

## Change in administrative status, urban growth, and land use/cover in a medium-sized African city

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Previous studies on urban land use/cover change emphasised the role of economic forces in producing population growth and its attendant land use/cover changes, almost to the exclusion of other important factors. In spite of a swelling literature on land use/land cover changes, studies comparing these changes before and after changes in the administrative status of cities are rare. This study therefore investigates the effect of change in the administrative status of a medium-size city on the urban expansion and land use/cover change with specific interest in assessing the trends and spatial patterns of land use/cover changes in pre-capital city period (1972-1991) and post-capital city period (1996-2016) of Osogbo, Nigeria. Landsat MSS, TM and ETM+ imageries (1972, 1986, 1991, 1996, 2006, and 2016) and population data were used in this study. Maximum Likelihood Classification was employed to categorise the images into built-up areas, vegetation cover, and water bodies. The study revealed that the city was scorpion-shaped and urban development was extensive in the pre-capital years while some were filling up and intensification of urban land use was noticed in the post-capital years. While the built-up area grew at an annual rate of 2.8% in pre-capital status years (1972 to 1991), the growth accelerated in post-capital status periods (1996 to 2016) 4.7% annually. This study has shown that change in the administrative status of the city contributes to the city's land use/cover changes through accelerated expansion in areal coverage and densification of the urban land use with attendant loss of vegetation and water bodies. City managers, therefore, should consider future changes in cities' administrative role in their urban land use planning.

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Creative Commons Attribution 4.0 International License. DOI:10.5719/hgeo.2019.131.1

**Key Words:** *Land use/cover change, urbanisation, medium-sized cities, built-up areas, wetlands, administrative status, Landsat image.*

**Article Info:** Received: *July 18, 2018*; Revised: *November 18, 2018*; Accepted: *March 6, 2019*; Online: *May 31, 2019*.

## Introduction

The last half of the twentieth century has seen an upsurge in the rate of urbanisation globally which has continued to intensify in the first decades of the 21<sup>st</sup> century. According to the results of the 2017 Revision of United Nations, the world's population numbered nearly 7.6 billion as of mid-2017, implying that the world has added approximately one billion inhabitants over the last twelve years. In 2018, 55% of the world's population lived in urban areas (United Nations, 2017). The trend in the global pattern of urbanisation shows that the proportion of people living in cities in the developing world has snowballed, with a concomitant increase in the number and sizes of small and intermediate urban centres as well as megacities (Seto, Güneralp & Hutyrá, 2012; UN-HABITAT, 2016). A prominent feature of the current global urbanisation regime is the rising profiles of small and medium-sized cities as focal points of unrelenting urbanisation, resulting in an uncoordinated growth, the proliferation of slums and informal settlements, increased carbon footprint, escalating crime rate, among other externalities (UN-HABITAT, 2016). A recent statistic has shown that 59% of the world's urban population and 62% of the urban population in Africa reside in small and medium-sized cities of less than 1 million people (UN-HABITAT, 2015). If this trend continues, urban land cover will increase by 1.2 million km<sup>2</sup> globally by 2030 (Seto et al., 2012), with attendant implications on land and energy consumption, greenhouse gas emissions, and ecological systems and urban governance (Briassoulis, 2000; Herold et al., 2005).

In spite of the promise that cities hold as creators of wealth, generators of employment and drivers of human progress by harnessing the forces of agglomeration and industrialisation (UN-HABITAT, 2016), cities of the developing world have particularly been noted for uncontrolled urbanisation and its resulting land use/cover changes. Land use/cover changes are essential drivers of global environmental change (Ramankutty, 2016). Globally, natural population growth, rural-urban migration, and economic development have been identified as drivers of city growth and expansion (Sajjad & Iqbal, 2012; Seto et al., 2012; Abebe, 2013; African Urban Dynamics, 2015; Ranpise, 2016). However, in the context of the developing countries, and even former communist countries such as China, the roles administrative restructuring play in shaping urban growth, land use/cover dynamics are gradually receiving attention by researchers (Liu et al., 2012; Taiwo et al., 2014; African Urban Dynamics, 2015; Heider et al., 2016).

In Nigeria, changes in the administrative status of settlements have had a profound effect on the subsequent increase in population, economic activities, and the ranges of functions the cities perform (Owoeye & Ibitoye, 2016). These have, in turn, impacted the cities' internal morphology as well as the expansion of the cities into the adjoining hinterlands. In the process, the urban centres annex and envelope the surrounding villages (Taiwo et al., 2014), with the latter becoming the focal point of commerce and culture within the expanded urban landscape.

Land use/cover changes came with this rapid but sustained urbanisation have as the areas previously occupied by vegetation and water bodies steadily gave way to brick and mortar, an indication of the expansion of urban land use into the hinterlands. In theorising driving forces of landscape change, Wirth (1969) cited in (Bürgi et al., 2004) distinguished between economic forces, social forces, and public forces, where the last refers to the role of government and institutions in driving landscape change. Extant literature on land use/cover changes is biased towards economic reasons, as they are drivers of the city's demographic and areal growth, almost to the exclusion of other significant political and cultural factors. One of such factors is the change in the administrative status of cities. This factor could be significant in explaining population growth in Africa's small and medium urban centres, most of which have limited economic activities but are witnessing substantial growth.

Change in a city's administrative status not only induces population change but also change in socio-economic variables and land development priorities (Li et al., 2015). In their study of city-making role of government in Hangzhou Metropolitan area in China between 1978 and 2008, Wu & Zhang (2012) observed an increase in the built-up area, which was mainly axial in pattern of expansion before 1991, while a radial pattern was observed after 1996, when two major administrative division adjustments had been made. This radial pattern transformed into multiple nuclei forms due to the city absorbing adjoining smaller settlements.

In a similar study, Li et al. (2015) investigated the relationship between the hierarchical structure of the Chinese urban administrative system and urban land expansion, noting that urban land expansion coincides with administrative hierarchy, and cities with higher administrative levels tend to expand more rapidly. The impact of the state on urban land expansion and change in the internal morphology of cities have been emphasized in the literature (Xu & Yeh, 2009; Li et al., 2015). Using a difference-indifference approach, Heider et al. (2016) have shown that maintaining county capital status has a statistically significant positive effect on the annual changes in population, and consequently, city growth. In the context of the political changes in Romania, Grigorescu et al. (2012) have observed significant urban restructuring in Bucharest in the post-communist era, further reinforcing the role of political decisions in urban development.

In the context of Africa, studies focusing on land use, land cover changes in urban areas abound (Braimoh & Onishi, 2007; Abiodun et al., 2011; Nwokoro &

Dekolo, 2012; Taiwo et al., 2014; Gasu et al., 2016; Owoeye & Ibitoye, 2016; Abebe, 2013). However, studies investigating the role of change in a city's administrative status in urban expansion remain scant. Taiwo et al. (2014) investigated the effects military and civilian administrations have on the urban land use and land cover changes in Osogbo but did not do a comparative analysis of the changes that occurred in pre- and post-capital status of the city.

In Nigeria, a State is the second-tier unit of the Federation with the power to legislate on matters listed on the concurrent lists. Although States in Nigeria are heavily dependent on oil revenue that is shared among the federal government and the federating units, they nevertheless enjoy some level of autonomy in revenue generation and allocation. In addition, the power to allocate land for development of any sort is vested in the governor of a State while matters relating to urban planning and development control lie within the responsibilities of the States.

Due to the enormous importance of a State, vast government bureaucracies (both Federal and State) are usually established in the State capital, and these attract a large number of government workers together with the associated impact on urban growth and land use/cover changes. Many State capitals are also headquarters of one or more local governments, thereby making them cities of multi-tier administrative functions.

Abebe (2013) has noted that understanding and quantifying the spatiotemporal dynamics of urban growth and its drivers are critical to formulating appropriate policies and monitoring mechanisms on urban growth and planning decisions. This is even more compelling in the context of cities that have witnessed unprecedented growth due to change in administrative status. This study, therefore, investigates the effect of a change in the administrative status of the medium-sized city of Osogbo, Nigeria, on the urban expansion with a specific focus in assessing the trends and spatial patterns of land use/cover changes in pre-capital city period (1972-1991) and post-capital city period (1996-2016). This study focuses on unravelling the impact that change in the administrative status of Osogbo (from a local government headquarters prior to 1991 to a State capital in post-1991) has on urban growth and land use dynamics.

## **Study area**

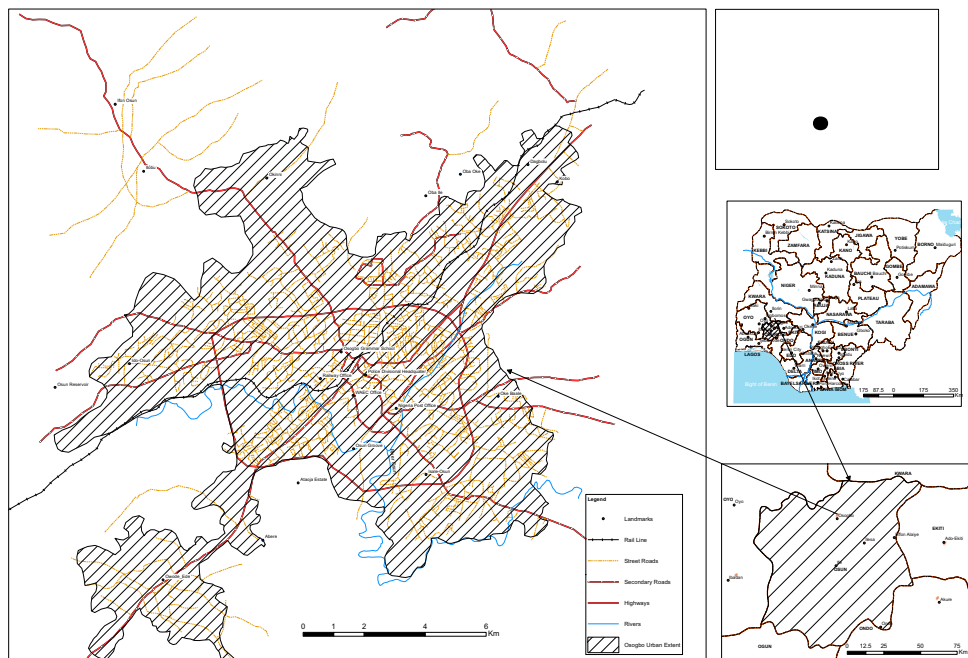
Osogbo was founded in the late 18<sup>th</sup> century and developed first as a traditional and cultural town. It is one of the foremost towns in the southwestern part of Nigeria. Osogbo is about 190 kilometres northwest of Lagos, the commercial and industrial hub of Nigeria. It occupies a land area of 144km<sup>2</sup> with a population of 288,455 in 2006 (National Population Census Figures 2006) which was projected to 650,000 people in 2015 (United Nations 2014). Known for its rich arts and cultural heritage (Aguda & Adegboyega, 2013), Osogbo has grown from being an agrarian settlement in the 1950s to a city of significant

commercial, industrial and administrative functions (Egunjobi, 1995). The location of the regional railway station in the city in the 1950s elevated it to a regional commercial hub where many of the multi-national companies like Paterson Zochonis, built their warehouses. This aided its growth and led to the springing up of several financial and educational institutions as well as hospitality businesses. The city is also home to large industrial concerns like the Osogbo Steel Rolling Mills, Osogbo Machine Tools Limited and small-scale industrial establishments, such as textile and foam making companies.

Osogbo became a State capital in 1991 following the creation of Osun State, in the same year. Before then, Osogbo had been a Divisional headquarters in 1952 under the regional structure and later housed the headquarters of two local governments - Osogbo and Olorunda local government areas - in 1996. These multiple administrative functions have been an impetus to population growth, land use change and urban expansion. Increased urban development has extended the city frontiers into neighbouring settlements and local government areas, lending credence to the submission of Bloch et al. (2015) that urban expansion is frequently not constrained within the municipal limits but often overlaps or spills over between various local government areas (LGAs) or even States. Currently, a large chunk of the city's expansion especially in the southwestern flank is beyond the traditional and administrative definition of the city. This multi-jurisdictional overlap of cities has been observed to impact negatively on equity and justice in the provision of municipal services (Samuel & Adagbasa, 2014). Osogbo houses the sacred groove of the River Osun goddess, which has been designated as the UNESCO World Heritage site. Each year, tourists come from around the world to the Osun Shrine and this has stimulated the city's economic growth. Owing to the rapid expansion of urban land use in the city in the past two and a half decade, which almost coincided with the cities elevation to a State capital, it is imperative to investigate the impact this change in administrative status has on the land use/cover pattern.

## **Materials and methods**

The study employed remote sensing data obtained from Landsat Multi-Spectral Scanner (MSS) (1972), Thematic Mapper (TM) (1986), (1991), (1996) and Landsat Enhanced Thematic Mapper Plus (ETM<sup>+</sup>) (2006) and (2016), population data and locational data for analysing land use/cover changes in a medium-sized urban centre. The boundary of the urban area is delimited based on the metropolitan limit as set by the Osun State Capital Territory Development Authority. The digital image data collected were enhanced to aid picture quality while the Area of Interest (AOI) was delineated using Google Earth<sup>TM</sup> to create a boundary for the city. The digital image processing started with the extraction of sub-scenes from the initial datasets for all the years under study. In order to transform pixels of data into the real world and avoid distortion, the ground control points were taken using Trimble Juno SC<sup>TM</sup> GPS.



**Figure 1.** Osogbo City

These points were used to geo-reference images using Universal Transverse Mercator projection of WGS1984 Zone 31°N coordinate system in order to maintain a uniform reference system for the images. In order to identify various land use/cover changes and to aid visual interpretation, false colour composites of images were processed from Landsat<sup>TM</sup> images by selecting bands 4:3:2 which conform to Near Infrared Red (NIR), Red (R) and Green (G) planes respectively (Aguda & Adegboyega, 2013; Taiwo et al., 2014). The bands' combination consisted of vegetation in shades of green and grey, built-up in shades of blue and water in shades of black. Image classification was done using ArcGIS 10.3 Image Analyst Extension<sup>®</sup>. Supervised classification using the Gaussian maximum likelihood classifier was used to generate three classes of land use/cover namely water body, built-up and vegetation cover based on the 95% maximum likelihood for each land use/cover type. The method is a process of assigning features of known identity to one or more known features using training data (Abebe, 2013). A supervised classification has been proven to be appropriate for classifying multi-spectral images to obtain different land use/cover types (ITC-ILWIS, 2001; Aguda & Adegboyega, 2013).

The resultant images were subsequently converted to their vector equivalent to enhance quantification (Taiwo et al., 2014). To further aid the classification of vegetation cover change, a Normalized Difference Vegetation Index (NDVI) computation was done. This research further combines sampling training of images' pixels and supervised classification through the maximum likelihood method with the visual image interpretation to classify the various land use types in the area.

**Table 1.** Classification accuracy of the images

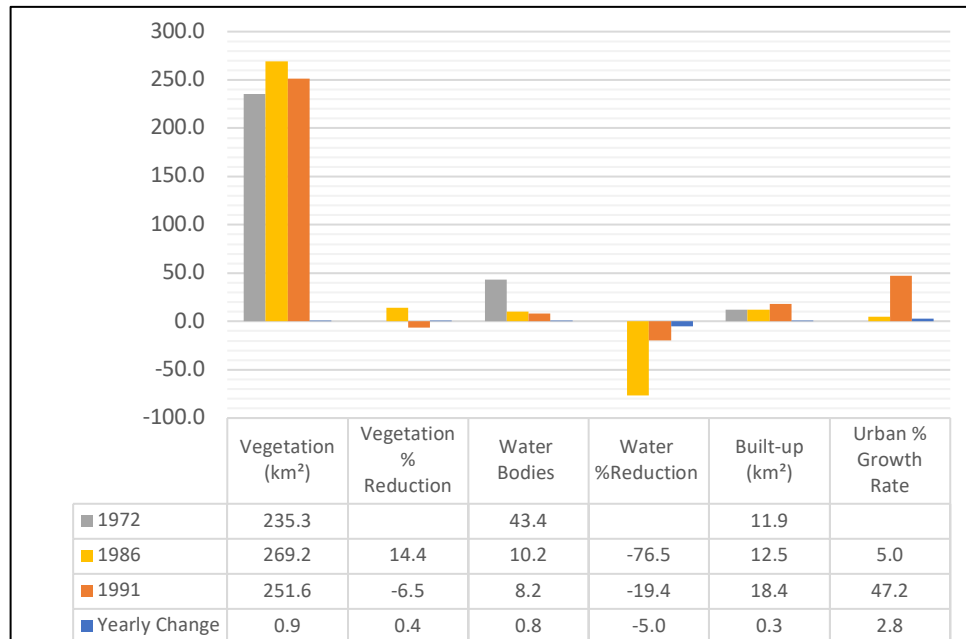
Year	Land Use Category	No. of Classified Pixels	Correct no. of Pixels	Wrongly Classified Pixels	% Accuracy	% Reliability	Overall Average
<b>1972</b>	Built-Up	56	45	9	84.6	90.2	87.1
	Vegetation	60	54	6	90.2	94.1	
	Water	28	24	4	86.4	90.6	
<b>1986</b>	Built-Up	64	60	4	94.7	90.0	90.7
	Vegetation	55	50	5	90.9	91.0	
	Water	30	26	4	86.7	90.0	
<b>1991</b>	Built-Up	40	36	4	90.0	90.4	90.2
	Vegetation	60	56	4	93.3	92.6	
	Water	47	41	6	87.2	88.0	
<b>1996</b>	Built-Up	60	57	4	95	95.67	93.1
	Vegetation	55	51	4	94	95.54	
	Water	31	28	3	90.3	91	
<b>2006</b>	Built-Up	45	43	2	95.56	95.45	94.9
	Vegetation	65	63	2	96.92	97	
	Water	39	36	3	92.3	93.1	
<b>2016</b>	Built-Up	59	57	2	96.61	96	93.2
	Vegetation	37	35	2	94.6	95.2	
	Water	26	23	3	88.46	89	

The accuracy of each of the land use/cover maps was measured using the confusion matrix generated from the image analysis (Table 1). This accuracy assessment is the commonly used method of measuring the classification accuracies of remotely sensed data, and it is the ratio of the total correctly classified pixels by the number of pixels in the confusion matrix (Foody, 2004; Liu et al., 2007; Enaruvbe & Atedhor, 2015). Three land use/cover categories were identified for the purpose of this study: vegetation, water bodies, and built up areas. Vegetation comprised of green cover including primary and secondary vegetation, cropland; water bodies comprised of streams, rivers, lakes and ponds (natural and artificial); built-up areas included buildings, road surfaces and undeveloped plot (not covered by vegetation).

## Results and discussions

### *Urban land use/cover changes in the pre-capital city period (1972-1996)*

The city of Osogbo has a long history of administrative and commercial relevance that dated back to the 1950s. Hence, the sustained growth in population and urban land use can be understood within this context.



**Figure 2.** Land use/cover Change in the Periods of Pre-Capital Status of Osogbo

Figure 2 shows the land use/cover changes of Osogbo from 1972 to 1991. Though the study area became a State capital on August 29<sup>th</sup> 1991, this satellite data was acquired in April 1991, which pre-dated the elevation of the city to a State capital. The spatial extent of the built-up areas of Osogbo city in 1972 was estimated at 11.9km<sup>2</sup>, while vegetation cover and water bodies were 235.3km<sup>2</sup> and 43.4km<sup>2</sup> respectively. However, in 1986, despite a population growth rate of 33.7%, the built-up area only recorded a slight increase from 11.9km<sup>2</sup> in 1972 to 12.5km<sup>2</sup>, accounting for only 5% increase. While previous studies have established a link between rapid population and urban expansion (Nwaogu et al., 2017; Odjugo et al., 2015), the current result shows that population growth alone may not be sufficient in explaining rapid land use/cover change in the urban contexts. Surprisingly, vegetation increased appreciably by 14.4% from 235.3km<sup>2</sup> 1972 to 269.2km<sup>2</sup> in 1986. The increase in both built-up areas and vegetal cover were compensated for, by the water bodies, which immensely shrank by 76.5% over the same period of time. The rapid loss of water bodies to both vegetation and built up areas could partly be explained by the intensification of urban agriculture, which was mostly practised on wetlands and the increase in urban land use caused by the increased commercial activities in the city. The city's rising commercial importance as a major collection point of cocoa, a major export crop in the western region of Nigeria at that time could explain the surge in the city's population. The presence of railway routes that links the northern with the southern part of Nigeria could also have contributed to an increase in the commercial activities as well as encouraging linear growth along this transportation line the study area (Bürgi et al., 2004; Aguda & Adegboyega, 2013).



By 1991, the vegetation cover decreased by 6.5% to 251.6km<sup>2</sup>, while the built-up area increased rapidly at the rate of 47.2% to 18.4km<sup>2</sup>, water bodies fell from 10.2 to 8.2km<sup>2</sup> within five years. This indicated that while built-up areas were growing, water bodies and vegetation were shrinking, and for the first time the rate of urban expansion (47.2%) outstripped the population growth rate for the same period (Figure 2). The rapid growth witnessed in the built-up areas and the concomitant decrease in the vegetation cover and water bodies are traceable to the escalation of socio-economic activities in the city caused by the location of Zonal Station on the Western Rail line. The railway station facilitated the emergence of warehouses of local and multinational companies such as Paterson Zochonis (PZ), Nestle, and Cadbury, all of which capitalized on cheap means of transportation provided by the railway to reach the hinterlands. This development further intensified commercial activities, which created more job opportunities and aided economic growth of the city while many more people were building houses for renting and accommodating their families. These factors actually boosted the commercial activities of this city in the periods between 1986 and 1991, which in turn accelerated the population growth as well the physical expansion of the city.

The sustained commercial growth of the city stimulated industrial, commercial, educational, and residential developments along major transportation corridors, causing the city to expand linearly along transportation corridors (Figure 2a-c). The establishment of heavy industries like the Osogbo Steel Rolling Mills and Nigeria Machine Tools at the northeastern fringe of the city along Osogbo-Ikirun road and the location of a Technical College and School of Nursing along Osogbo-Iwo road and at Agunbelewo along Ilobu road (western axis) respectively attracted commercial and residential developments along these axes. Expectedly, these axial developments had harmful effects on the water bodies and forested areas, which were fragmented by road construction and eaten up by residential and commercial developments. Moreover, the growth of tourism-related businesses such as the traditional dyeing industry owes much to the importance of River Osun as a tourist attraction, which largely contributed to the influx of tourists to the city because of the annual Osun Osogbo festival. Although data on the annual inflow and outflow of tourists are not readily available, the festival nevertheless remains a globally acknowledged tourism event as the UNESCO designated the Osun Shrine as a World Heritage Centre.

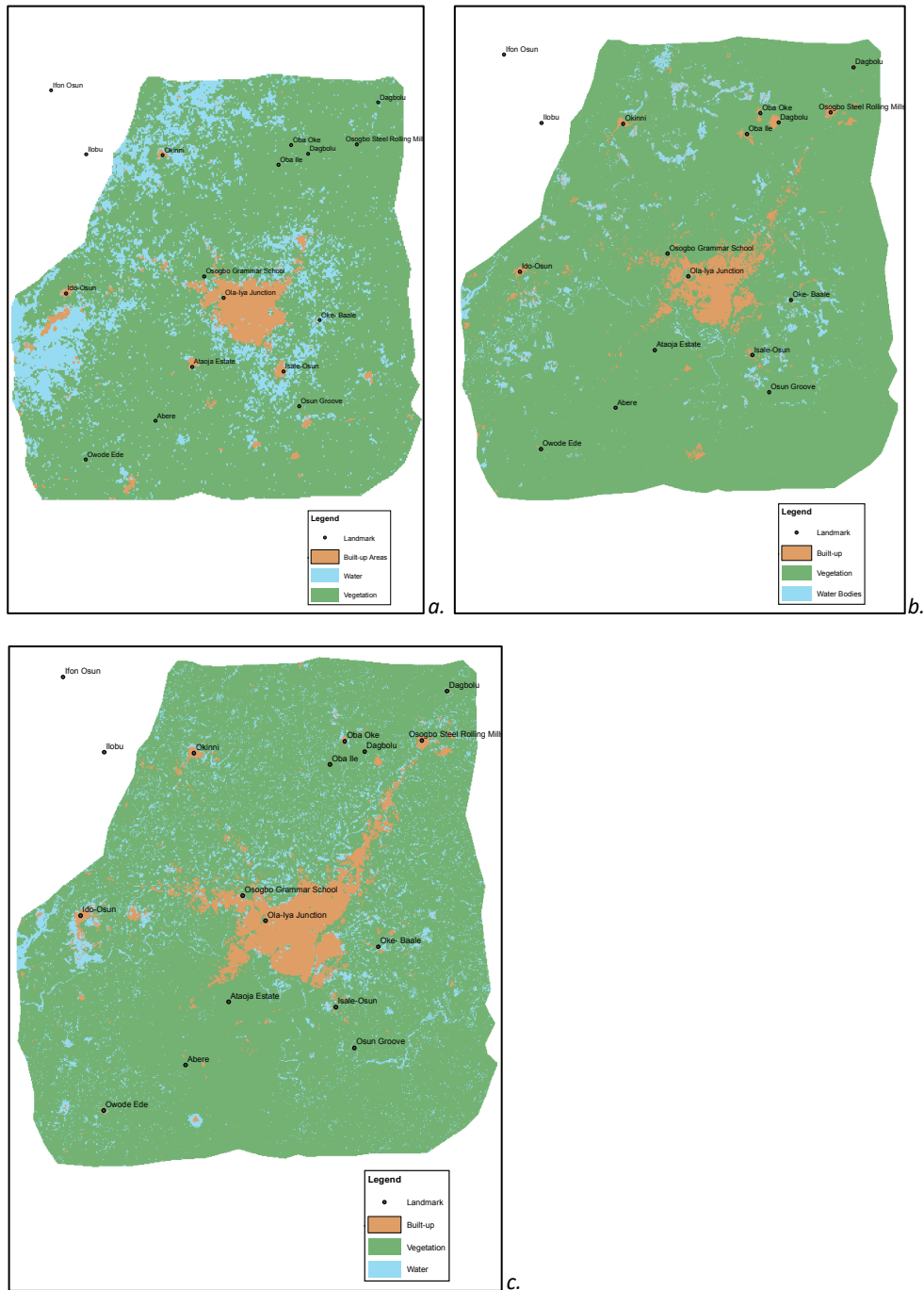
As it is evident in Figure 2(a-c), the pattern of urban development in the pre-capital status period (1972-1991), primarily axial, with developments occurring along the major roads, gave rise to a scorpion-shaped city. It is noteworthy that urban development at this period was extensive rather than intensive. The proliferation of green and blue patches (denoting vegetation and water bodies respectively) attests to the fact that even as the city was expanding outwardly, vacant plots and green areas still existed within the urbanised areas. In the periods preceding the elevation of Osogbo to the status of State capital, the built-up area added an average of 0.3km<sup>2</sup> annually, translating to 2.8% while the

population maintained a growth rate of 1.9% annually (Figure 2). These modest growth rates contrast with what was observed in the post-capital status period of the city.

#### *Urban land use changes in the post-capital period (1996-2016)*

Osogbo became a State capital with effect from August 27, 1991. However, it took a few years before the new administrative arrangements began to function effectively. The new status of the city contributed to its rapid urbanisation, as it implied the relocation of people, majorly civil servants, contractors, business investors, and their families from Ibadan (the erstwhile State capital) and other towns and villages in the region. Though the effect of State capital had not been significantly felt on the land use/cover changes in the study area in 1996 as Figures 4 depicts, the built-up areas significantly increased from 18.4 km<sup>2</sup> (1991 value) to 25.8km<sup>2</sup> and vegetation recorded slight contraction from 251.6 in 1991 to 249.1km<sup>2</sup>. The area coverage of water bodies decreased from 8.2 km<sup>2</sup> to 7.9km<sup>2</sup> within 5 years. This could have been due to the intensification of urban development within the city space and expansion into the city's peripheries (Figure 3a).

Between 1996 and 2006, the built-up area of the city increased at the rate of 104.3% from 25.8km<sup>2</sup> to 52.7km<sup>2</sup>. This indicates that the spatial extent of the city is nearly thrice the size it was fifteen years before (1991). The annual rate of urban expansion was estimated at about 9% for this period. This suggests that the city is growing at an astronomical rate while vegetation and water bodies were being lost at steady rates. The identified significant drivers of growth were administrative. The effect of the new State capital has brought to bear on the economic growth and land use configuration of the city. Previous studies have shown a strong link between city's administrative status and economic performance (Heider et al., 2016) by fostering concentration of population and jobs in the administrative headquarters (Krugman, 1996). This impact occurs in many dimensions. For instance, change in the administrative status brought about an increase in population and hence, increased demand for housing to accommodate the burgeoning population. The demand for housing, in turn, gave rise to residential developments by government, private estate developers, and other informal actors in the housing sector, thereby increasing the areal extent of the built area. As the population increased, economic activities also picked up with the consequent expansion and intensification of commercial land use. Areas that were previously vacant within the developed areas were converted to commercial purposes; new markets were constructed while the existing ones were expanded.



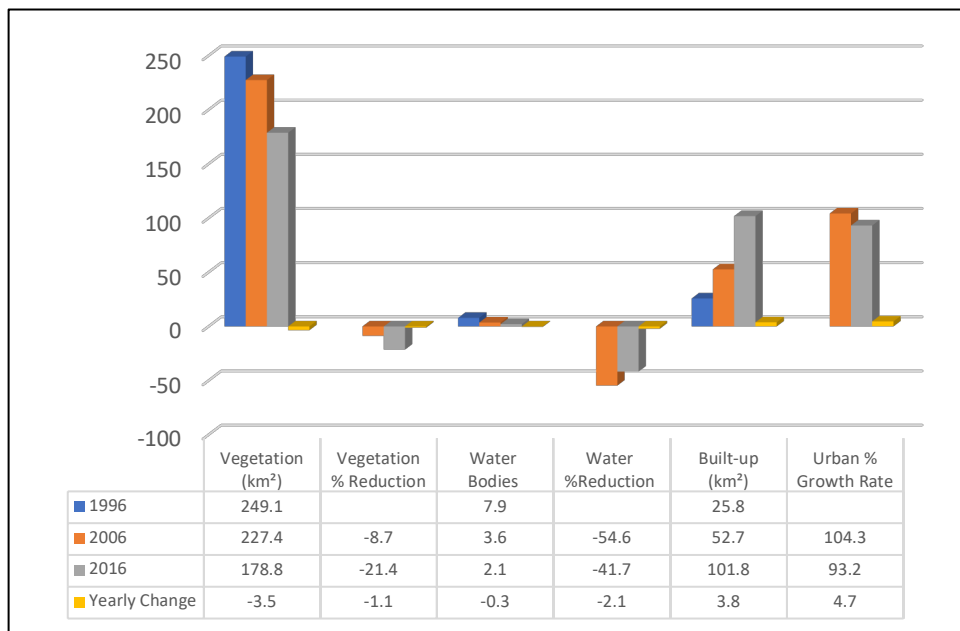
**Figure 3.** Land use/cover change in the periods of pre-capital status of Osogbo. a. Osogbo in 1972. b. Osogbo in 1986. c. Osogbo in 1991

Government's direct involvement in land development was another dimension that boosted the city growth. The construction of new State House of

Assembly and State Secretariat at Abere, along Osogbo-Gbongan road (south-eastern axis) which covered several hectares of land attracted significant commercial and residential land uses along that corridor. Similarly, State and Zonal Offices of the Federal government were established in the city, further expanding the administrative and institutional land uses. Federal agencies such as the Universal Basic Education Board (UBEB) and National Examination Council (NECO) State branch, Federal High Court and the Directorate of State Security Services were located along the south-eastern axis (Gbongan road), a development that further intensified urban development along the corridor. These urban functions had stimulated, to a certain extent, high population growth within the period that invariably led to increased demand for housing as the city continued to expand. In addition, the acquisition of land for future use dispersed developments away from the urban fringe with the resultant sprawling of the city into the neighbouring villages and towns. It is important to note, that River Osun constitutes a major limiting factor to the expansion of the city towards the southern axis. It may be argued that the river significantly affected the morphological development of the city by influencing the direction of its expansion (Bürgi et al., 2004) and producing some degree of spatial discontinuity of the built-up areas, most especially in Isale-Osun sector where the Osun Groove is located.

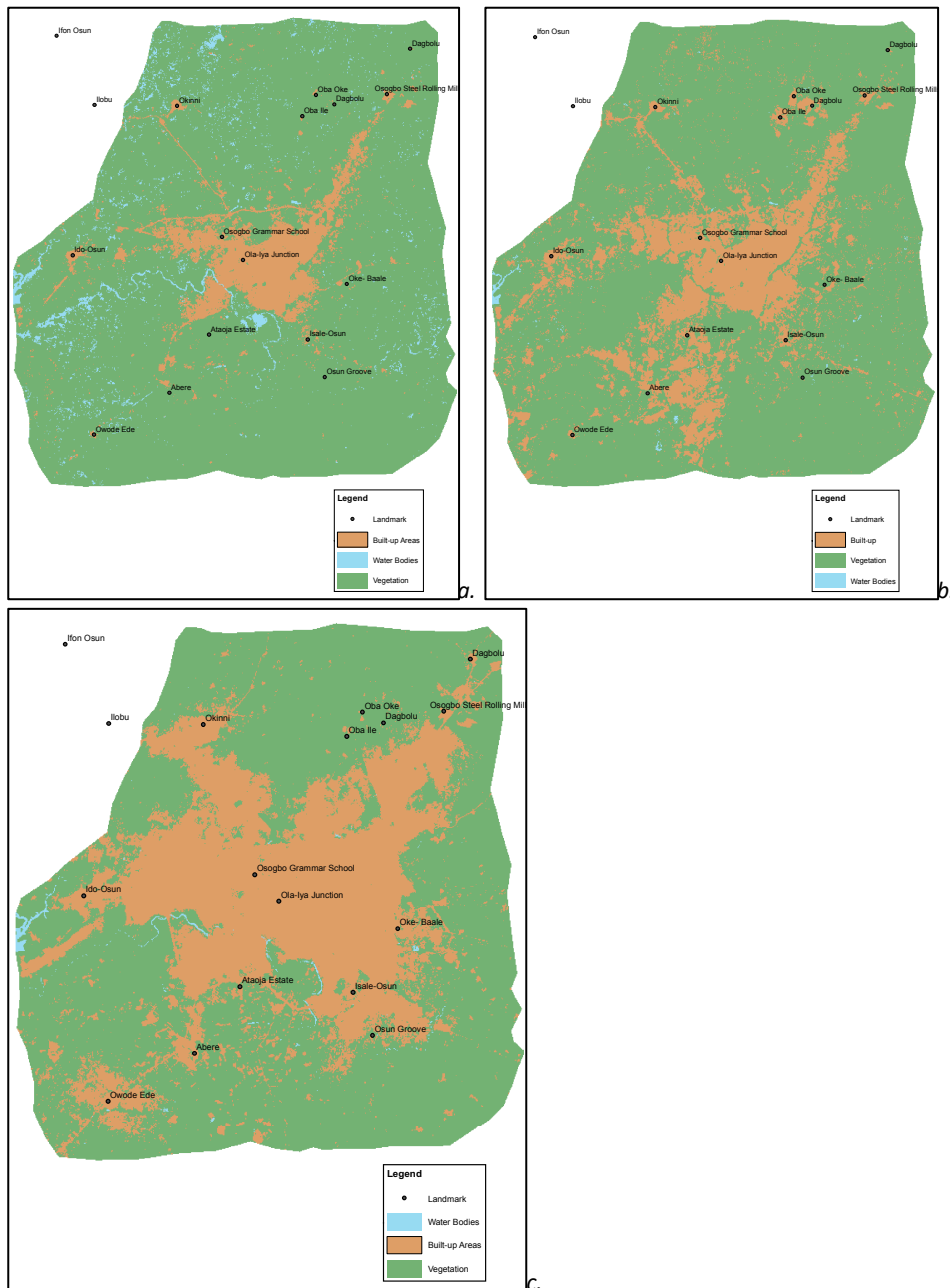
The significant growth in the urban expansion in 2006 is attributable to the intensification of urban land use fuelled by government activities as new government offices and residential developments to accommodate the burgeoning state government workforce were being constructed. Between 1996 and 2006, the population growth rate was 31.8%, which fuelled accelerated urban expansion as the built-up area recorded an increase of over 100% from a 25.8 to 52.7km<sup>2</sup>. Government-sponsored housing estates such as the Oroki, Dada and Ataoja Estates came on stream to bridge the housing gaps occasioned by the upsurge in the city's population. This development further increased the conversion of wetlands, river channels and previously undeveloped land parcels to various urban functions. Of importance was the rapid growth of the Government Reservation Area (GRA), which had hitherto remained mostly undeveloped. The intensification of urban development is particularly noticeable around Alekuwodo, Gbonmi and Atewolara where river channels have been gradually narrowed down to pave the way for residential, commercial and religious land uses. Gradual exhaustion of vacant properties within the built-up areas tends to push people outwards into building shelter in the peripheral settlements like Owode-Ede and Ido-Osun (southwestern fringe); Ota Efun, Abule-Osun and Kelebe in the northeastern axis; and Okinni and Ilobu on the western axis. Owioye & Ibitoye (2016) attributed significant growth factors within this period to the full mobilization and relocation of the State Government functionaries to the new State Secretariat at Abere, establishment of Nigeria Teachers' Institute and Nigeria Civil Defence at Oke Ayepe along Gbongan and Ilesa Roads respectively.

In the periods between 2006 and 2016, more of the expanding urban land uses seemed to be concentrated at the southern end of the city, and a pronounced extension at the southwestern side of the city was observed (Figure 5b-c). As shown in the summary of land use/cover change between 2006 and 2016 (Figure 4), the built-up areas grew to 101.8km<sup>2</sup> by 2016, although the growth rate slightly declined to from 103.4% to 93.2%. This is a response to the sustained population growth that had reached 32.3%. Vegetation and water body, on the other hand, accounted for 178.8km<sup>2</sup> and 2.1km<sup>2</sup>, losing 3.5% and 41.7% respectively. The slight reduction in the vegetation cover may be due to the government's efforts at greening the city by converting available open spaces into green areas.



**Figure 4.** Land use/cover Change in the Periods of Post-Capital Status of Osogbo

In addition, public awareness through widespread campaign to discourage deforestation and its probable consequences may have also contributed to the slowdown in the removal of the vegetal cover. This steady spatial expansion of the city had fully encroached on autonomous settlements like Dagbolu-Osogbo, Dagbolu-Ikirun along the northern axis and Okinni and Ido-Osun on the western and south-western axes respectively. The factors responsible for this development may include expansion of road network in the city such as dualization of Akoda-Osogbo road and the extension of the Ring Road to cover the eastern section of the city that facilitate a smooth flow of traffic. This period witnessed the establishment of the State branch of Central Bank of Nigeria, which boosted the commercial and banking activities and the upgrading of a general hospital to a Teaching Hospital (LAUTECH) that employs more medical personnel, security, and administrative staff.



**Figure 5.** Land use/cover change in the periods of post-capital status of Osogbo. 5a. Osogbo in 1996. 5b. Osogbo in 2006. 5c. Osogbo in 2016

Closely related to this is the location of Osun State University (Main) Campus at the eastern axis and establishment of Fountain University behind the Osun Grove. These factors have contributed to a large extent to the population growth of the city which triggered increasing demands for housing that were promptly responded to, by private individual developers.

In all, the city population and areal extent grew at annual rates of 3.2 and 4.7% respectively in the post-capital status period as against the 1.9% and 2.8% respectively in the pre-capital period. There was also an annual 1.1% reduction in the area covered by vegetation in the post-capital periods as against the 0.4% contraction recorded in the pre-capital status periods. By this result, it is evident that the rate of urban expansion escalated in the post-capital years, whereas both vegetation and water bodies recorded steady loss. The city expansion captured in his study did not include autonomous settlements that have merged with the city such as Ilobu and Ifon Osun on the northwestern side.

The expansion of the city beyond its traditional and administrative boundaries has been a source of constant friction between the adjacent communities. A major feature of the urban development in the post-capital periods of Osogbo was the increased densification and radial growth of the city (Taiwo et al., 2014) causing the city to grow increasingly compact (Figure 5c) in the centre while significant sprawling is noticeable along the fringes. The outward expansion of the city has also created new challenges for providing transportation to those living at the edge of the city and extending infrastructure and municipal services to these new but mostly informal residential developments.

## **Conclusion**

This study has, using geospatial techniques, traced the trajectory of urban expansion in a medium-sized city in the periods preceding the elevation of the administrative status of the city and the periods after the elevation. The main thrust was to see whether there was any significant difference in the magnitude and pattern of urban development in the years preceding the city's elevation and the years after it. It is apparent from the present study that the change in the city's administrative status impacted significantly on the internal morphology, form, as well as the areal expansion of the city. The elevation of the city from a local government headquarters to a State capital brought a momentous increase in population, economic activities and the consequent demand for land for administrative, residential, industrial and commercial uses. Evidence from this study showed that the rate of urban expansion actually snowballed after the initial, gradual growth in the periods after the city had been elevated to a State capital in 1991. The city recorded an exponential expansion consequent upon its elevation to the status of State capital and grew more compact, taking a radial form compared to the relatively dispersed development and star-shaped form it maintained in the pre-capital years. For a city like Osogbo that had been a divisional headquarters since 1952 and headquarters of two local governments from 1996, the cumulative effect of these administrative changes became more palpable after its elevation to a State capital.

It thus shows that for small and medium-sized cities, especially in third world countries where economic activities are limited, change in administrative status could be a major catalyst fuelling urban population growth and areal expansion. However, the multi-dimensional nature of the impact of a change in capital status on urban expansion presents a challenge in isolating the administrative status factor from among other factors as it closely interacts with other drivers of urban land use change such economic and demographic factors. It even becomes knottier for cities like Osogbo that had been, at various times, seats of administration for lower tiers of governments before being elevated to a State capital. Often, the initial increase in socio-economic activities brought about by these administrative changes and the concomitant urban physical and demographic growth could also be a significant factor in the choice of the city as a State capital, thereby creating an egg and chicken situation.

It is also noteworthy that the absence of data that can facilitate comparison among cities whose political status have changed to find out if differences exist in the rate of their population growth as well as areal expansion over time, represents a major limitation to the findings of this study. A comparative analysis of land use/cover change between a city that has experienced a change in its administrative status and another that city which has not, can also provide a more reliable evidence of the link between a change in a city's administrative status and the land use/cover changes. However, such studies may be problematic in some developing countries – such as the case with the present study – where population census and migration data are rarely available. In most cases, analyses are based on population projections generated using national or regionally derived average population growth rates, which obscure local variations that are sensitive in comparative studies of this sort.

In situations where multi-period actual population data for cities are unavailable, a way of testing the hypothesis is to compare the land use/cover changes in a city that has experienced a change in administrative status with another that has not. Comparing the rates of urban growth and land use change between the two cities especially after the change in its administrative status would provide insights into the contribution of the administrative change on urban land use/cover dynamics. Further studies are therefore required for a rigorous interrogation of this hypothesis in order to provide supplemental evidence that can help strengthen or refute this thesis. Such studies are capable of deepening the existing knowledge on the relationship between change in city's administrative status and land use/cover dynamics as this is vital for planning and monitoring cities that have experienced a change in their administrative status.

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