City Expansion and Agricultural Land Loss within the Peri-Urban Area of Osun State, Nigeria

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Abstract

Urban encroachment into arable land along the peri-urban areas of Osun State, Nigeria prompted this investigation. The study is aimed at determining rate, pattern and effects of uncontrolled spatial expansion in the city. This study examines the trend in eight (8) peri-urban communities in Olorunda and Osogbo LGAs which were purposely selected. A multi-stage sampling technique was adopted in administering 230 questionnaires on randomly selected peri-urban farmers. Primary data collected were analysed using SPSS while Geographical Information Systems (GIS) data acquisition and sources were used to capture vegetation change, with 3 Landsat imageries sourced for the study. Findings revealed that 72% of interviewed farmers had a fear of losing their farmland to developmental projects as 16.1% of farmers had previously lost between 1 and 2 acres of farmland to such projects. Land modelling change detected that settlement/built-up-areas have increased from 978.03 hectares (6.60865%) in 1986 to 2976.39 hectares (20.11178%) in 2014, to the detriment of farmland/vegetative cover. As a result farmland/vegetative cover reduced from 9277.71 hectares (62.69045%) in 1986 to 7995.33 hectares (54.02527%) in 2014. The study discovered that such a degree of city encroachment and expansions into vegetative land cover is greatly impeding agricultural activities and farm production. Thus, the paper advocates that the government and land administrators formulate and implement policies in this direction.

Key words: Agricultural land; Vegetal Land Cover; Encroachment; Housing and Spatial Expansion.

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Introduction

The unprecedented rate of urbanization and the sprawling pattern of development have resulted in the quick disappearance and/or total alteration of fertile agricultural lands in peri-urban areas, especially within the Global South. It was estimated that approximately 14 million hectares of land (approx. 475,000 ha/yr.) in developing/Global South countries would be converted into various land uses/development between 1990 and 2020 (Naab *et al.* 2013). Approximately 400,000 hectares of vegetative land cover has been lost (Adesina, 2005), with more expected to be lost due to various physical developmental projects in most urban settlements (Appiah, 2014; Dekolo and Olayinka, 2014; Mugish and Nyandwi, 2015). Such loss could be due to dormitory and satellite towns (Zasada, 2011) which result in the outward expansion of built-up areas beyond visible and invisible city borders into green areas mainly used for farming (Brennan, 1999; Kwasi, 2004; Oyesiku, 2010).

Urbanization in sub-Saharan Africa is altering traditional livelihood strategies and displacing agricultural land uses in many areas (Angel *et al.*, 2005; Adeboyejo and Abolade, 2007). Olima (2003) opined that population growth rate in both urban and rural areas is not commensurate with the quantity of land supply. Land is fixed in nature and so does not increase with increasing population growth. Expansion of cities affects the areas surrounding them (i.e., the suburbs) by altering the natural resource base and converting vegetal land cover to new uses, thus challenging the environment and dwellers' livelihoods **(**Gündel, 2006).

Since the early 1950s, rapid urbanization has been a feature of Nigeria. The Human Development Report (2004) and Oyesiku and Alade (2010) observed that almost half of the Nigeria population (45.9% of 120.9 million) reside in urban areas. Mabogunje (2002); Gbadegesin *et al.* (2010); and UNDP (2011) observed that urban population growth between 1953 and 2007 rose from 10.6% to about 50% of the total population. This exponential population growth caused overcrowding and a distortion in cityscape (Ogu, 1999). Besides rapid urban population increase in existing cities, more urban centres emerge with the creation of new states (Osuocha, 2006).

To buttress this assertion, the 1991 National Population Census recorded 359 urban settlements, each with a population of at least 20,000, and it was estimated that the figure increase to 450 urban centres in 2000. In 2004, urban centres in Nigeria were estimated to be about 853 with the same 20,000 urban population thresholds (UNDP, 2011). Therefore, it could be deduced that all states and their local government headquarters have already assumed an urban status in Nigeria.

The success of urban/peri-urban agricultural practices in many cities depends on how well it is integrated into other urban management policies, land uses and planning. Evidence presented by Amoateng *et al*. (2013); Mok, *et al*. (2014); Mugish and Nyandwi, (2015); and Kleemann, *et al*.

(2017) shows that housing development on arable farmland in UPA areas in most cities has become an issue on the global agenda in recent times. Maxwell (1995); Lawry *et al*. (2014) and Odhiambo (2015) observe that a plethora of reasons including rapid urbanization, insecurity of land tenure and lax land use regulation or enforcement has limited growth of UP agriculture.

Zasada (2011) opined further that farming in peri-urban areas is expected to be an integral part of the cultural landscape; it often provides environmental amenities, accessible green open spaces and recreational services. However, this pleasant living environment currently attracts new projects which in turn drive up housing development and increase land prices and rents. The concern in this regard is the decline in availability of agricultural land due to population pressure and urbanisation.

Against this background, there is the need for adequate understanding the interplay between trends of urbanization and undermining agricultural land use within peri-urban areas. On this note, this study aims to understand the magnitude of agricultural land loss along the peri-urban areas of Osogbo due to city expansion.

Conceptual Underpinnings and Literature Review

The concept of the Peri-Urban

Earlier in the 19th century, Johann Heinrich von Thünen (1783-1850) developed a theoretical model that describes the processes of local land-use patterns. The model explains five concentric zones with distinct characteristics and functions. The core ring served as the city centre (urban area), and subsequent rings as the peri-urban areas, fringes and rural settings (predominantly agrarian communities and zones surrounding the city centre). Farming activities occur in the ring closest to the city where dairying and intensive farming (vegetables, fruits, perishable goods, milk and other dairy products) were cultivated with highest profits. However, the agricultural model explains the locations and costs of agriculture in and around the urban centre where land is expected to be readily available for cultivation purposes that exist at the transition zones. Basically, the concept of peri-urban agriculture is directly associated with the agricultural model, within which the transition zones/peripheries and the fringes are areas of high agricultural land uses and practices.

The Council of Europe (CEMAT, 2007) defined peri-urban areas as: “areas that are in some form of transition from strictly rural to urban. These areas often form the immediate urban-rural interface and may eventually evolve into fully urban. Similarly, Birley and Lock (1999) conceived peri-urban areas as those immediately surrounding cities, where farmlands are being developed for urban uses. The Organisation for Economic Co-operation and Development (OECD) (2007) described peri-urban as the ‘grey area’ which is neither entirely urban nor rural in the traditional sense. Buxton (2007) saw it as a ‘middle band’ of land with an unbalanced mixture of urban and rural functions,but often continually affected by incessant push and pull tendencies from the cities. The result is a heterogeneous mosaic of environmental and productive ecosystems working in combination with the prevailing socio-economic peculiarities (Ravetz *et al*., 2013; Appiah *et al*., 2014) which are fast changing, with complex patterns of land use and landscape fragmented between local and regional boundaries (Piorr *et al*., 2011) creating a clash in boundary identity (Johnson, 1974).

Adjekumhene (2002) saw a peri-urban area as a space characterised by emerging multidimensional physical development as a result of interaction between urban and rural land uses. In this zone, rural activities and modes of life are in rapid retreat, with extensive urban land use intrusion, that is, urban area physically and functionally expanding into the rural area (Amoateng *et al*., 2013). These areas exhibit peculiar characteristics that make them distinct in development, including accelerated development of urban residential and urban commercial uses and decrease in rural primary activities, rapid but unplanned growth with inadequate service infrastructure, middle and low income residents, and serving as receptacles for the growing rental market (Buxton, 2007; Hewitt, 1989; Government of Swaziland, 199; Johnson, 1974).

Drescher and Iaquinta (2000) observed four interrelated categories within the peri-urban region to include: village peri-urban; diffused peri-urban; in-place peri-urban and absorbed peri-urban. Brook and Davila (2000) considers the peri-urban interface as the meeting of rural and urban activities; in effect, a process rather than a place with increased competition for land and water between agricultural and non-agricultural uses, and rural and urban dwellers (Gould 1988; NRI/UST 1997).

Studies by Amoateng *et al*. (2013) and Drabkin (1977) indicate that peri-urban areas are experiencing unplanned physical growth characterised by an unregulated pattern of physical development, resulting in complex organic urban growth. Such areas often and predominantly expand with horizontal developments, turning potential areas of activity and human attraction into a “mini-city”. This growth results in land use changes which, according to Sarfo-Mensah and Adam (1998), can classified into two major forms: land used for agriculture at the expense of fallow and forest land; and land used for building development, especially housing, at the expense of agricultural land. This finding supports the view that residential development remains a major driver of peri-urbanization (suburbanization) (Drabkin 1977).

Land Governance

Governance is a mechanism, and institutions, through which citizens/groups articulate their interests, exercise their legal rights, meet their obligations and mediate their differences (UNDP, 1997). The principles of sustainability, subsidiary, equity, efficiency, transparency, civil engagement/citizenship and security (in space and tenure) are the underlying principles of good urban governance identified by Egunjobi *et al*. (2008).

Land governance is basically about determining and implementing sustainable land policies (World Bank, 2009). Hence it is seen as the process by which decisions are made regarding the access to and use of land, the manner in which these decisions are implemented and the way conflicting materials on land are protected (FAO, 1998-2006). Arguably, proper land governance is key to achieving sustainable development.

Land marketing within the peri-urban areas of sub-Saharan Africa where land is rapidly being converted from agricultural to residential use has increased tremendously (Chirisa 2010). Since the land market is complex and diverse, characterised by a high level of uncertainty and widespread disputes, there is a need for proper land governance. Hence, land under threat of urbanisation within the peripheries can integrate urban and peri-urban agriculture with the accelerating urbanisation (SPFS, 2001).

According to Aluko (2010), land governance is about the policies, processes and institutions by which land, property and natural resources are managed. These include decisions on access to land, land rights, land use, and land development. Under the effective rule of law and good governance, physical planning is meant to systematically control the development towns and cities through preparation of land use developmental plans, master plans, land-use zoning, and layout. Good governance is a fulcrum upon which effective urban management rests; it plays a decisive role in the formulation of land policies which will serve as a guide for all the land administrators and forestall discrepancies with respect to the issue of land governance in its application to urban planning.

Appiah *et al.* (2014) and Lambin *et al*. (2003) observed that access to and use of land is usually constrained by policies and other institutional prohibitions both at the local and national levels. With customary land holdings, individuals, groups, societies, families and kinsmen are custodians of the land often dictate its use (Bugri, 2008; Arko-adjei, 2011). Likewise, the laid down developmental plans by the federal, state or district powers dictate the use of land at the national and institutional stage through master plan allocations (Appiah, *et al*., 2014; Kasanga and Kotey, 2001). However, in all ramifications, there is the need to consider the collective interests of the larger population in taking any decisions of land use and modification.

The Smart Growth Concept

This concept emerged as an answer to the enduring problem of sprawling development and its many negative consequences. Its historical antecedents are varied and numerous, dating back decades from national land use efforts, state growth management laws, housing reforms and anti-exclusionary zoning mandates (Burchell, *et al*., 2000). The concept seeks ways of directing growth in an intentional, comprehensive way so as to develop sustainable communities. The concept attempts to coordinate development within the city centre with an attempt to bring about the sustainable development of the adjoining suburbs through mixed land uses, compact building design, diversity of transport options, walkable communities, and a reliance on participatory planning to promote a strong sense of place (US, EPA, 2002).

Participatory planning in this regard is all inclusive for the people and their choice of activities (agriculture inclusive). Nelson and Wachter (2002) state that the foundation for the smart growth concept is mixed land use, especially the protection of lands for recreation, conservation of natural resources, and open space, to make existing communities attractive and liveable enough to steer growth away from the countryside (Smart Growth America, 2000).

From the foregoing, it can be observed that the smart growth concept does not seek to stop development; rather, it seeks to accommodate all land-uses (including agriculture). APA (2002) saw the concept as a comprehensive space management approach that embraces traditional and indigenous activities and land uses,through nature appreciation, land conservation, and revitalization of older suburbs (Parfrey, 2002) towards supporting environmental sustainability and creating synergies, allowing great development opportunities to their inhabitants (Monzon, 2015).

This concept remains relevant towards understanding the effect of urbanization on agricultural land across space.

Literature Review

Rural dwellers remain outnumbered by urbanites in developing regions (UN, 2004), with about 70% of more than 400 cities found in regions of the globe (Cohen, 2006). Characterized by increasing human population, economic dearth, unemployment, migration along the suburbs and expansion of the metropolitan periphery and adjoining rural areas (World Bank 2000; Abdissa, 2005; Naab *et al*., 2013), loss of agricultural land is now the reality (Masika, *et. al.* 2002). Land deficiencies within the urban land-use component increase the index of livelihood vulnerability of suburban poor who are mostly farmers (Olima, 2003), as land uses for residential, industry and commercial, civic and cultural purposes tend to dominate agricultural lands in the urban space (Naab *et al*., 2013).

Population and food demand is increasing, yet cultivable land continues to decline (Francis and Youngberg, 1990; Masanja, 1999; Titilola, 2000; Donahue and Troch, 2003; BrainCelhay *et al*., 2009; Magaso, 2009; Asamoah, 2010; Chirisa, 2010; Doos, 2012; Acheampong and Anokye 2013; Kleemann *et al*., 2017). Land owners within the urban and peri-urban areas remain focused on the economic value of lands and invest their landed property in activities with higher future earnings and returns than agriculture practices (Irwin and Geogeghan, 2001; Webster, 2002). They have little understanding of their role as critical assets for city-building with respect to food production (Malizia, 2005; Chapman; 2005; Apte, 2008). It is a process of survival as indicated by Ilbery (1987) and Bryant and Johnston (1992), but to the detriment of food security (Mougeot, 2000; World Vision, 2003).

According to Ewuim *et al.* (1998) and FAO (1999), urban and peri-urban agriculture occurs within and surrounding the boundaries of cities throughout the world at a time when densification and its impact are highest, thus limiting access to land for farming, which often triggers food insecurity (Ayuk, 2001; Okuneye, 2002). This development, according to Wilken (1991), Okuneye (2002), Edeoghon *et al* (2008), and Awotodunbo (2012), calls for increased investment efforts in the form of new legislation on agricultural land use and management practices aimed at promoting good land management and sustainable environmentally sound agricultural practices.

The relationship between uncontrolled urbanization and urban agricultural land loss in Africa has been well established by Jayne *et al*. (2003) and Headey and Jayne (2014). Rimal, (2013) provided a descriptive effect of loss of land in Asia. He forecast that the loss of cultivated lands by 2050 would amount to 5.7 percent of the total land under cultivation in 2000. The study further indicated that Southeast Asia might lose more than 10 percent of its cultivated lands; Western Asia and North Africa close to 10 percent; South and Central Asia 8 percent; and East Asia close to 7 percent. Earlier studies (Roca, 1993; Tyler, 1994; Feder, 1997) also revealed that road expansion and industrialization have accounted for over 1million hectares and 400,000 hectares of agricultural farmland loss in China and USA respectively. India as a country has experienced a 16.31% decline in agricultural land use along the fringes and city centre due to rapid urbanization (Kavitha, *et al*., 2015), resulting in a reduction in agricultural land holdings (Fazal, 2000).

The loss of global wetland used for UPA is declining as land reclamation remains an inevitable process of city urbanization (Bren d'Amour *et al*., 2017), subjecting UPA to continued displacement, land and environmental degradation, inadequate research and extension services and neglect due to unfavourable economic and political policies on urban and peri-urban agriculture (RUAF 2004; CIAS 2004; Adedayo and Tunde, 2013). Satterthwaite *et al*. (2010) state that urban expansion inevitably covers some agricultural land while changes in land values and land markets around cities often result in land being left vacant as the owners anticipate the gains they will make from selling it or using it for non-agricultural uses.

Despite little attention given to faming in the periphery, its relevance to improving livelihood cannot be under-emphasized, as it remains an integral part of peri-urban land-use (Mascarenhas 1999; Kessler *et al*. 2004; Anosike and Fasona 2004; Nabulo 2004; Dima and Ogunmokun 2004; Rahaman, 2008). Poor physical accessibility to land and urban dynamics and the resultant persistent loss of forest and agricultural resources in cities and peri-urban areas can be said to be due to weak land-use planning framework (Agbola and Ojeleye, 2007; Dekolo, *et al*., 2013).

As reinstated by ISOCARP (2015) and Pothukuchi and Kaufman (2000), planners and environmentalists can strengthen agriculture by compiling data on community food systems; analysing the connections between food and other planning concerns; assessing the impact of current planning on the local food system; integrating food security into community goals and educating future planners about food system issues. These can be done through the application of GIS and remote sensing (Aronoff, 2005; Lesschen *et al*., 2005; Ademiluyi, *et al*., 2008), principal component analysis (Turan, *et al*., 2010), vegetative indices (Muttitanon and Tripathi, 2005), clustering and post-classification comparison (Araya, 2009).

This reflects the fact that food cannot be disconnected from planning discipline (Sustain, 2011), as our towns and cities historically have been built around the supply and distribution of food (Steel, 2008). It is against this backdrop that the nexus between city expansion and agricultural land loss within the peri-urban area of Osun State, Nigeria remains an imperative discussion towards food security, improved land-use planning and liveable settlement.

Study Locations

The study was conducted in Urban/Peri-Urban communities of Osun State. Osun State is situated in a tropical rain forest zone which lies between latitude $7^0$30' 0"N and longitude 4^0 30'0" E with a land area of approximately 14,875 Sqm^2. The state has a population of 4,137,627, with a housing population of 3,423,535 and a density of 240/km^2 (620/sq mi) (NPC, 2006). Osun State comprises 30 LGAs, with Osogbo, an emerging city, as the state capital. The study covers only two LGAs of the state which are Osogbo Local Government Area (the state capital) with her headquarters at "Oke Baale", and Olorunda Local Government Area, with its headquarters at "Igbonna". Both LGAs have experienced drastic development, such that theirs geographic boundaries can hardly be differentiated (Fig. 1). Osogbo falls within the tropical rain forest zone and well drained.

The two LGAs (study area: Osogbo and Olorunda) are identical in developmental activities. Nonetheless, as a result of rapid growth and urbanisation within their urban space, the fringes and peripheries surrounding both LGAs have started experiencing substantial developmental activities which often start as an urban sprawl of residential development towards the exurban.

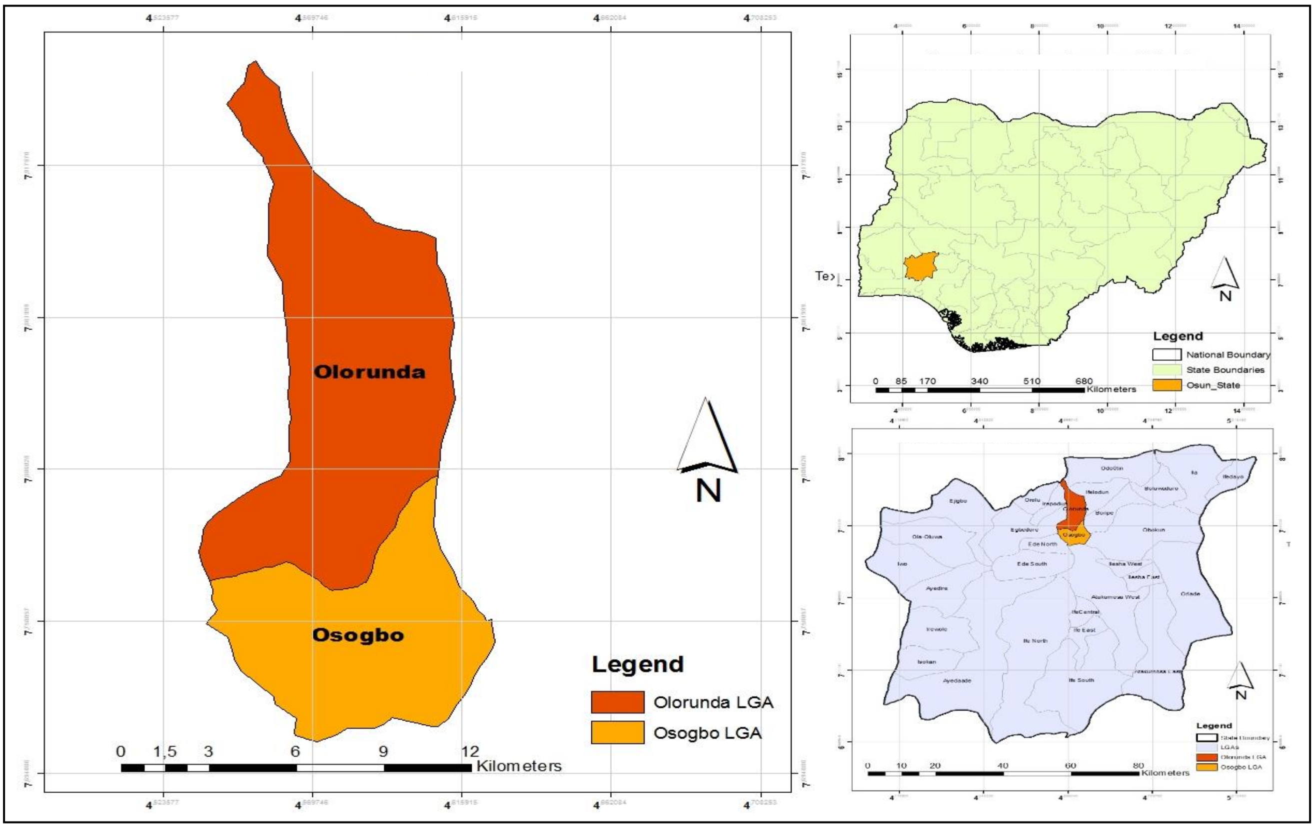

Figure 1: Map of the Study Area in the National Context.
Source: Extracted from Diva GIS 2014) and modified by the Author 2014.

Materials and Methodology

This research adopted a descriptive survey and a case study approach. Both quantitative and qualitative data were obtained through primary and secondary sources. Primary data were sourced through structured questionnaire and key informant interviews, field survey and observations. Key informant interviews were purposively conducted with two officials (*Field Officers, Agricultural Extension Officers and coordinating agricultural officers*) of selected agriculture institutions and agencies; Department of Agriculture and Rural Development in Osogbo and Olorunda LGA, Osun State Agency for Agriculture Development Corporation (OSSADEC), Osun State Agricultural Development Programme (OSSADEP), Ministry of Agriculture; and Ministry of Lands Physical Planning and Urban Development, Osogbo Local Planning Authority and Olorunda Local Planning Authority. Contribution from key informants compliments the data gathered from secondary sources.

A multi-stage sampling strategy was adopted to stratify farmers within and various communities under each LGA for the study. Firstly, the selected LGAs in Osogbo and Olorunda and their respective administrative wards/communities were all identified (table 1.1). The second stage was the classification and stratification of identified administrative wards/communities into urban and peri-urban communities. Thereafter, a purposive sampling and selection of the studied group (peri-urban administrative wards and communities) were carried out.

At the third stage, total numbers of registered farmers in purposely selected peri-urban wards/communities were retrieved from the Agriculture department at the headquarters of each LGA considered for the study (Jagun A, Jagun B,Otun Jagun C and D, Otun Jagun E,Dagbolu, Oba Oke, Oba Ile and Ilie). These wards/communities eventually represented the sample frame for the study. Finally, a sampling of 50% (0.5) of registered farmers in the peri-urban areas formed the sample size of 230 farmers for the study. Randomly, household questionnaires were administered to selected farmers for the study.

Table 1: Sample size of the study

Osogbo Lga		**Olorunda Lga**	
Admin Ward	Communities	Admin Ward	Communities
Urban Centres (Communities)			
1	Ataoja A	1	Oke Onitii, Ago Wande, Ayetoro and School of Nursing
2	Ataoja B	2	Igbona market, Balogun Agoro, Station road, Latona area
3	Ataoja C	3	Oriaye, Olubi, Akogun areas
4	Ataoja D	4	Radio station Akogun, Gbeja, Mubarak, Atelewo areas
5	Ataoja E	5	Odo eran, Youth centre, Irepodun, Fiwasaye, Olayiwola, Ifaology
6	Aketa	6	Oluode, Owode, Abaku
7	Alagbaa	7	Sabo area, Owoope
Peri-Urban Centers (Communities)			
8	Areago	8	Kola Balogun, Oke Ayo, Dagbolu, Testing Ground, Oke-Odo, Kobo-n-gbogbo-e, Otaefun, Powerline areas
9	Jagun A	9	Oba Oke
10	Jagun B	10	Oba Ile
11	Baba Kekere A and B	11	Ilie
12	Otun Jagun A		
13	Otun Jagun B		
14	Otun Jagun C and D		
15	Otun Jagun E		

Source: Field data.

Both descriptive and inferential statistics using SPSS (IBM.20) were used to present and discuss findings. Geographical Information Systems (GIS) and Remote Sensing (RS) data were used to capture the changes in vegetation land cover and land uses within the peri-urban areas. Three (3) Landsat imageries for the years 1986, 1996 and 2014 were acquired and analysed to identify the changes over time. This technique has been used in studies by Badlani, *et al.* (2017); Van der Linden (2015); Addo (2010), Seto and Fragkias (2005); Dekolo and Nwokoro (2013) to investigate land use/land cover changes in urbanising regions.

Landsat data were acquired from the global land-cover website at the University of Maryland, USA (GLCF, 2015). The images comprise a thematic mapper (TM) image acquired on 18th December 1986, an Enhanced Thematic Mapper plus (ETM $^{+)}$ image acquired on 6th December 2006 and an Operational Land Imager (OLI) acquired on 5th of February 2014 as shown in Table 1.2. The satellite data have 30m spatial resolutions and the TM and ETM Plus images have a spectral range of 0.45-2.35 micro meter with bands 1,2,3,4,5,6,7 and 8 while the Operational Land Imager (OLI) extends to band 12.

Table 2: Shows the Characteristics of Landsat Imagery

S/N	Data Type	Date	Spatial Resolution
1	Landsat Thematic Mapper (TM)	18th December 1986	30 meters
2	Landsat Enhanced Thematic Mapper Plus (ETM^{+})	7th December 2006	30 meters
3	Landsat Operational Land Imager (OLI)	5th February 2014	30 meters

Source: Field data

Spatial and statistical analyst extensions in ArcGIS 10.2 version were used to perform the spatial analyses, while supervised classification was performed using IDRISI taiga for the years 1986-2014. The satellite imageries were pre-processed to correct the error during scanning, transmission and recording of the data. The pre-processing steps used were:

1. Radiometric correction to compensate the effects of atmosphere;
2. Geometric correction, i.e. registration of the image to make it usable with other maps or images of the applied reference system; and
3. Noise removal to remove any type of unwanted noise due to the limitation of transmission and recording processes.

Both Landsat ETM+ and Landsat TM images were captured under clear conditions (0% cloud coverage for both images), uniform atmospheric conditions within the images were assumed and no atmospheric corrections were applied. Pre-data processing of images was done by the USGS in order to rectify any geometric or radiometric distortions to the level of a 1G product. The correction process employs both digital elevation models and ground control points to achieve a product that is free from distortions related to the Earth (e.g. curvature, rotation), satellite (e.g. attitude deviations from nominal), and sensor (e.g. view angle effects). The USGS also geometrically corrected and geo-referenced both images to the WGS1984 datum and Universal Transverse Mercator (UTM) Zone 31N coordinate system (Landsat Project Science Office, 2001; USGS, 2010b).

Image Compositing: follows a false Colour Composite operation performed using IDRISI Tiaga software and the Landsat bands were combined in the order of band 4, band 3 and band 2 for Landsat TM and ETM+ while Landsat OLI was composited in the order of band 4, band4 and band 3 due to a change in the sensor.

Image classification involves false colour composite, further Classified using the maximum likelihood classification technique. A supervised classification was performed by creating a training sample and based on a spectral signature curve, various land use classes were created, namely Settlements, Vegetation, Water body, and Exposed surfaces. The classified map was generated for the years 1986; 2006 and 2014 respectively. In order to verify the result, thorough ground-trotting of the study area was carried out.

Results and discussion of findings

Demographic and Socio-Economic Characteristics

Field observation and interview with officials revealed that farmers in the study area are mainly indigenes (Yorubas' from Osogbo) most of whom are born in the rural communities where they have access to land owned by families and communities. Land approved by the government for farming activities is also acquired by commercial agricultural farmers. However, farmers of varying age and gender were identified. 36 of farmers were within the active young age of below 30 years; 38.7% were between 31 and 40 years, and 34.1% fell within the ages of 41 - 50 years. Farmers within the age range of 51 - 60 years accounted for 6.9% while those above 60 years of age represented the remaining 2.8%. From the sample, 71.4% are male and 26.3% females. From the foregoing it can be deduced that more youths and females of (26.3% which represent 1:4 of male) are starting to embrace farming practices in the urban and peri-urban areas, mostly undertaken by aged people and males. Invariably, this could contribute to meaningful agricultural practices and food security.

Acquah-de Graft and Onumah (2011) reaffirmed the role education plays in the functioning of a farm. In view of this, from the sample, 9.2% obtained Islamic school education, 19.4% had primary school education, 39.6% had secondary school education, while the remaining 13.4% are graduates of tertiary institutions. This finding revealed that many of the farmers will be able to communicate with and understand explanations from agricultural extension officers. As stated by an official of the Osun State Agency for Agriculture Development Corporation, "*Many of the farmers come for training, workshops and seminars that we organise and invite them for".*

Of the large percentage of the youth engaged in farming practices indicated above, 83.4% are married, which implies that they are responsible and mature people with families to cater for, and therefore they will take farming more seriously. Data gathered show that 7.4% are single farmers. Those who were separated constituted 2.8%; 0.5% were divorced and 6.0% were widowed. This implies that farming is more prominent among married youth and that the other groups form a small but significant percentage of farmers, hence there may still be hope for the future of farming in the area if encroachment and housing expansion/development does not hinder it (Table 1.3).

Table 3: Socio-Economic Characteristics.

Age of Respondent	Respondents	%	Sex of Respondent	Respondents	%
<30	36	16.6%	Male	155	71.4%
31 - 40	84	38.7%	Female	57	26.3%
41 - 50	74	34.1%	No Response	5	2.3%
51 - 60	15	6.9%	Total	217	100.0%
61 above	6	2.8%			
No response	2	.9%			
Total	217	100.0%			

Highest Level of Education	Respondents	%	Marital Status	Respondents	%
No Formal Education	40	18.4%	Single	16	7.4%
Primary Education	42	19.4%	Married	181	83.4%
Secondary Education	86	39.6%	Separated	6	2.8%
Tertiary Education	29	13.4%	Divorced	1	.5%
Islamic Education	20	9.2%	Widowed	13	6.0%
Total	217	100.0%	Total	217	100.0%

Primary Occupation	Respondents	%	Monthly Income Status	Respondents	%
Civil Servant	20	9.2%	1 - 10,000	18	8.3%
Private Employed	9	4.1%	11,000 - 20,000	56	25.8%
Retired	21	9.7%	21,000 - 40,000	87	40.1%
Unemployed	37	17.1%	41,000 - 50,000	46	21.2%
Student/Apprentice	6	2.8%	Above 50,000	3	1.4%
Trading	61	28.1%	No Response	7	3.2%
Farming	39	18.0%	Total	217	100.0
Artisan	24	11.1%			
Total	217	100.0%			

Source: Field data

Kareem and Raheem (2012) observe that larger numbers of peri-urban farmers are either full-time or part-time farmers. Responses from some sampled farmers revealed that farming was their predominant activity, but many had a secondary source of livelihood. Eighteen percent indicated farming as their primary means of livelihood; 28.1% had ventured into commercial trading activities as a secondary source of livelihood. Among the farmers interviewed, 11.1% were artisans, and 2.8% were students/apprentices. Those who were gainfully employed in the public sector and by private businesses were also engaged in farming (for commercial or consumption purposes); they represented 9.2% and 4.1% of the sample respectively. Also, 26.8% of the sampled people engaged in farming in the study area were either retired or unemployed. With the farmers earning between #21,000 - #40,000 (40.1%), #11,000 - #20,000 (25.8%), #41,000 - #50,000 (21.2%), above #50,000(1.4%) and below #10,000(8.3%). This implies that respondents are relatively comfortable as many earn about the minimum wage of #18000.

Characteristics of Urban/Peri-Urban Agricultural practices

Peri-urban farming can be at a subsistence/consumption or commercial level (Morton, 2007; Mandere, *et al*., 2010). The study established that 39.6% of farming is done for commercial purposes, 23.0% for consumption, and 14.7% for both consumption and commercial purposes. Twenty-nine farmers claimed to have put their plot of land to active and productive use for income generation, 1.4% to prevent wastage of space and 3.2% as a means of land security. FAO (2001) and RUAF (2016) observed peri-urban agriculture to be largely characterised by the growing of plants and rearing of animals, but on different scales: 12.0% engage on a commercial level, 20.3% in subsistence farming, 24.0% in peasant farming and 38.2% on a small scale commercial level (See table 4). Peasant farming and small scale commercial agriculture are often common because most farmers operate on family lands, communal lands or personal lands that are not large enough when compared to those that engage in commercial farming in the study area.

Table 4: Form of Farming Practices

Form of Farming Practices	Respondents	Percentage
Subsistence Farming	44	20.3%
Large Scale Commercial Farming	26	12.0%
Peasant Farming	52	24.0%
Small Scale Commercial Farming	83	38.2%
No Response	12	5.5%
Total	217	100.0%

Source : Field data

Urban encroachment on the hinterland occurs so fast that many farmers have lost their farmlands located at the transition areas of the city. This compels farmers to travel daily from to their farmlands located in the rural areas, and to the periphery of the expanding city centre from home. As presented in table 1.5, farmers whose farms were located more than 5km away lived on the fringe and in rural communities (40 respondents with 27 of the famers stating that their farms were located in a rural area, 10 in the hinterland, and 2 within the city area). Some farmlands were located less than 50m from respondents place of residence.

To further establish the relationship between farm location and distance, the study hypothesised that there is no significant relationship between farm location and distance to farm. From the analysis as presented in table 1.5, there is a clear indication that the location of farm land is a function of its distance from the city. X^2 test of 0.00 at 5% significance level, calculated at 30.0 degrees of freedom, indicated that the relationship between distance and location is highly significant. However, locational distribution of farmland does not affect farming practices, but can only reduce or hinder the number of working hours per day; a 5km distance affects up to 25% of working hours daily on the farm (McCall, 1985). This finding also aligns with the views of Drescher and Iaquinta, (1999); Cox, (2004); Tofowomo, (2008) and Taiwo (2013 and 2014) that urban dynamics caused by urbanization results in the lateral growth of development which triggers invasion into farmlands, thus increasing travel distance of farmers.

Table 5: Location of Farm Land and Distance of Farmland to Place of Residence

Location of Farm Land	Distance from Farmland to House						
	< 50m	100 m - 500 m	500m - 1km	1km - 2km	2km - 4km	> 5km	Total
In the Rural Area	23	0	5	14	7	27	76
In the Hinterland	0	0	12	14	16	10	52
within the Community	0	10	9	6	7	2	34
within the City	0	17	0	0	2	0	19
Within my House	19	1	0	0	6	0	26
No response	2	0	1	1	1	1	6
Total	44	28	27	35	39	40	213

Chi-Square Tests of relationship between farm location and distance to farm.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	231.493[a]	30	.000
Likelihood Ratio	225.702	30	.000
N of Valid Cases	213		

a. 25 cells (59.5%) have expected count less than 5. The minimum expected count is .03.

Source : Field data

Rate of Urbanization and Farmland Encroachment.

A number of studies (Lopez *et al*., 2001; Bhatta, 2010; and Bankole and Bakare, 2011) have shown the effect of uncontrolled and unplanned urbanization, in the form of sprawl, on vegetation and agricultural land-uses, subjecting peri-urban areas to multiple activities (Appiah *et al*., 2014) which are mostly informal. This study findings revealed that 27.2% of the farmers' lands were registered with the government and there were authorized statutory documents to this effect, while 60.4% of farmlands had not been registered with the government; about 12.4% failed to indicate their farm status. Nonetheless, the state does not have any land designated for farming within the urban and peri-urban areas, as farm lands are owned by individuals/families.

Many of the farmers perceived that they were at risk of losing their farmlands to encroachment in 20 years (Figure 2). Thirty percent of the farmers thought encroachment would cause them to lose their farmlands in 10 years' time, while 52% were really worried that encroachment was imminent. These apprehensions are in tandem with Naab *et al*. (2013) who identified rapid conversion of prime agricultural land areas to urban land uses (mostly residential construction) in the urban periphery as the key challenges posed by urbanization processes. Therefore, government needs plans to improve existing farm settlements in the state to accommodate affected farmers.

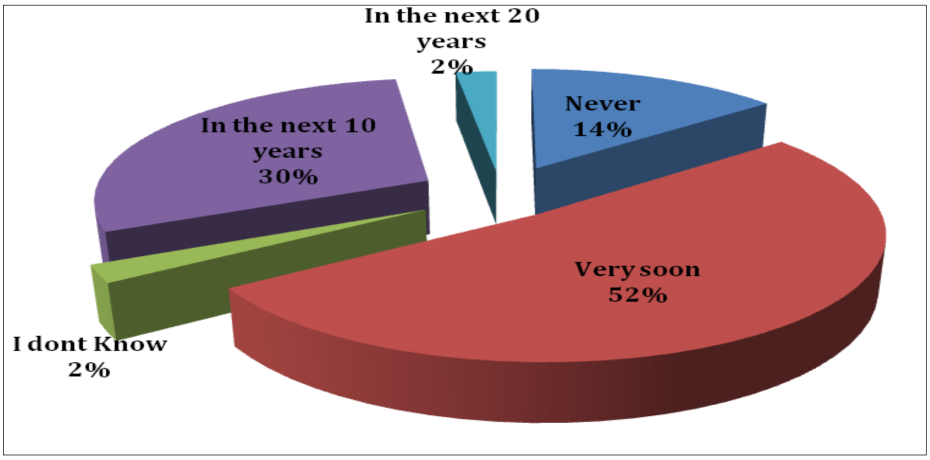

Figure 2: Encroachment on Farm land in next 20 years
Source : Field data

Developmental activities along the urban and peri-urban areas in the form of road construction, public facilities, services and utilities affect farmlands (OECD, 1979). In view of this, 41.9% perceived that housing encroachment by government, corporate bodies or individuals on farmlands had been occurring at an alarming rate in the past years. Over thirty-eight percent attributed housing encroachment on farmlands to population increase within the community and the consequent increase in housing demand. Also, physical development activities have contributed 13.4% of the rate of encroachment while 2.8% reduction in size of farmland could be traced to the sale of farmland by family members, communities and or land speculators, among other land tenure associated problems. Other ways in which agricultural farmlands were at risk included: 21.2% farmland sold off in exchange for money, 16.6% land lost due to land tenure systems triggered by communal and or familial clashes, 15.7% government acquired land and 14.3% who personally developed part of their farmland for housing.

Urban dynamics and development contribute to the extinction or shrinking of farmlands (Fred *et al*. 2004). Table 1.6 reveals that in the past 20 years existing farmlands were used for other purposes or were vacant open spaces. For instance, 30.9% were vacant 20 years ago, and 23.0% were just open spaces. 17.5% were used for compound farming or poultry on fenced residences while only 16.6% of existing farmlands were fenced to avoid intruders gaining access. About ten percent has been used as farmland for 20 years now. Currently, 49.8% of respondents used their land for farming activities alone, and 21.7% for both farming and housing, a practice that is often common among farmers engaged in poultry, aquaculture and domestic animal rearing. About 12.9% carried out farming and other commercial activities, whereas only 2.3% of farmlands had been turned into outright residential spaces because farming became less lucrative or due to old age. Therefore, current usage of land may vary from one study area to another and from one individual farmer to the other, as indicated in table 1.7.

Table 1.6:Peri-urban land use dynamics in the last 20 years

Peri-urban land use 20yrs Ago	Respondents	%
Vacant Land	67	30.9%
Fenced Property	36	16.6%
Open Spaces	50	23.0%
Residential Land Development	38	17.5%
Farmland	21	9.7%
No Response	5	2.3%
Total	217	100.0%

Source : Field data.

Table 1.7: Current peri-urban Land use dynamics 2014.

Current Uses of Land 2014	Respondents	%
Farming Only	108	49.8%
Residential and Farming	47	21.7%
Residential Only	5	2.3%
Farming and Mixed uses	25	11.5%
Farming and Commercial	28	12.9%
No Response	4	1.8%
Total	217	100.0%

Source : Field data

Planning is futuristic. The study attempted to project the status of existing farmlands in the next 10 years from the farmers' perspective. Above thirty percent farmers perceived that their farmland would still be used for farming, 32.3% envisaged encroachment in the form of residential layouts, 22.6% expected a mixed land use (farmland and residential development), 11.1% mixed land use (farmland and commercial development) while the remaining 1.4% expected their land to be used for commercial purposes within the next 10 years.

Spatio-temporal Analysis of Farmland and Settlement Expansion

A supervised classification was performed by creating a spectral signature curve of various land use classes created (Settlements, Vegetation, Water body, and Exposed surfaces). The classified map was generated for the years 1986, 2006 and 2014 with ground-truthing for verification. Land Modelling Change actually indicates how vegetation has been covered up by housing expansion. As shown in Table 7 it was observed that settlement has been on the increase from 6.60865% in 1986 to 20.11178% in 2014 while vegetation has been decreasing, from 62.69045% in 1986 to as low as 54.02527% in 2014. Other factors contributing to encroachment on agricultural farmlands include water bodies and exposed surfaces. Due to fish farming, snail rearing, canal dredging and drainage construction in the study area, water bodies have also changed from 0.81% in 1986 to 1.94% in 2014. Though this is still a negligible increase in amount of water bodies, it still claims part of the land cover. Hence exposed surfaces include open spaces, tarred and un-tarred roads, walkways, drainages, bare grounds, play grounds, cleared sites, development sites, grazing lands and any other lands that are not covered with vegetation. Exposure surface also has shown tremendous increase in percentage over the years as indicated in Table 8 below.

Table 1.8: Changes in the Land uses; Encroachment Trends on Vegetation Cover

Area (Hectares)				Area (Percentage)		
Landuse/Landcover	Year 1986	Year 2006	Year 2014	Year 1986	Year 2006	Year 2014
Settlement	978.03	1206.45	2976.39	6.60865%	8.152108%	20.11178%
Vegetation	9277.71	8615.34	7995.33	62.69045%	58.21475%	54.02527%
Exposed Surface	4423.5	4690.17	3539.88	29.89005%	31.69197%	23.91934%
Water body	120	287.28	287.64	0.810852%	1.941181%	1.943613%
Total	14799.24			100%		

Source: Field data

Table 7 shows that there has been a drastic change in settlements, vegetation, exposed surfaces, and water bodies. Therefore, table 8/figure 3 shows gains and losses of various land uses resulting from human developmental activities to provide shelter and for aesthetics. Thus, basic net changes occurred from the core towards the fringe/suburbs whereby loss of vegetation recorded 1402 hectares of land, exposed surfaces had shrunk to the extent of 884 hectares while settlements had increased tremendously by 1998 hectares of land at the expense of agricultural farmlands, farming practices and activities, thus threatening food security of the state

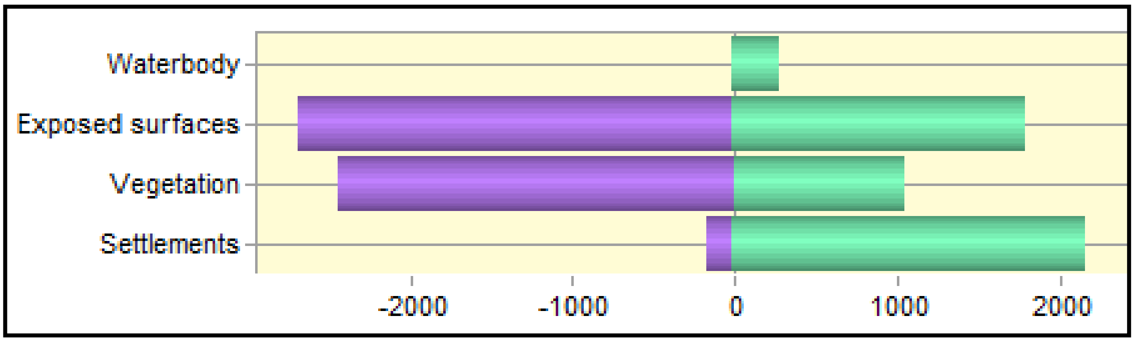

Figure 3: Gains and losses in Hectares between 1986 and 2014

Source: Field data

Table 9: Land use changes in hectares

Gains and losses between 1986 and 2014			Net change between 1986 and 2014	
Land use/Land cover	Gains	Losses	Land use/Land cover	Change in Hectares
Settlements	-178	2176	Settlements	1998
Vegetation	-2441	1039	Vegetation	-1402
Exposed surfaces	-2692	1808	Exposed surfaces	-884
Water body	0	288	Water body	288

Source: Field data

Figure 4 shows the extent of housing expansion on agricultural farmlands (Vegetative Cover). This has indicated the trends of 30 years, how physical development has caught up with suburbs, fringes, and peripheries from the city centre (Osogbo), Osun State. The settlement (built-up areas) was observed to have moved towards the Eastern and Northern parts of the city with little expansion towards the South. This is so because the city is located at the South-Western part of the state, so it is built-up already.

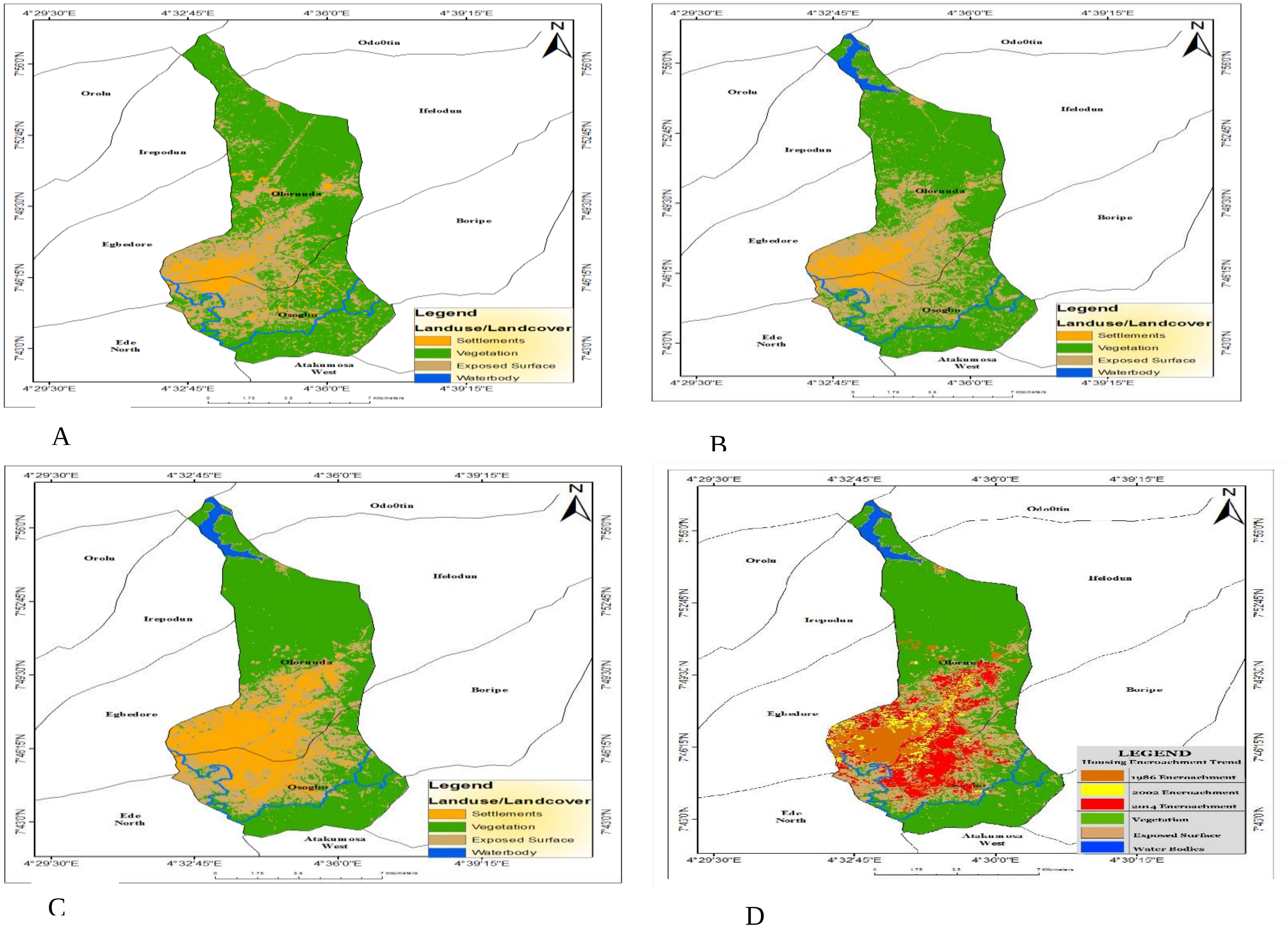

Figure 4: Trend Analysis Map on Housing/Settlements Expansion. A (1986), B (2006) C (2014) and D (1986-2014 combined map).

Conclusions and Recommendations

City expansion has resulted from increased urban population and physical development. The rates at which large expanses of agricultural lands in the urban fringes are taken up by human activities and development are alarming. Many arable lands have been converted into built-up areas (settlements), with significant value added to housing production to meet the immediate housing demand for Osogbo, Olorunda and their environs. Farmlands and farmers in the rural fringes continue to lose their farmlands to various developmental projects with no compensation or consideration for their livelihood and food production.

In the next 10 years, development would have caught-up with arable lands in the fringes of Osogbo and its environs. Housing encroachments were observed to be uncontrolled due to weak government response to the trend of unplanned city expansion,leaving peri-urban farmers exposed to the negative shocks of urbanization.

Recommendations

The registration of land for agricultural activities by farmers is suggested by the study to help curtail the loss or fear of losing their farmlands.

There is an urgent need to carry out the Master Plan Renewal to secure the agricultural lands, particularly the government owned farm settlements in the state.

It is very important to consider vertical development as against the dominant horizontal development to curtail the increasing land demand and supply that will edge out land for agriculture.

New residential developments along the peri-urban areas should protect the rights of existing agricultural land by conserving arable lands to support farming activities.

Integrating UPA into residential layout designs remains an option towards maintaining secure tenure for farmers and farming activities.

There should be proper compensation for forced eviction, encroachment, and conversion of farmlands into housing development and physical infrastructure, and relocation must be organised for the affected farmers to continue their farming practices.

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