MACROJOURNALS

The Journal of **Macro**Trends in Technology and Innovation

Mapping Agricultural Land use Conversion and Management on Food Supply (Food Crops) in Saki West Local Government, Oyo State, Nigeria.

Michael Ajide Oyinloye

Department of Urban of Urban and Regional Planning, School of Environmental Technology, Federal University of Technology, Akure, Nigeria

Abstract

The average rate of agricultural growth in Africa has held at about 1.7 to 1.9 percent per annum in real terms since 1965 but there has been a decline in per capita agricultural output which is mirrored in a decline in per capita food production (by about 6 percent since the average during 1979 to 1981). The rapid rate of increase in food imports (increasing at nearly 4 percent per annum since 1974) is the result of poor agricultural performance, combined with rapid population growth and expanding urban populations unable to obtain sufficient agricultural produce from the country side. The primary aim of this project is to use Remote Sensing and GIS to monitor the impact of agriculture landuse conversion on food supply in Saki West Local Government Area, OyoState, Nigeria. Landsat images of 1990 and 2000 of Saki West Local Government Area, Nigeria were obtained.The images were geometrically corrected and ground control points obtained through intensive ground surveys permitted the co-registration of all images to a Universal Transverse Mercator (UTM).The satellites imageries were made to pass through processes of image enhancement, geo referencing, re-sampling, image classification and digitizing. A supervised classification was performed on false colour composites (bands 4, 3 and 2) into the land use and land cover classes. Minimum likelihood algorithm with Arc GIS 9.3 software was also used. Also, a set of structured questionnaire, were administered using the stratified random sampling technique to elicit information on: the socio-economic factors responsible for conversion of agricultural landuse; effect of agricultural landuse conversion on food supply and; measures adopted to preserve agricultural landuses.The results revealed increase in agricultural landuse conversion over the periods (1990-2000).Recommendations were provided that will reduce the rate of conversion in study area.

Keywords: *Agricultural Landuse, Food supply, Remote Sensing, GIS, Saki*

1. INTRODUCTION

The issue of food insecurity is now a global problem. The Food and Agricultural Organization of the United Nations (FAO, 2003) has put it that about 850 million people in the world are undernourished, a number that has hardly changed from the 1990-1992 figures on which the World Food Summit (in 1996) and Millennium Development Goals' commitments to halving hunger by 2015 were hoped. Five (5) years ago, before the emergence of the global food-price crises, African leaders pledged to increase support for agriculture. Recognizing the importance of a strong agricultural sector for economic growth and poverty reduction, they made a commitment to invest ten – percent (10%) of their national budgets in agriculture by 2008. As 2008 comes to an end, where the things stand? (IFPRI, 2008). The population of undernourished people in Nigeria in 2001 has been put at 9.1 million (FAO, 2003).

The process of urbanization transforms land use and farming systems, patterns of labour force participation, infrastructure requirements, and natural resource systems. Uncontrolled urban growth can pose a major threat to agricultural land and in many cases benefits mainly middle- and upper-income groups (Oluwayemi, 2011). In Manila's extended metropolitan region, for example, large areas of rice land have been converted to industrial, residential, and recreational uses or have lain idle while owners awaited either development permits or more propitious market conditions. Such changes eliminate highly fertile agricultural land from production that urban households would otherwise rely on for affordable food (IFPRI, 2000). The situation is also not different in Saki West Local Government, being the fact that the agricultural lands need to be preserved to ensure an adequate food supply for the populace.

The conversion of agricultural land to other uses is not a new occurrence in the world. Cardenas (2000) reported that hundreds of hectares of productive farming land were converted to various urban uses in Cavite, Philippines to satisfy the urge to attract foreign investments, generate more employment opportunities, and decongest major population centres. From 1986 to 1994, there was some 856 land conversion applications filed in Cavite covering some 12,414 hectares. Of this number, about 698 petitions consisting of some 9,963 hectares were either approved or exempted. Assuming then that the majority of those applications under process would also be eventually approved or exempted, then the total size of agricultural lands that may have already been lost to urban uses could amount to approximately 12,060 ha over the past nine years. The same scenario is not far-fetched in India where a decision was taken to convert 500 acres of agricultural and residential land at Rajarhat to a proposed IT park. Everyday in the U.S, four square miles of the nation's prime farmlands are shifted to other uses other than agriculture. Florida, producer of half the world's grapefruit and one-quarter of the world's oranges, will lose all of its unique and prime lands in less than 20 years if the current conversion rate continues (Hunger Project, 1985). China has relatively cropland - approx 100 million hectares – for its population. As a result of industrial development, China is losing agric land to roads, railroads, and manufacturing plants at the rate of 1.26 million hectares a year. At the same time, China, with half of all its cropland under irrigation, is facing a severe water crisis due to seasonal

variations in rainfall, periodic floods, and diversion of water to non agricultural uses. Whether China's agric resources can sustain its population in the coming decades is seen by many as a critical test of whether the world as a whole can find a sustainable balance between food production, consumer demand, and population growth in the future (Botkin and Keller, 2001). The agricultural land conversion has really affected domestic food production in Nigeria. Between 1994 and 2001 up to 2003, Nigeria's domestic food production consistently fell short of the food demand. During this period, food demand was met mainly through domestic production and less through imports. Within the country, food aid has not been a common strategy for meeting annual short falls in food production for the main reason that the nation is lucky not to be exposed to national emergencies and natural disasters of the magnitude that would compel it to rely on food relief. Between 1994 and 2003,food shortages rose from 0.53 million to 6.51 million metric tonnes representing over 2000 percent increase. In 2003 the estimated short fall is 9.01 million metric tonnes. An annual growth rate of 6 percent in food production will be required to bridge the gap in the next 7 years (2010). This however assumes that the food demand will not grow beyond its present rate (Oluyemisi, 2006).

Nigeria ranked as the dominant economy in sub-Saharan Africa and as the continent's major exporter of crude oil. Yet, agriculture is the main source of revenue for two-thirds of the population. Still, more than 50% of Nigerians live in poverty with corruption and poor infrastructure as the main obstacles for future sustainable development (World Bank, 2010). Political decisions taken since independence have relegated agricultural development to a secondary economic position. As a result, agriculture has suffered, and, increasingly, has occupied a back seat in economic terms (Aigbokhan, 2001).

Following this trend, agricultural lands nationwide are now being converted into other uses. This take of land for other uses has brought about a considerable loss of farmland and thus a shortage in food supply in the study area. Most agriculturists and farmers are hostile to such losses. Compulsory purchase or free exploitation of farmland for other purposes without the influence of land resources planning is a serious and a deteriorating situation. Planning authorities, who are responsible for the zoning of land into various uses, need to vehemently control the zoned agricultural lands. Monitoring and mediating the negative consequences of land use conversion while sustain the production of essential resources should become a major priority of researchers and policy makers around the world. The objectives of this study are therefore:

1. Identification of landuse classes in remotely sensed data sources;
2. To examine the socio-economic factors that affect conversion of agricultural land and land use types in the study area;
3. To assess the impact and management of the agricultural land use conversion on food supply; and
4. To examine the impact of urban (population) growth on agricultural land use conversion

2. THE STUDY AREA

Saki is the administrative headquarters of Saki West Local Government in Oyo State. Saki West local government is located on latitude $8^{o}40^{'}$ and longitude $3^{o}24^{'}$ (see figure 1, 2 and 3). The population of Saki in 1991 was put at 89,595 and grew to 278,002 in 2006 (NPC, 1991, 2006) and an area of 2,014$km^{2.}$ The gradual development of the town is as a result of her sharing a border with Benin Republic and also for her huge agricultural lands. Saki town is thus referred to as the food basket of Oyo State because of its agricultural activities (Wikipedia, 2006). The contribution of agriculture to the economy of the town is presently high. The agricultural sector is a significant source of employment in the territory. Modern Saki is an exporter of cotton, swamp rice, teak, and tobacco while yams, cassava, maize, sorghum, beans, and okra are grown for subsistence. Cattle raising is increasing in importance, and there is a government livestock station. There are vast cattle ranches at Saki and the town houses the headquarters of the Oyo State Agricultural Development Programme.

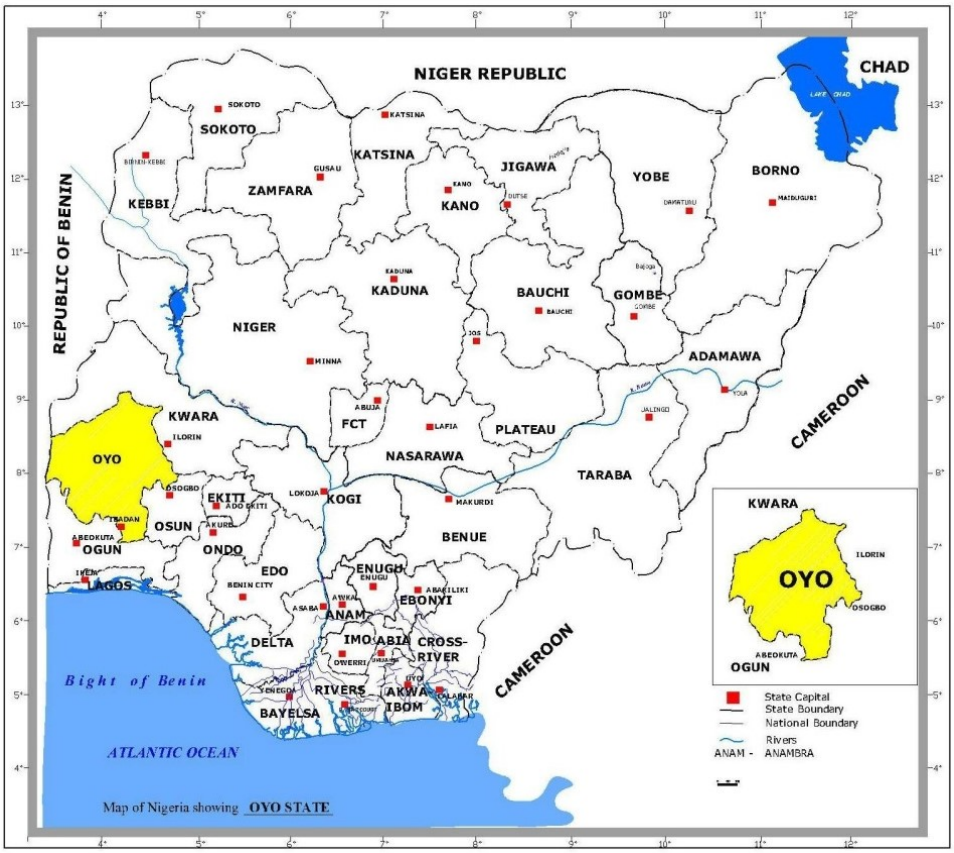

Figure 1: Map of Nigeria showing Oyo State

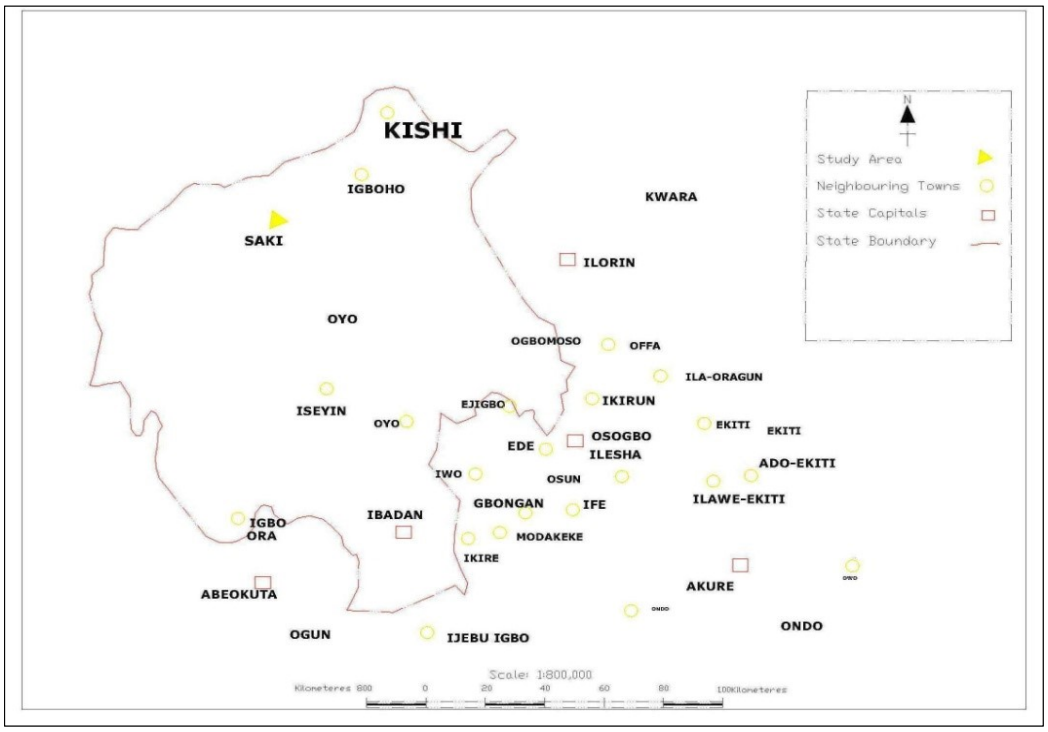

Figure 2: Map of Oyo State showing Saki Local Government
Source: Oyo state Ministry of Physical Planning and Urban Development

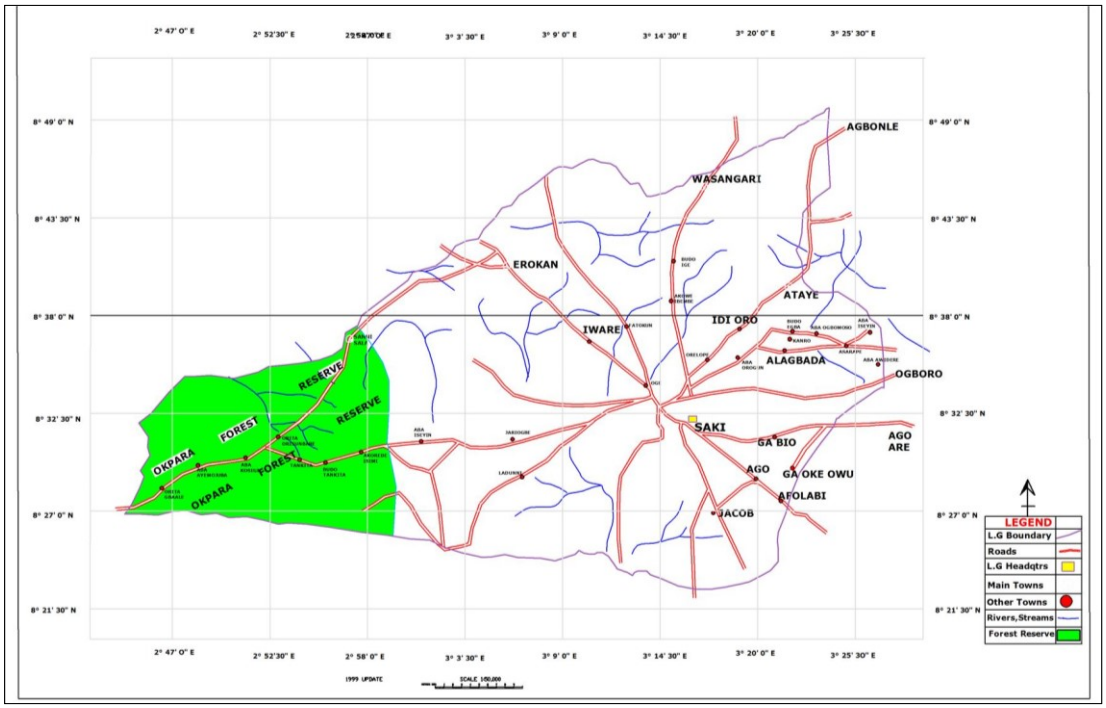

Figure 3: Map of Saki Local Government and its neighbouring towns
Source: Oyo state Ministry of Physical Planning and Urban Development

3. DATA ACQUISITION AND METHOD

This study is interested in the analysis of mapping agricultural landuse conversion and management on food supply (food crops) in the study area. To achieve this, data were collected using structured questionnaire which was administered on eleven political wards in the study area. The questionnaire was administered on household heads in the study area. The questionnaire addresses income of respondents, occupation, household size, former use of land, length of stay, period of conversion, approval of conversion, land acquisition, effect of agricultural landuse conversion among others. Also, photographs of interested scenes were taken to compliment the questionnaire administered.

Data for agricultural landuse conversion of the study area were obtained from two remotely sensed data and a topographical of 1965 covering the study area were used to monitor the conversion for the periods.Landsat Thematic Mapper ™ images were used for 1990 and 2000 in the study area. The images were geometrically corrected and ground control points obtained through intensive ground surveys permitted the co-registration of all images to a Universal Transverse Mercator (UTM). Supervised signature extraction method was used in classifying the image. The different crops under the agricultural landuse could not be discriminated at the resolution of the image. A generally classified image was prepared for ground truth checking during the fieldwork. The legend of the current agricultural landuse map was reduced to four different categories. To compare the supervised agricultural land use conversion classification, the initial landuse maps of 1990 were compared with 2000 using a simple cross-tabulation algorithm, which created a new map and table. Area affected by conversion was evaluated by comparing the level of current utilization against their initial use.

4. RESULTS AND DISCUSSION

The results of the administered questionnaire and the GIS outputs are presented below:

4.1. Socio economic Trait of the Respondents:

Table 1 shows the occupation of the respondents. 61% of the respondents are engaged in farming while 14.9% of the respondents are artisans 7.4% and 16.6% of the respondents are traders and civil servants respectively. The high percentage of farmers gave credence and justification to the assertion that Saki is the food basket of the Oyo State.

Table 1: Occupation of the Respondents

Occupation	Number of Respondents	Percentage
Farming	214	61.1
Artisan	52	14.9
Trading	26	7.4
Civil Service	58	16.6
Total	**350**	**100.00**

Source: Field survey, 2014

Table 2 shows that majority of the respondents are low income earners. 24% of the respondents earn below ₦10,000 per month, 86 people earned between ₦10,000 and ₦25,000 while 65 people earned between ₦25,001 and ₦40,000 per month. Also, 71 and 32 respondents earn between ₦40,001 and ₦55,000; and ₦55,001 - ₦70,000 respectively. 49 of the sampled population earn above ₦70,000 per month.

Table 2: Monthly Income of Respondents

Income	Number of Respondents	Percentage
Below ₦10,000	24	6.9
₦10,000 - ₦25,000	86	24.6
₦25,001 - ₦40,000	65	18.6
₦40,001 - ₦55,000	71	20.2
₦55,001 - ₦70,000	32	9.1
Above ₦70,000	49	14.0
No response	23	6.6
Total	**350**	**100.0**

Source: Field survey, 2014

Table 3 shows number of wives of the respondents. From table 3 below, about 73.43% of the sampled population has one wife while about 22.57% has two wives. 3.14% and 0.86% of the respondents has three and four wives respectively. Although monogamy is dominant marriage practice in the study area, but those that married more than one wife said that their children will help them on their farms.

Table 3 : Number of Wives of Respondents

Number of wives	Number of Respondents	Percentage
1	257	73.43
2	79	22.57
3	11	3.14
4	3	0.86
Total	**350**	**100.00**

Source: Field survey, 2014

The household size of the respondents was shown in table 4. 54.0% of the respondents have a household size of 4-6 persons while 8.0% of the respondents have a household size of 1 - 3 persons. Also, 36.3% and 1.7% of the respondents have a household size of 7 – 9 persons and above 10 persons respectively. This implies that there is a tendency for increase in population in the study area.

Table 4: Household size

Household size	Number of Respondents	Percentage
1 - 3	28	8.0
4 - 6	189	54.0
7 - 9	127	36.3
10 and above	6	1.7
Total	**350**	**100.0**

Source: Field survey, 2014

From table 5 shows that 25.2% of the respondents have tertiary education while 15.1% have no formal education at all. However, 23.4% and 36.3% went are primary education and secondary respectively. The level of education is generally low and constitute a large percentage of farmers in the study area.

Table 5: Level of Education

Level of Education	Number of Respondents	Percentage
No formal Education	53	15.1
Primary Education	82	23.4
Secondary Education	127	36.3
Tertiary Education	88	25.2
Total	**350**	**100.0**

Source: Field survey, 2014

63.1% of the respondents in table 6 declared that the land they presently occupy was formerly used for agricultural land use while 4.6% said the land was formerly used for forest reserve. This implies that farming is very prominent in the area. 2% and 4.9% of the respondents said that the land was formerly used for industrial and commercial purposes respectively. Open space/recreational and public land use are 9.1% and 3.1% respectively while 13.1% affirmed that the land was formerly used for residential uses.

Table 6: Former Use of Land

Former Use	Number of Respondents	Percentage
Forest reserve	16	4.6
Agricultural	221	63.1
Commercial	17	4.9
Industrial	7	2.0
Open space/recreational	32	9.1
Public	11	3.1
Residential	46	13.1
Total	**350**	**100.00**

Source: Field survey, 2014

The length of stay of the respondents in the area was determined to know how informed they are about the use the land they occupy was formerly put into. Table 7 shows that 19.71% said they just moved to the area i.e. less than 5 years. This shows the rate of rapid development in the local government especially for residential land uses and uses along the major roads. 34.86% declared they have been in the area for 5 – 10 years while 26.86% have been staying in the area between 11 to 15 years. Those staying in the area for over 16 years are 18.57% of the respondents.

Table 7: Length of Stay of Respondents in the area

Length of Stay	Number of Respondents	Percentage
Less than 5 years	69	19.71
5 - 10 years	122	34.86
11 - 15 years	94	26.86
16 years and above	65	18.57
Total	350	**100.00**

Source: Field survey, 2014

The present state of conversion in table 8 shows that 68% of the agricultural landuse have been converted to residential, 18.6% to commercial while 8% and 5.1% to public and industrial uses respectively. Figure 4 shows the agricultural landuse that has been converted to residential landuses. The implication of this is that residential landuse increases as population rises.

Table 8: Present State of Conversion

State of Conversion	Number of Respondents	Percentage
Residential landuse	238	68.0
Commercial landuse	65	18.6
Public landuse	29	8.3
Industrial landuse	18	5.1
Total	**350**	**100.0**

Source: Field survey, 2014

Figure 4: A view of an agricultural land use that has been converted to residential landuses; Source: Field survey, 2014

Table 9 shows that 54.9% of the respondents had obtained approval for their development while 26% have not obtained approval. This implies that the Town Planning Authority in the study area is aware of the conversion of the agricultural lands. Interestingly, 19.1% of the respondents who obviously had not obtained approval from Town Planning Authority.

Table 8: Present State of Conversion

Approval of Conversion	Number of Respondents	Percentage
Approved	192	54.9
Not Approved	91	26.0
In the process for Approval	67	19.1
Total	**350**	**100.0**

Source: Field survey, 2014

Table 9 shows the effect of agricultural land use conversion on food supply. 72.6% of respondents forthrightly declared the conversion of agricultural landuse has greatly reduced food supply, 17.1% said it has moderately reduced food supply. 22 and 14 people said the

conversion had fairly and poorly reduced food supply respectively. This agricultural landuse conversion has greatly the escalating cost of food items in the market in the study area.

Table 9: Effect of Agricultural landuse Conversion on Food Supply

Effect of Agricultural Landuse Conversion on Food Supply	Number of Respondents	Percentage
Greatly reduced	254	72.6
Moderately reduced	60	17.1
Fairly reduced	22	6.3
Poorly reduced	14	4.0
Total	**350**	**100.0**

Source: Field survey, 2014

Table 10 shows the general effect of agricultural land use conversion on the respondents. 47.5% of the respondents affirmed that the conversion reduced food supply. Other effects noticeable by the people are reduction in household income (26%), reduction in farm size (12%), reduction in export and others are 11.1% and 3.4% respectively.

Table 10: General Effect of Agricultural landuse Conversion on Respondents

General Effect of Agricultural Conversion on Respondents	Number of Respondents	Percentage
Reduced Food Supply	166	47.5
Reduction in Household income	91	26.0
Reduction in Farm Size	42	12.0
Reduction in Export	39	11.1
Others	12	3.4
Total	**350**	**100.0**

Test of Hypothesis using Chi-Square Analysis (X^2) was carried out to show the relationship between urban (population growth) and agricultural land use conversion. All the eight (8) variables shown in table 11 are significant at 1% and 5% alpha levels. The null hypothesis was thus rejected since the asymptotic value is less than the level of significance. It therefore iindicates that there is a significant relationship between urban growth and agricultural land use conversion. The implication is that as population was increasing, landuse conversion was also increasing at a higher rate.

Table 11: Urban Growth and Agricultural Land use Conversion

Urban growth	Chi-square value (X^2)	Asymptotic Significance	Remarks
NUMWIVES	59.602	.000	Reject null
INCOME	371.899	.000	Reject null
FAMPLAN	249.821	.000	Reject null
HOUSIZE	208.182	.000	Reject null
EDUCATN	471.114	.000	Reject null
REACONV	388.202	.000	Reject null
PREULAND	139.237	.000	Reject null
MARRIAGE	162.291	.000	Reject null

Source: Field survey, 2014

5.0 GIS ANALYSIS

GIS analysis was carried out on the Landsat TM and Enhanced Thematic Mappings (ETM$^+$) Bands 4 and 5 imageries. The images were classified using the same software before importing to ArcGIS environment. Figures 5 and 6 show the imageries of 1990 and 2000 respectively of the study area.

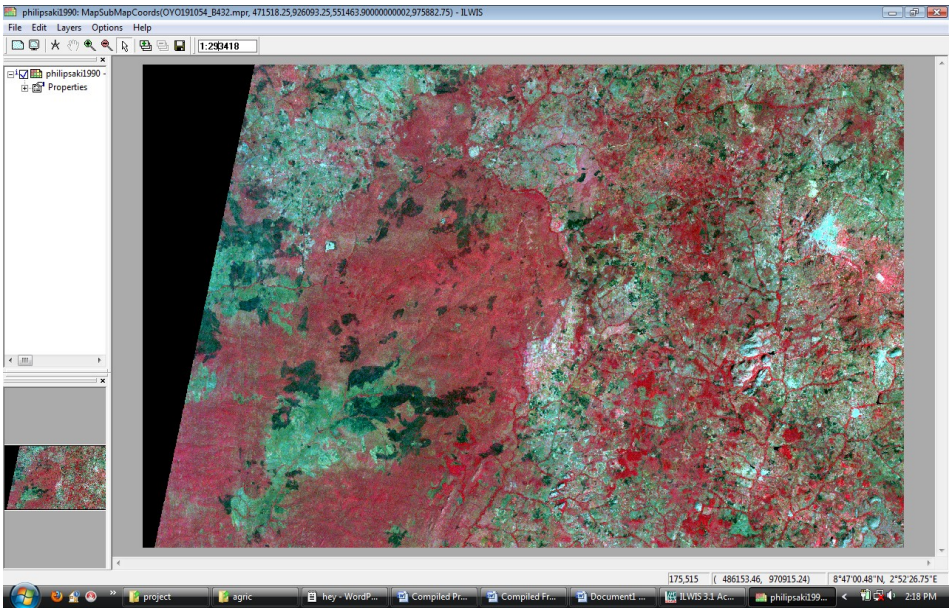

Figure 5: Map Showing Year 1990 LandSat TM image of the Study Area
Source: Field survey, 2014

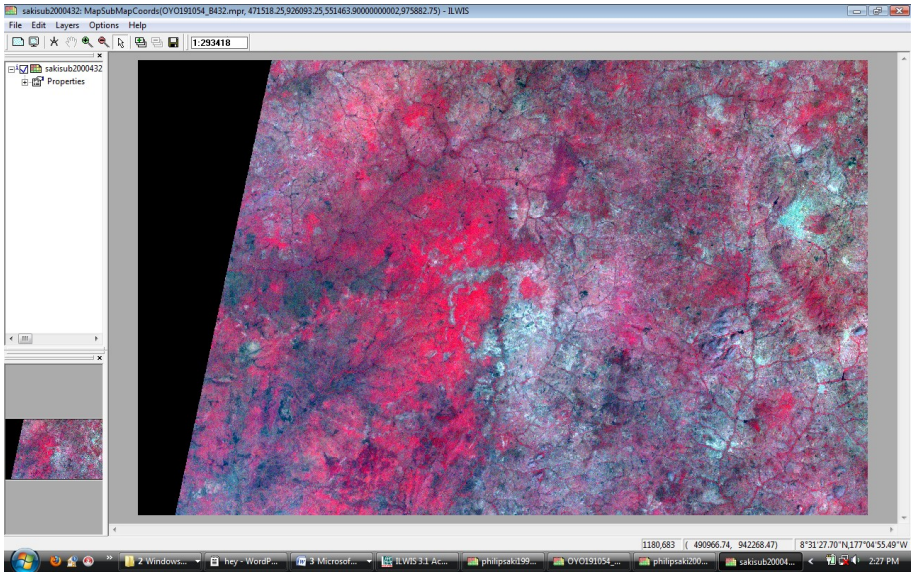

Figure 6: Map Showing Year 2000 LandSat (ETM^{+}) image of the Study Area
Source: Field survey, 2014

From figures 7 and 8, the Built up areas increased from 13.22% in year 1990 to 22.61% in year 2000 while the Light vegetated area/Wetlands reduced from 26.07% in year 1990 to 21.85% in year 2000. This can be attributed to population expansion in the study area leading to clearance of agricultural land uses. Also, the Thick vegetated areas reduced from 54.8% in year 1990 to 52.32% in year 2000 as shown in table 12 and figure 9. This reveals how forests are being cleared in the study area. Rock outcrops also reduced from 5.91% in year 1990 to 3.22% in year 2000. This could be attributed to the need to provide construction materials (e.g. gravel, granite, etc.) for building and road construction in the study area and neighbouring towns.

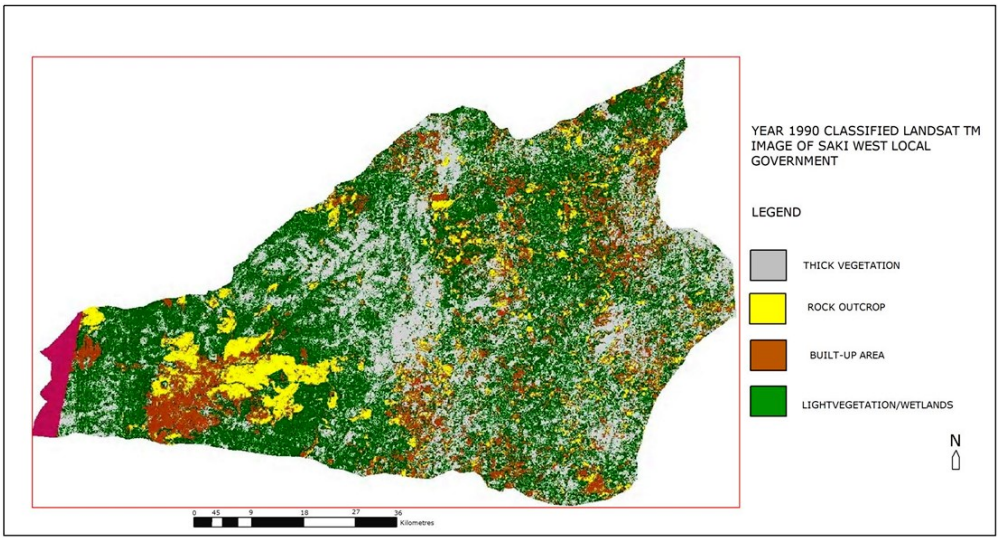

Figure 7: Map Showing the 1990 Classified LandSat Image of the Study Area
Source: Field survey, 2014

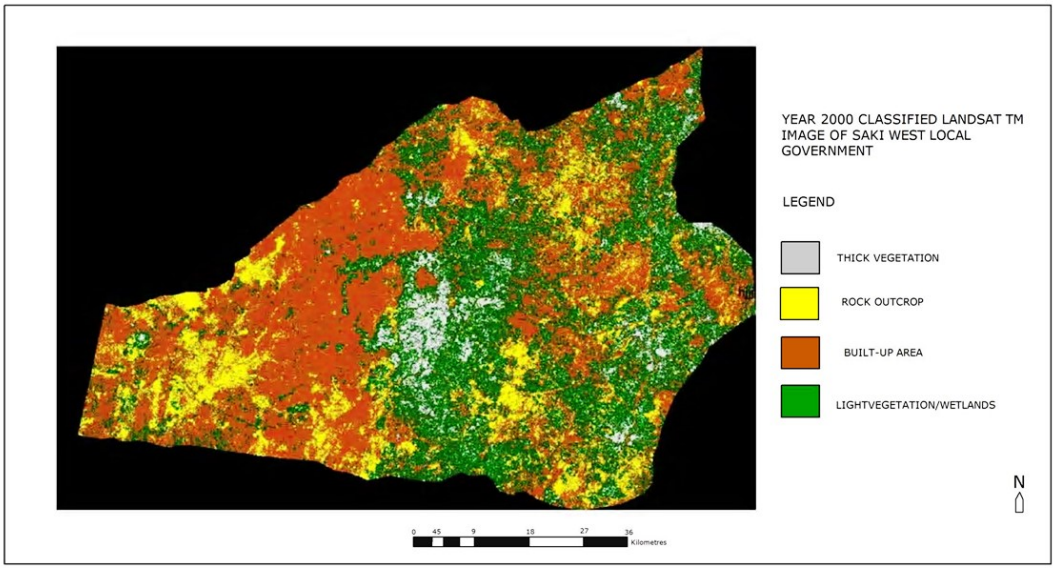

Figure 8: Map showing the 2000 Classified Landsat image of the Study Area.
Source: Field survey, 2014

Table 12: Percentage and Number of Pixels of Classified Land Use of Year 1990 and 2000

Land Use	2000	1990	2000	1990
	Number of Pixels		Percentage (%)	
Built up Area	162177	110373	22.61	13.22
Light Vegetation/Wetlands	177872	217567	21.85	26.07
Rock Outcrops	26881	48119	3.22	5.91
Thick Vegetation	425933	479884	52.32	54.80

Source: Field survey, 2014

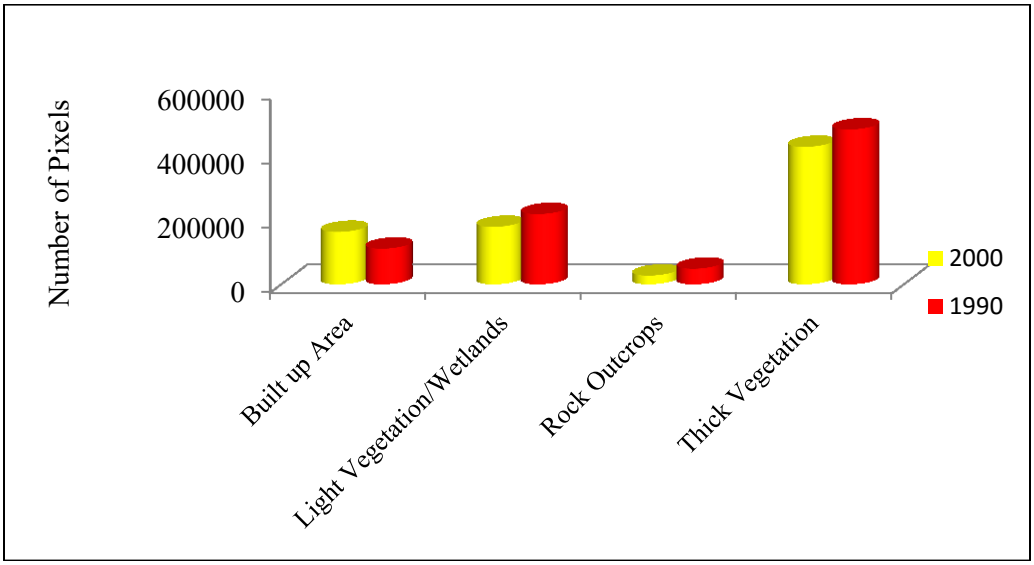

Figure 9: Classified Landuse Landsat TM of year 1990 and 2000 of the Study Area. Source: Field survey, 2014

6.0. CONCLUSION AND RECOMMENDATIONS

This study has highlighted the effect of the conversion of agricultural land uses on food supply in Saki Local Government of Oyo State, Nigeria. Basically, agriculture is the main stay of income of the people in the study area, though majority of the respondents are low income earners. The trend in the conversion of agricultural land use to built-up areas could be seen as rapid in the study area. From the findings 63.1% of the land they are occupying presently was formerly used for agriculture but presently, is being used for residential provision. Agricultural lands are being converted to various uses due to the following reasons: business purpose; housing provision; industrial provision; infrastructural provision, erosion and pattern or route development. From the GIS outputs, the following result could be deduced. The LandSat image also shows marked differences in the land use classification in the ten (10) year period. The built-up areas have increased 13.22% to 22.61% over the period from 1990 to 2000. The increasing in the agricultural landuse conversion escalates as population continues to grow. This study therefore advances some recommendations as a way of preventing rapid conversion of lands in the study area. There is need to control urban spreading to agricultural land as this will have serious repercussion on food production. The Local Government should as a matter of urgency see to the provision of a land use plan in order to regulate the growth and spread of developments in the study area. The agricultural lands to be provided for in the plan should be jealously guided against any form of conversion. This will ensure farmers have access to their primary resource for farming. The State Government in collaboration with the Local Government should initiate regional development programs that will ensure an equitable distribution of resources in the state so as to discourage migration, which is one of the causes of population increase in a place. It is therefore necessary and imperative for State Government and Local Government to

collaborate on adequate and proper management of agricultural landuse conversion of the study area.

REFERENCES

Aigbokhan, B. E (2001) Resuscitating Agricultural Production (Cocoa, Cotton, Groundnuts, Palm Oil, Rubber, Etc) For Exports. At http://www.cenbank.org/OUT/PUBLICATIONS/occasionalpapers/rd/2001/Owe-01-6.PDF

Botkin D. B and Keller E.A (2000) *Environmental Science: Earth as a Living Planet*. John Wiley & sons, inc. Canada

Cardenas , D (2000) Effects Of Land use Conversion on Local Agriculture: The Case of Cavite, Philippines. ftp://ftp.fao.org/es/esa/beijing/cardenas_landuse.pdf

FAO (2003) The State of Food Insecurity in the World. At ftp://ftp.fao.org/docrep/fao/006/j0083e/j0083e00.pdf

FAO (2006) The State of Food and Agriculture: Food Aid for Food Security. *FAO Agricultural Series.* No 37. pg 112.

Hunger Project (1985) *Ending Hunger: An Idea Whose Time has Come*. Praeger Publishers, New York, USA.

IFPRI (2008) The 10% that could change Africa. At *http://www.ifpri.org/sites/default/files/publications/if23.pdf*

NPC (2006) Legal Notice on Publication of the Details of the Breakdown of the National and State Provisional Totals 2006 Census. National Bureau of Statistics at www.nigerianstat.gov.ng. Retrieved on 20th of May, 2011.

Oluyemisi (2006) Agricultural Campaign Trail. At http://www.businessdayonline.com/NG/index.php/inspiring-woman/18387-oluyemisi--on-the-agric-campaign-trail. Retrieved on 26th of April, 2011.

Oluwayemi, P.A.(2011) The Impact of Agricultural Landuse Conversion on Food Supply in Nigerian Cities: A Case Study of Saki Local Government, Oyo State. Unpublished B.Tech thesis, Department of Urban and Regional Planning, Federal University of Technology, Akure, Nigeria.

Wikipedia (2011) Shaki. At http://en.wikipedia.org/wiki/Shaki,_Nigeria. Retrieved on 26th of May, 2015