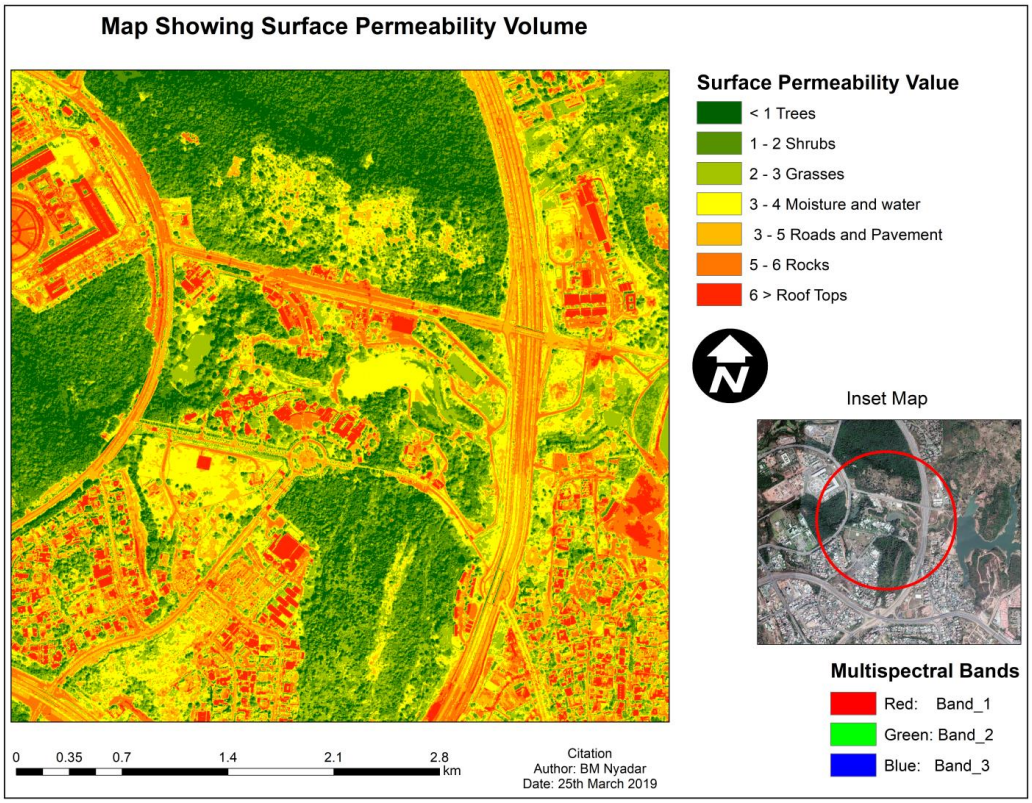

Figure 7: surface permeability map of part of three-armed zone Abuja

CONCLUSION

It can be seen that a cartographic portfolio is a valuable tool that showcases expertise in cartography. It demonstrates skills relevant to map design, data visualisation, and Geographic Information System (GIS). Building a cartographic portfolio encourages continuous learning and improvement in cartography for students and professionals by enhancing jobs like urban planning and environmental science. It is a good source for storing data visually and to keep records and demonstrates the ability to communicate complex information effectively. A well organized and visually appealing cartographic portfolio can be a powerful tool for informed decision making.

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