APPLICATION OF REMOTE SENSING AND GIS IN REVISING TOWNSHIP LOCAL AND POLITICAL WARDS MAP: A CASE STUDY OF MUBI METROPOLIS

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Abstract
The progressive concentration of population in urban unit leads to physical and social transformation of our urban centers. In which man's every day activities results to rapid change of urban landscape. This make maps produced some years back soon lack details of recent development. Hence, map revision - the process of updating earlier maps becomes necessary so as to incorporate recent changes in the landscape. This research explored the potential of high resolution satellite sensor imagery and GIS for the updating wards map of Mubi metropolitan area. The materials used for this study include HP Laptop Computer HP 530 an HP colour printer, hand held GPS (Garmin 72) and Genx A4 hardware. ILWIS 3.1 Academics was used for geo-referencing and Arcview 3.2a for digital mapping while Idrisi was used for overlay, calculation of area and map analysis. The study found out that the entire Mubi metropolitan area was a single political ward sub-divided into 16 local wards in1975. By 2005, the number of political wards expanded to 8 while the local wards increased to 32.This indicates that Mubi metropolis is experiencing a rapid spatial growth. It was recommended that revision of township wards maps should be embarked upon as often as possible by mapping agencies like ministry of survey. Also the use of remotely sensed data should be adopted for mapping and updating of township maps by surveyors.

Keywords: wards, updating, remote sensing, gis, mubi metropolis.

Introduction

Ward is an electoral district within a municipality used in local politics. Cities are usually divided into wards, each containing a number of precincts, for the purpose of electing members of council. Wards are usually named after neighborhoods, thoroughfares, parishes, landmarks, geographical features and in some cases historical figures connected to an area. A number of wards make a city which makes district which make state which make country. http://wiki.answer.com

Musa (2006) reported that from every day activities of man the landscape changes rapidly. Based on this reason therefore, maps produced some years back soon lack details of recent development, hence, map revision; the process of updating earlier maps, is necessary so as to incorporate recent changes in the landscape. Over the 35 years, Mubi metropolitan area has expanded in population and structure. This makes it necessary to update the local and political ward map of the metropolis.

Satellites are capable of being used for the purpose of map updating. Holland et al (2006) noted that high resolution satellite sensor imagery has a role to play in the update of township mapping, especially in the detection of change. According to Olaore (2004), high and accelerating rate of the township changes and township area extensions, particular in developing countries, calls for an efficient and fast technique for mapping the urban changes with the required accuracy for updating the existing maps. The availability of the new generation satellite imageries have opened a new era and signaled promising futures for producing and updating digital maps. This

research explores the potential of high resolution satellite sensor imagery and GIS technique for the updating of local and political wards map in Mubi metropolitan area.

Statement of the problem

Keates (1973) made it clear that map revision is an important factor in virtually all types of map production. Therefore, once a map is produced, the graphic image is static; there is a constant need to provide the map with information on changes and at the same time reducing or avoiding this defect. This however, has to be set against the value of having a permanent graphic image for use and the fact that much of the information on the map will remain valid for relatively long periods, even though some items will have changed (Olaore, 2004). High and accelerating rate of the township changes and township area extensions, particular in developing countries, calls for an efficient and fast technique for mapping the urban changes with the required accuracy for updating the existing maps. The availability of the new generation satellite imageries have opened a new era and signaled promising futures for producing and updating digital maps.

The existing map of Mubi which was published since 1975 has not been revised till date. Attempt at map revision are crippled by the lack of recent aerial photos. This means that all the developments and changes that have taken place since 1975 still remained unmapped. Moreover, most of the existing maps are not registered onto any projection system which makes it difficult to ascertain the coordinate points on the map. Hence calculation of area and distances of which is highly needed for georeferencing are difficult if not impossible on the map. The fore mentioned factors necessitate the present work which is aimed at producing a revised local and political ward map of Mubi metropolis.

Study Area

Mubi metropolis as a geo-political area comprises of two Local Government Areas; Mubi North and Mubi South. According to Adebayo, (2004) the area is located between latitudes 10° 30' and 10° 05'N of the equator and between longitude 13° 10' and 13° 30'E of the Greenwich meridian. It occupies a land area of 192,307Km and support a total population 260,009 people (National Population Census 2006).

Mubi town originated as a farmstead founded by Fali and Gude peasants who settled to cultivate the fertile plains of River Yadzeram. The influx of Fulani cattle rears in the 18th century and merchants in the 19th century increased the native peasant population (Tini, 2001). This resulted to the emergence of several hamlets in the vicinity. Mubi Township came into existence on 1st April 1936 by amalgamating the village units of Lokuwa, Wuro Gude, Kolere, Shuware and the hamlets of Wuro Alkali, Wuro Bulude, Wuro Hamsobe and Wuro Yombe. These settlements were merged to form a central administrative setup called Jimilla. The predominant ethnic groups found the metropolis include Fali, Gude, Fulani, Marghi, Higgi, Njanyi, Kilba and Hausa, who mostly dwell in the same ward. The dominant religions of the people are Christianity and Islam.

The growth of Mubi town is traced to the agricultural, administrative, and commercial functions it performs. By 1902, Mubi was a German base from where the neighbouring tribes (i.e. Fali, Gude, Kilba, Higgi, Margi and Njanyi) of the region were subjugated. On 1st April 1960, Mubi was made Native Authority headquarters. The same year, July 1960, the town became provincial headquarters of the defunct Sardauna province. In 1967, Mubi was made L.G.A headquarters while in 1996, the town was splinted into Mubi-North and Mubi-South Local Government Areas. Currently, the town is the seat of Mubi

Emirate Council and the headquarters of Adamawa-North Senatorial District.

Mubi is geographically well placed and functions not only as center of commerce in the region but also extends its sphere of influence to countries such as Cameroun, Central Africa Republic and Chad. Numerous banks, filling stations and hotels exist in the town to support the commercial activities.

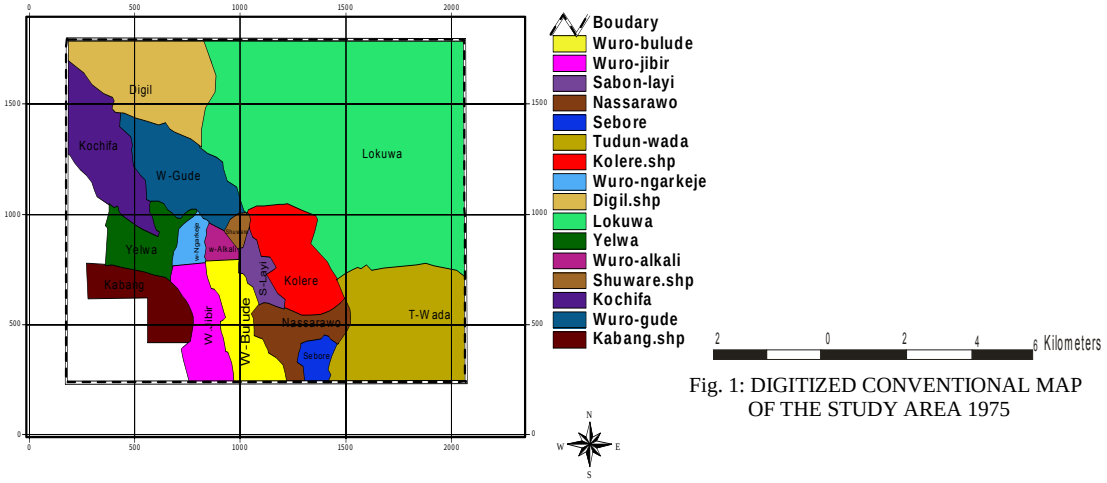

Fig. 1: DIGITIZED CONVENTIONAL MAP OF THE STUDY AREA 1975

Fig.2: SATELLITE IMAGE OF THE STUDY AREA.
Source: QUICKBIRD (2005)

METHODOLOGY

Description of Materials

A HP Laptop Computer HP 530, HP colour printer, hand held GPS (Garmin 72) and Genx A4 Scanner were the main hardware used for this study. The software packages used were of two categories: the GIS and non-GIS packages. The GIS software packages were ILWIS 3.1 Academics for geo-referencing and Arcview 3.2a for digital mapping while Idrisi was used for overlay, calculation of area and map analysis. Other non-GIS Software packages includes CorelDraw 12 for map scanning and map export to ILWIS, Microsoft word 2003 for typing and other text formatting processes.

Sources of Data

Two data types were sourced by the researchers in order to achieve the desired aim and objectives. The data sources area summarized in Table1.

Baseline Data

Table 1

S/N	Data Type	Data Source	Date	Other characteristics
1	Mubi Metropolitan Map	Federal Ministry of Survey, Lagos	1975	
2	Satellite image of Mubi Metropolitant	QuickBird	2005	Multispectral Resolution (24m), Band: Multispectral Panchromatic, Format: Geo TIFF

Georeferencing

The researchers took the GPS reading of two round-abouts (police round-about and Lokuwa round- about) and two road junctions (Maiha road junction and Gella road junction) for the purpose of geo-referencing the conventional map and satellite imagery.

In order to geo-reference the satellite image, four identifiable points on the ground were visited. The points include police round-about, Lokuwa round- about, Maiha road junction and Gella road junction. In each of these points, the GPS was turned on and coordinates were observed and recorded. The coordinates picked were 10° 15 52.89"N, 13° 16’ 10.51"E (police round-about) 10° 16’ 23.86"N, 13° 16' 40.48"E (Lokuwa round-about) 10° 16' 08.53"N, 13° 15' 10.71"E (Maiha road junction) and 10° 15' 48.78"N, 13° 16' 30.22"E (Gella road junction). The coordinates were transformed to Universal Transverse Mercator (UTM) through the transform module of Ilwis 3.1 to create the geo-reference points. Geo-referencing ensures that coordinates of pixels in the image correspond to the true coordinates of the points they depict on the ground. The minimum ‘‘X’’ and ‘‘Y’’ values of 306150.24, 1139028.81 and maximum values of 314191.88, 1139332.43 respectively were selected and used for map boundary creation. The four points picked with GPS were identified on the satellite image and used as tie points for geo-referencing. The referenced satellite image was then resampled using the georeferenced corners of the image and some points were again picked on the ground and were compared with the same points on the referenced map and found out that the coordinates on the ground corresponds to the coordinates on the map. This is called *ground truthing*. The image was then exported to Arcview for digitizing.

The conventional map of Mubi was scanned using the Genx scanner through CorelDraw 12 and imported to Ilwis environment via *Tagged Image File-TIFF* and the map was geo-referenced using the four point corners of the map as tie points. The referenced map was then resampled using the minimum and maximum coordinates of the resampled satellite imagery that the two maps (conventional map and satellite imagery) can have the same resolution and rows/columns for the two maps to overlay; they were then exported to Arcview environment for digitizing.

Digitizing

The roads on the satellite imagery were digitized as line features through the digitizing modules of Arcview by creating independent thematic layer for each of the digitized features on the satellite imagery. That is tracing the roads. The ward boundaries (local and political) were also digitized as polygon through the same

digitizing modules of Arcview. Some of the boundaries were identified by field survey and information from the ward heads. Each thematic layer was then edited to eliminate digitization error.

Results and Discussion

Revision of the Wards Boundaries

The 1975 boundary lines of political and local wards in Mubi metropolis has been revised in this study. In 1975 had sixteen (16) local wards namely; Kolere, Sabon-Layi, Sebore, Lamorde, Kabang, Digil, Yelwa Kochifa, Wuro-Ngarkeje, Wuro-Gude, Wuro-Alkali, Wuro-Jibir, Wuro-Bulude, Tudun-Wada, Nassarawo and Lokuwa (Fig. 3).

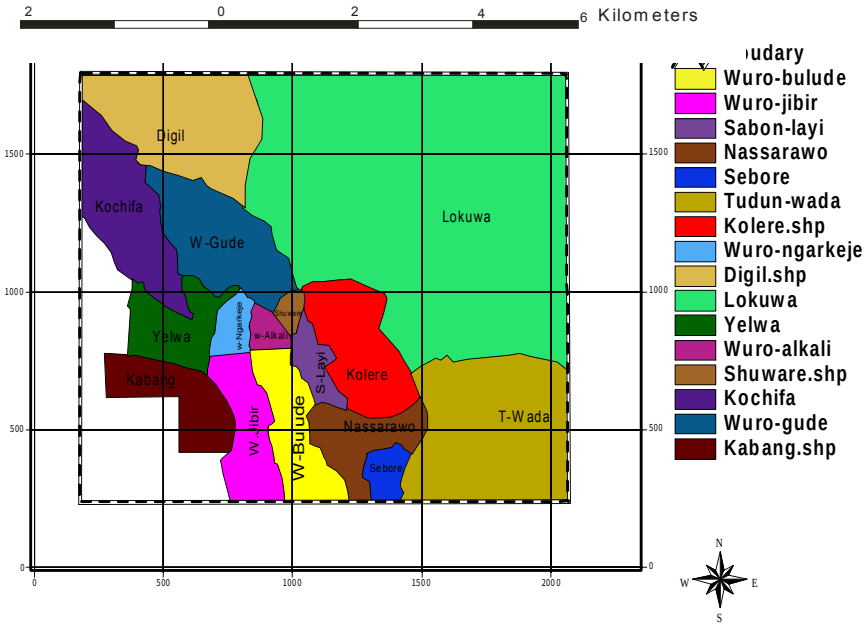

Fig. 3. Mubi metropolis Local Wards, 1975

All of the wards in figure 3 existed as a single political ward in 1975. But in 2005, the political wards increased to eight. The newly created wards include Lokuwa, Kolere, Sabon-Layi, Nassarawo, Gude, Lamorde, Yelwa and Digil (Fig. 4).

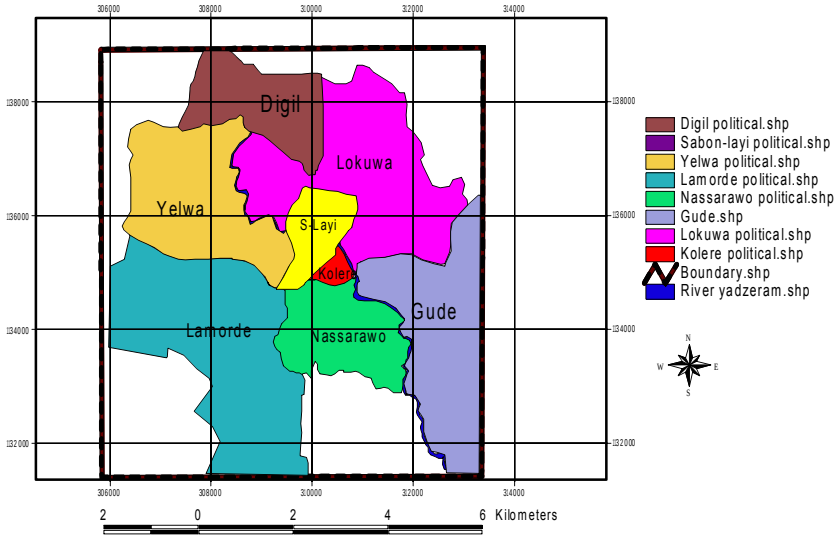

Fig. 4. Mubi metropolis Political wards, 2005

The local wards increased from sixteen in 1975 to thirty two in 2005. The new local wards include Sabon-Gari, Unguwan-rami, Saminaka, Unguwan-Kara, Arahan-Kunu, Gi'ima, Matakam, Dazala, Wuro-Harde, Wuro-Barka, Va'atita, Gi'palma, Gerewol, Shagari-Lowcost, Sabon-Pegi and Barama. See figure 5.

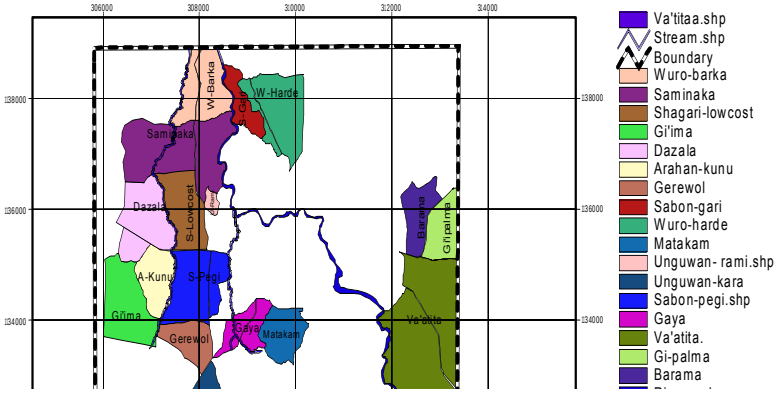

Fig. 5 Mubi metropolis New Local wards, 2005

The existing thirty-two local wards are shown in figure 6. This clearly indicates that Mubi metropolis is experiencing a rapid spatial growth. The implication of such rapid urban growth are imbalance in land use allocation, overcrowding, pollution, loss of natural resources, increased travel distance and cost of transportation and urban delinquenc.

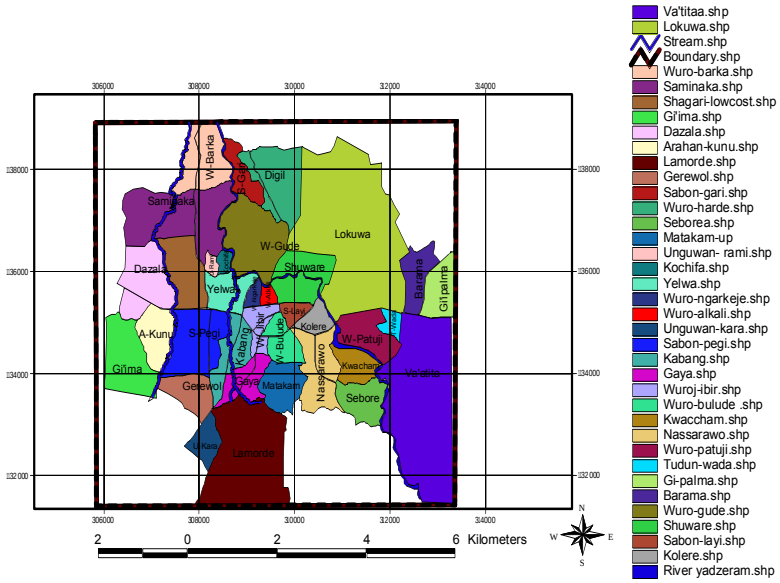

Fig. 6. The 32 Local wards, 2005

Conclusion

This research produced a revised Local and Political ward map of Mubi metropolis. The simplicity, accuracy, versatility and most importantly the convenience associated with digital mapping, especially when addressing problems associated with map revisions, will beckon all those associated with maps and map making (Musa 2006). This research also concludes that map makers should gradually embrace the integration of satellite remote sensing, Global Positioning System and Geographic Information System in map revision project. Remotely sensed data and GIS provide a reliable base for map revision especially when high resolution satellite imagery (QuickBird imagery) is used, updating of maps becomes easier and less expensive.

Recommendations

The full potential of GIS can be realized by integrating remotely sensed data in a geographic information system environment. The following recommendations are therefore made;

- The use of remotely sensed data should be adopted for mapping purpose by the relevant government authority for example, Federal Ministry of Survey.
- High resolution satellite imageries should be made available at relatively low – cost to researchers to aid in global mapping.
- Revision of township wards maps should be embarked upon as often as possible by mapping agencies such as ministry of survey so as to have current wards map of an area for further research and develop.

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