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SITE SUITABILITY SELECTION FOR FUTURE ESTABLISHMENT OF SECONDARY SCHOOLS IN MUBI NORTH LOCAL GOVERNMENT AREA OF ADAMAWA STATE, NIGERIA: THE GEOGRAPHIC INFORMATION SYSTEM APPROACH.

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ABSTRACT:

The objective of this research work is aim at providing reliable information to land-use planners, it offers almost limitless opportunities for intelligent land-use allocation using Geographic Information System approach. Land-use planning is a decision making process, it is a geometrical process. Therefore, planners need appropriate and reliable geographical information to enable them make sound decisions relating to sharing of various competing land-uses. Thus, the end product of the GIS will be part of an Educational Decision Support System that provides the user with a map of Mubi North with focus on the schools locations and future sites for establishment of secondary schools with additional related information to assist decision-makers in either expanding current school or suggesting sites for new schools in Mubi North, and also, for student and resources location/allocation. The aim of the research was achieved through identification of private and public secondary schools in the study area, mapping the secondary schools in the study area, carrying out Buffer Analysis of two kilometer from schools location. And finally Through the use of Area Distance Analysis technique that was used to proposed suitable sites for more schools in the study area.

Key words: GIS, georeferencing, buffer analysis, area distance analysis and map resampling.

INTRODUCTION

The Geographic Information System technology offers land use planners almost limitless opportunities for intelligent land-use allocation. Land-use planning is a decision making process, it is a spatial process. Hence, planners need appropriate geographical information to enable them make sound decisions relating to sharing of various competing uses, (Lynn, 1999).

The Geographic Information System can be effectively and efficiency used to provide the suitable site information that would guide one to reduce the problem of over population in schools. The use of Geographic Information System in establishment of schools and facilities management is absolutely imperative, especially given that about 80% of the data needed for healthy land-use planning and management is space related (Lynn, 1999).

Selecting the most appropriate site for a school is an important consideration for a school district and the school community. The location, size and shape of a school site can materially affect the educational program and opportunities for students, because according to Umor (2009), certain urban centers are favored in the allocation of schools and staff at the expense of others. What is even more alarming is the correlation, which these observers claim to exist between quality of facilities and academic performance. Bent (2006) reported that, an important principle underlying good school site selection is central location, easily accessible and convenient to the area from which the majority of the school population will be drawn. Although desirable, sometimes it may be necessary to modify the location to satisfy other conditions, such as the quality of the route environment, site elevation to avoid drainage from surrounding areas and adequately pitched to

shed its surface water quickly, when land is unavailable in the center of the service area etc. In his words, Umor (2009), however, noted that certain urban centers are favored in the allocation of schools and staff at the expense of others. Writing on poor performance of students in public examinations in the rural communities where classrooms are over populated due to lack of equal distribution of schools, Ezenmuh (2009), stated that in many developing nations in Africa certain physical facilities are none existent, and that those instances where amenities are available many are of sub standard and are mostly found in urban centers. What is even more alarming is the correlation, which these observers claim to exist between quality of facilities and academic performance. Lamenting on the glowing inadequacies of school facilities in our educational industry, Akinkugbe (1994) opined that everywhere you look, primary, secondary, special, technical, tertiary, there is abundant evidence of crippling inertia, criminal neglect and a pervasive decay in values and standard.

One of the prime objectives of this study is to identify suitable sites for future establishment of secondary schools base on distances from settlements within the study area.

The problem of inadequate distribution of schools' facilities in the study area has been identified in the foregoing passage. Another reason for the proposal is due to absent of secondary schools in some of the settlements and also the walking distance involved in moving from some of the settlements to schools in the study area.

This study has come up with a proposal for future establishment of secondary schools in the study area using Area Distance Analysis, Population and Accessibility as variables to propose more schools in the study area.

Materials and Method:

Trips were made to all the schools in the study area and coordinates of each school were obtained using Handheld GPS Receiver (Germin 75S). The digital base map was obtained by digitizing the topographical map of the study area. A list showing the private and public secondary schools in the study area was obtained from the state Ministry of Education (Mubi Zonal Office). In digitizing the feature classes, digitized map was used to map the features classes. First, it was downloaded from the internet so that the satellite image could be seen for accurate mapping. The satellite image was georeferenced this was done so that the image will possess the characteristics of the physical ground. The digitizing exercise then started by adding the layers that were created in Arc Catalog. The start editing was activated in the editor tool and features classes were digitized by selecting the "create New Features" in the Task drop-down menu. The red pencil icon was clicked and the pointer becomes a small crosshair symbol.

Map Registration/ Georeferencing

Registration of a map needs to be performed each time a new map is loaded before it can be used for data extraction. Rectangular coordinates called control points were used. These points are usually well spread apart, for example points chosen from the corners of the map were used for registration. Depending on the software in use a minimum of four points are required.

The coordinates of these points were entered in and used to georeference the map. For this project five points where used to georeference the map and a Root Mean Square (RMS) of 0.1m was obtained. The Root Mean Square error is given in both page units and in Map units to maintain highly accurate geographic data the RMS error should be below 0.004 inches or its equivalent measurement in the coordinate system being used.

Map Digitizing

Digitizing is the process of transforming data from analogue format such as paper map to digital format so as to allow storage, such as "buffer", "area distance analysis", etc were used for the analysis. i.e. the "buffer analysis, area distance analysis and visualization in a digital environment such as a computer environment. For the purpose of this study, on-screen digitizing technique was employed. Each theme/layer was digitized so as to distinguish one theme/layer from other layers.

Data Analysis

One of the significance of Geographic Information System software is their capability to carry accurate analysis. Arcview 3.2a was used to analyze the data that was generated from the geospatial database; some tools of the software" was used to determine from the map of the study area 2km walking distance as displayed in figure 2 and figure 3.

Feature Data Class Creation

In this project Arc View 3.2a software was used for this aspect. A folder was created in drive c and Geodatabase was also created in this folder that is in ArcView and was named Mubi North Project Geodatabase and feature dataset was created in that same Geo database and named Mubi North dataset. Projected coordinate system was selected with the name Minna_UTM_Zone _33, with datum name D_Minna for the feature dataset. In this feature dataset, feature classes were created namely, Road, Settlemenst, Schools and River. For example, for each of these feature classes, the types of features stored were selected as

School as Point Feature, Road as Line Feature, and Settlement as Polygon Feature

Plotting the Coordinates

The coordinates of the schools were copied in notepad and saved as a .txt (plain text) file format. The coordinate used is shown in table 1. The following steps were taken to import the files into Arc Map:

- In the main bar "tools" was right – clicked, a dialog box appeared and the "Add XY Data" was selected.
- The "Add XY Data" window appeared and the browse to folder button was clicked. The folder in which the school coordinates file was saved was browsed and added.
- The space for the X and Y coordinates (i.e. easting and northing) were specified and the coordinate system of the input coordinate was selected, applied and ok.
- The locations of the schools were automatically added to the map as points feature.

Data Manipulation

Different software was used in order to manipulate the various data effectively. These included: Corel Draw 12, Arcview 3.2a, Picassa 9.2 and Microsoft Word 2003. The Universal Transverse Marcator (UTM) coordinates of all the schools were used to develop the geospatial database for the purpose of this study.

The map of the study area which was scanned using HP scanner and later inputted into Corel Draw 11 for proper adjustment and after which the map was exported into Arcview 3.2a where it under went georeferncing and resampling. The map was resampled in order to select the area of interest. This was done so as all the schools will fall in their respective ground locations. Geo-database file was created in ArcView3.2a environment after geo-referencing and resampling of the base map. A theme (shape file) named "geodatabase" was created, this was done via the toolbar menu. On the toolbar menu "view" was clicked, on the scroll down box that appeared "new theme" was selected and "point feature" was ticked. On the database table, fields were added based on the number of attribute data that were used. In selection of fields, each field was given either "text", "number" or "double". For those fields that have to do with words a "text" format was assigned to the fields while those that have to do with figures "number" format were assigned respectively. After assigning of either "text" or "number", the fields were also given precision values based on the length of the attribute inputted in to various fields, i.e short integer or long integer. Some prominent features on the map were digitized as theme ("shape file") using on-screen digitizing capability of the ArcView3.2a software.

The attributes of all the schools' facilities and the population of each school within the study area were used to generate the geodatabase. These were linked to the cartographic (photographs) view for subsequent analysis.

On the ArcView 3.2a GIS software menu bar, "theme" was selected on the drop-down box that appeared "create buffer" was selected and "features" was also checked too. 2,000 meters was assigned in "distance box" and "dissolve barriers" between the buffer circle, the "yes" box was checked finally "finish" bottom key was accepted so as to complete the "create buffer" process. Similar method was employed in carrying out Area Distance Analysis using 2km (2,000 meters) as specified distance.

Discussion

To achieve the objective of identify suitable sites for future establishment of secondary schools base on distances from settlements within the study area, the whole secondary schools (private and public) in the study area were analyzed as shown in figure 2 and figure 3. Figure 2 shows the 2km buffered secondary schools (private and public) in the area. And figure 3 carried detailed geometric descriptions of suitable sites for future establishment of secondary schools in the study area.

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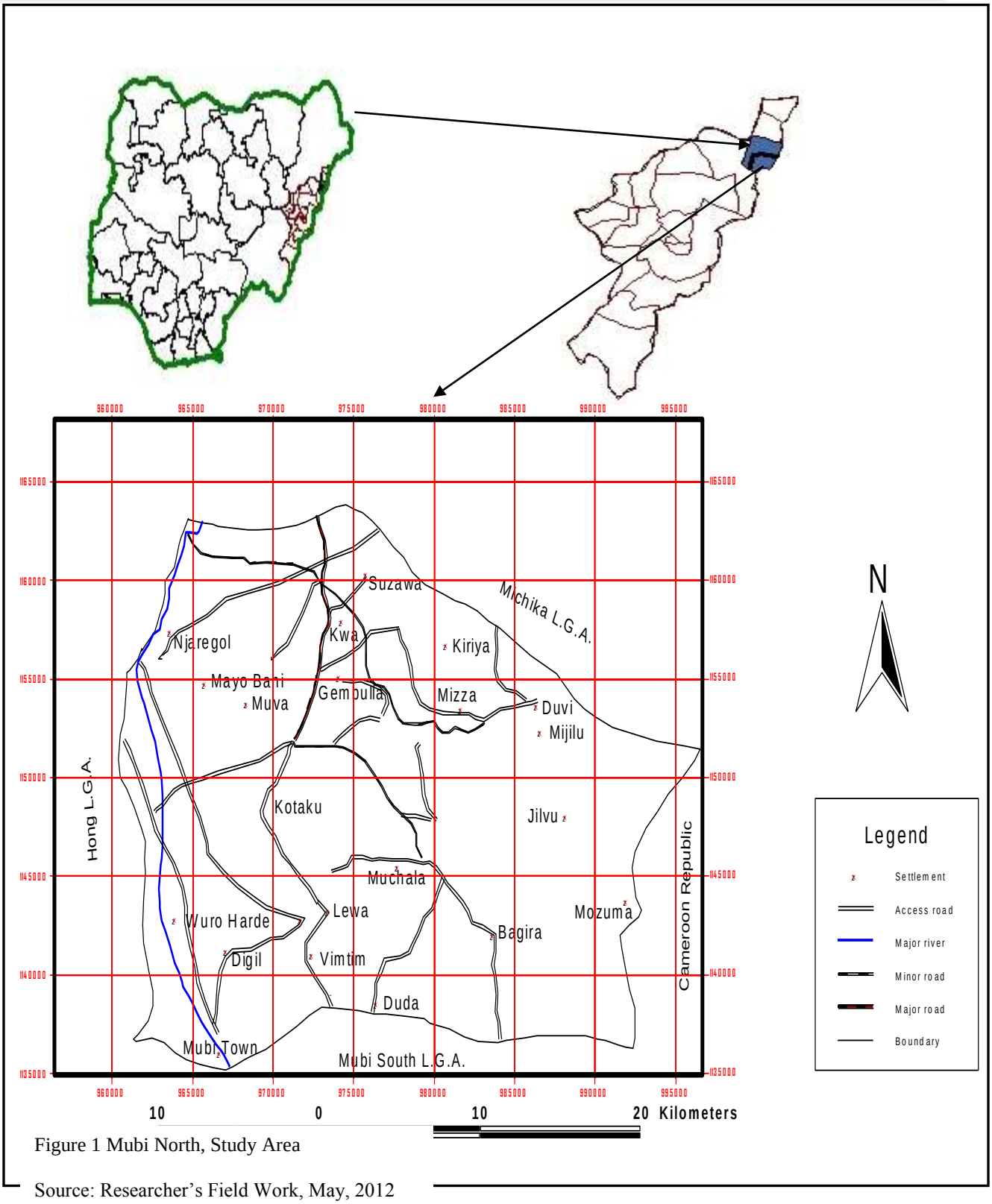

Figure 1 Mubi North, Study Area

Source: Researcher's Field Work, May, 2012

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All the secondary schools in the study area were buffered at a distance of 2Km away from each school location so as to know whether the existing secondary schools were situated very far from the targeted settlements. In other words, the Buffer Analysis was carried on all the existing schools in the study area so as to know whether the existing schools were situated following the Local Education Authority (LEA) and the Universal Basic Education (UBE) standard. The result of the analysis shows that most of schools were located in the right places with the exception of Mayo-Bani, Betso and Digil that were located far from the surrounding settlements, as clearly shown in figure 2 below.

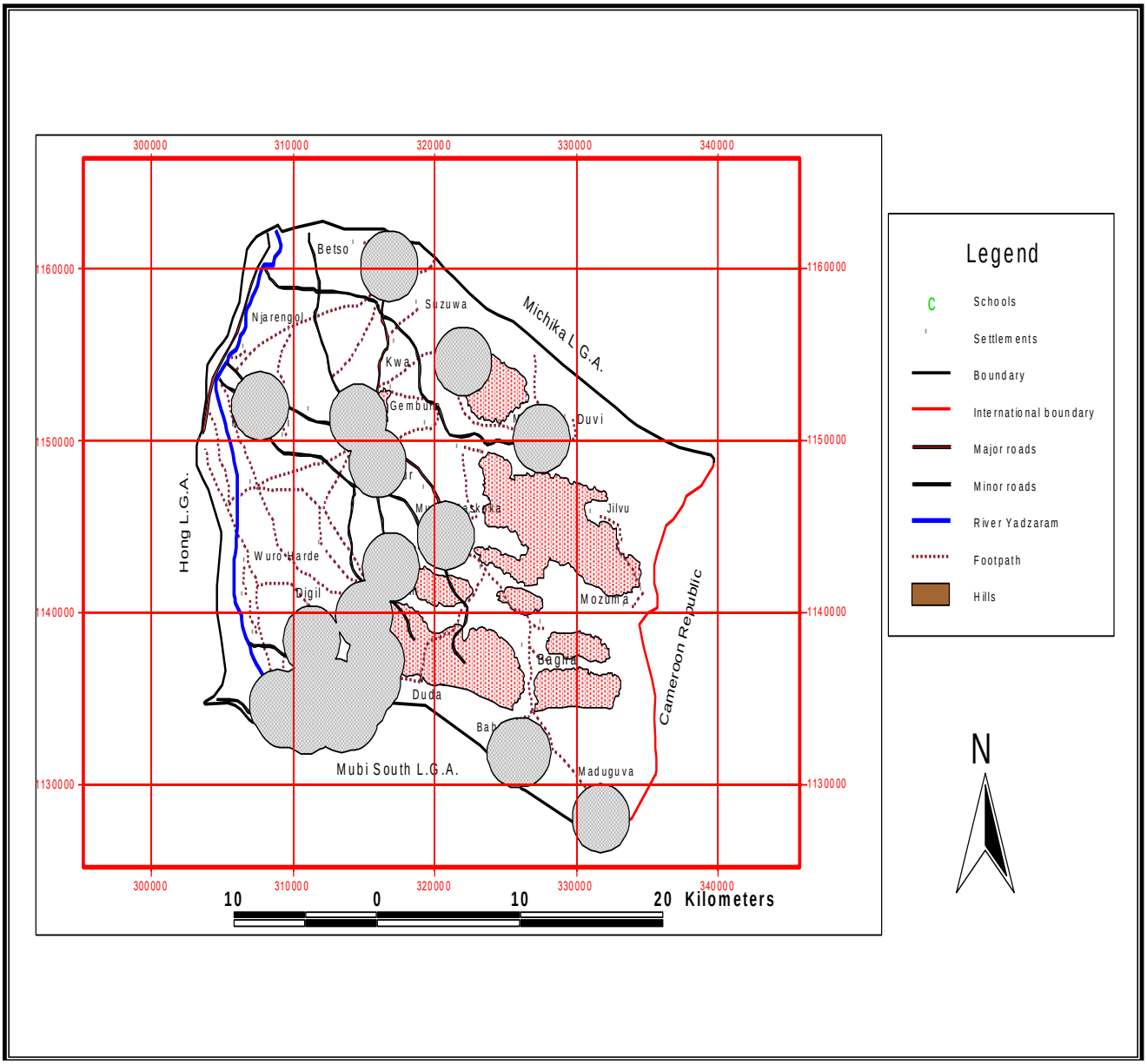

Figure 2 Distributions of Buffered Schools to a Walking Distance of 2Km.
Source: Researcher's Field Work, May, 2012.

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By mere looking at figure 1 above, user will understand that most of the existing private and public schools are concentrated in Mubi main Town, whereas in the out sketch schools are sparsely distributed this is due to the sparsely distributed rural population and the physical terrain in the area.

To balance the inadequacy of schools distribution in the study area, distances to schools from settlement were calculated using Geographic Information System technique referred to as "Area Distance Analysis". The result of the analysis are represented in circular or ring form, each circle or ring are distinguished with a unique color that are graduated in meters of 1923.098 (2Km) gap between each color. The white ring around each settlement are all measured in 1923.098m which is approximately 2Km each while other rings are more than 2km. Following the Local Education Authority (LEA) and the Universal Basic Education (UBE) standard; that secondary schools must not exceed the walking distance of 2km from point of departure and that is why this study considered all the white rings as suitable areas for future establishment of secondary schools in the study area while other colors are unsuitable due the walking distances involved. Figure 2 below shows Area Distance Analysis for location of future secondary schools in the study area.

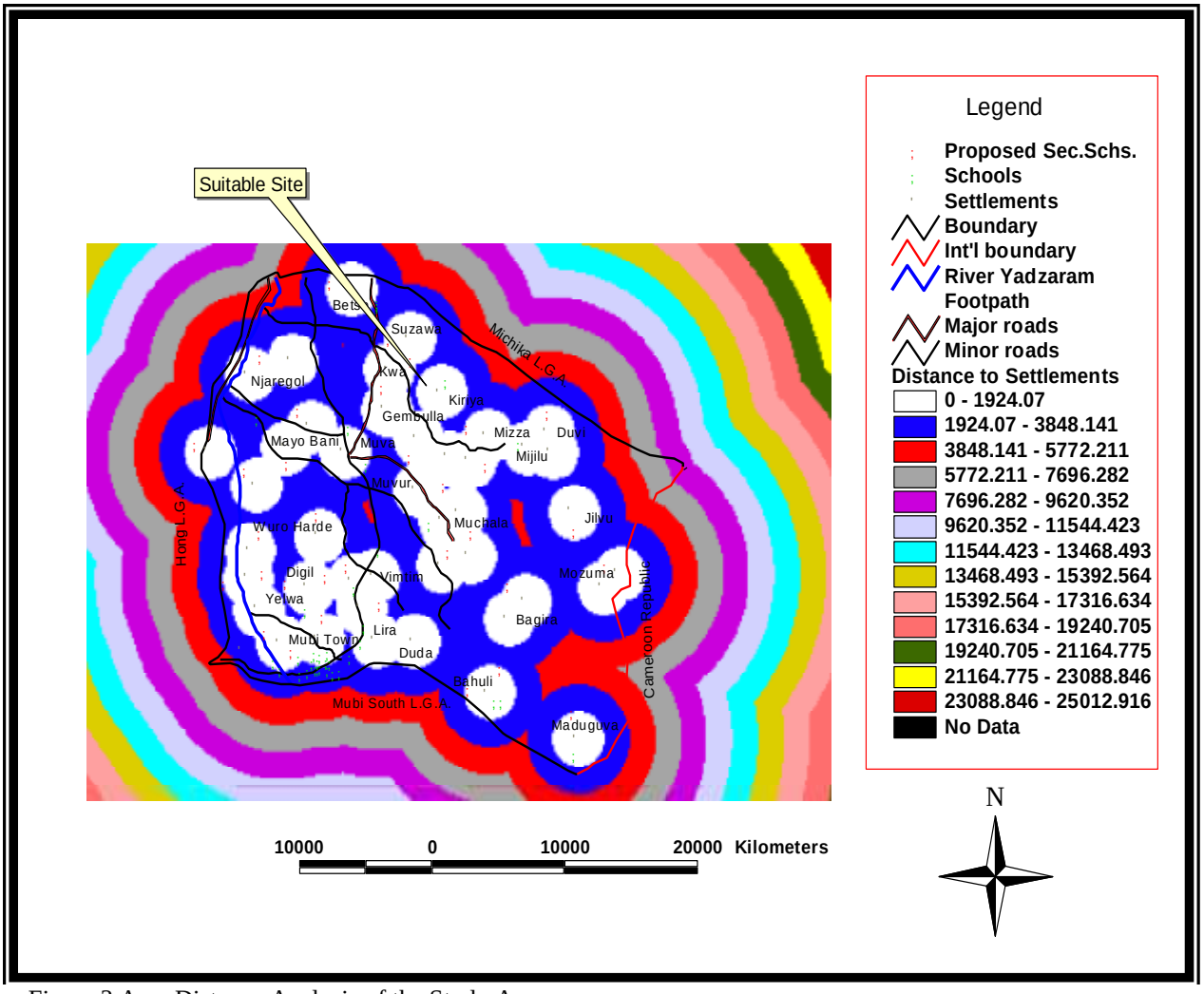

Figure 3 Area Distance Analysis of the Study Area

Source: Researcher's Field Work, May, 2012.

Field investigation revealed that a negative correlation exists between the sizes of population and the number of schools in existence. In order to determine the adequatecy of secondary schools in the study area, the 2011 Population estimate of the Local Government Area was obtained from Mubi North Local Government Area department of Primary Health Care (PHC) and data was projected to 2013 as shown in table below:

Table 1: Population of Mubi North according to political wards

Ward	Ward	PHC Population Estimate 2011	Projected Population 2013
1	Bahuli	15243	16108
2	Vimtim	13019	13758
3	Lokuwa	18141	19171
4	Kolere	14278	15088
5	Digil	15712	16604
6	Muchala	17060	18029
7	Mijilu	13971	14765
8	Yelwa	16404	17336
9	Betso	17280	18261
10	Mayo Bani	14149	14952
11	Sabon Layi	19124	20210
Total		174381	184282

Source: Mubi North L.G. PHS Department 2011 Population Estimate Projected to 2013

In projecting the wards population in table 1 above, the Geometric Growth Model (Satyagopal Mandal, 1992) formula was adopted which is: P1=P2 (R+) T

P1=Present Population

P2=Population of the base year

R=Rate of growth

T=Time internal

Considering the differences in population of the political wards in the study area, the research considered an area with a population of about 2000-3000 to have a secondary school in accordance to Universal Basic Education (UBE) and Local Education Authority (LEA) standard (Ejieh, 2009).

Considering accessibility as a basic factor in the location of schools, where Schools should be located either adjacent or close to major or minor roads for proper functioning of schools activities (APHAC, 1960), all the proposed schools shown on the map developed (figure 3) are located on accessible sites so as to achieve the educational goal of the study area as ensured in the Nations National Policy on Education

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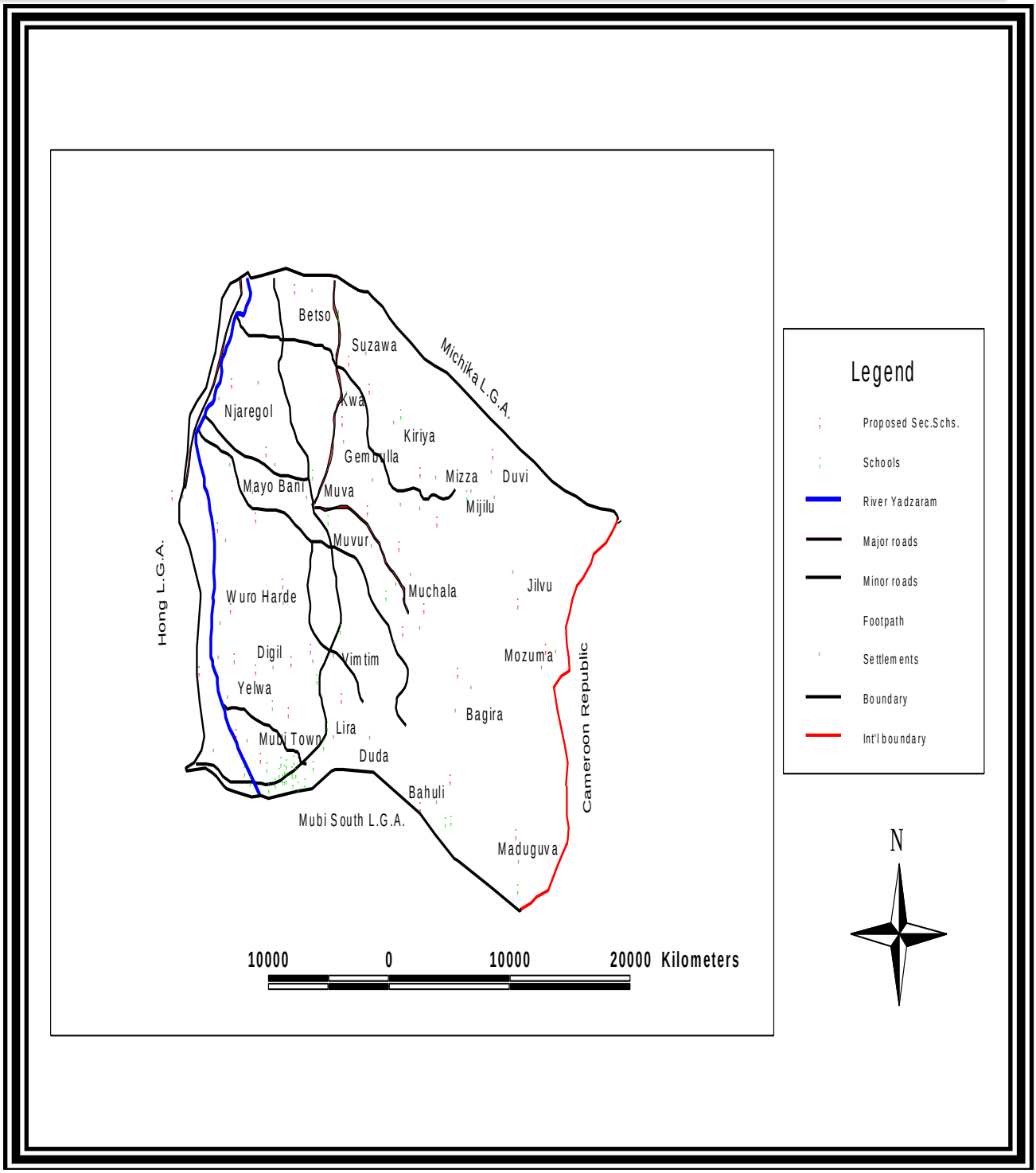

Figure 3: Proposed and existing Secondary Schools in the Study Area.
Source: Researcher's Field Work, May, 2012.

CONCLUSION

Geographic Information Systems (GIS) is a commonly used tool for environmental management, modeling and planning. The study has tried to demonstrate the capability of an interactive GIS technique in site suitability selection for future establishment of secondary schools in the study area. It is obvious from the study that GIS is the most convenient tool to use in the monitoring and management of the environment. Through GIS approach, the whole existing schools in the study area were mapped and proposed sites for more schools that will meet the demands for schools in the study area.

REFERENCES

1. Akinkugbe, O. O. (1994). Nigeria and Education: The Challenges Ahead. Intec Printers Limited, Ibadan-Nigeria.
2. Bent, G. (2006). Site Suitability for Establishment of Junior School in South-East Kenya. Elexander
3. Ezemuh, N. (2009). The Challenges of Unequal Distribution of School Facilities in South-East Nigeria. Educational Management and Administration, 2(2).
4. Lynn, L.M. (1999). Creating large digital maps for municipal planning applications using desktop GIS- The_penang Experience. 6th Esri South Asia Users Conference, 8-10 Sep. Penang Malaysia
5. Igbuzor, O. (2006). The State of Education in Nigeria: A Keynote Address Delivered at Roundtable organized by Civil Society of Action Coalition on Education for All (CSACEFA). Retrieved from: www.dawodu.com/Igbuzor 14.htm, (Accessed on July 15,2011).
6. Satyagopal M. (1992). Department of Mathematics University of Kansas.
7. Umor, M. (2009). The Contempory Challenges of Poor Educational System in Akwa-Igbom State. Journal of Education Research 1(2).