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ORIGINAL ARTICLE

URBANIZATION AND HOUSEHOLD FOOD SECURITY IN LAFIA LOCAL GOVERNMENT AREA, NASARAWA STATE, NIGERIA: A GEOSPATIAL AND SOCIO-ECONOMIC ANALYSIS, 1984–2024

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Abstract

The rapid pace of urbanization is in the emergent secondary cities of Nigeria altering their peri-urban zones and reconfiguring the food-security trajectories of the urban dwellers living within. This paper explores the relationship between urban land-use change and household food security in Lafia Local Government Area (LGA), including its dwellers' socio-economic parameters, over a forty-year time frame (1984 - 2024). Multi-temporal Landsat images (1984, 2004, 2014 and 2024) were subjected to supervised maximum-likelihood classification to delineate five LULC classes, while a structured questionnaire administered to a sample size of 400 households (selected statistically by the Taro Yamane formula, for socio-economic data and expenditures) produced indicators of their food security status using expenditure-based food security indices and identified its socio-economic predictors by binary logit regression. The results reveal an unrelenting increase in the built-up area and reduction in farmland and vegetation cover from 1984 to 2024, reflective of succumbing to un-coordinated urban encroachment into native production territory. Based on 2004-2014 expenditure-based food security indices, 61.7% of the various household representatives were food secure while 38.3% were food insecure, with annual household income and membership in a cooperative society being the most significant predictors of the outcome. It was ascertained that several aspects of urban expansion in Lafia substantially led to reductions in food system components of local urban residents, but that income diversification and social capital built on membership of cooperative societies are strategic pathways to household food security in such contexts. Food-sensitive LULC zoning, periodic LULC monitoring and targeted agricultural-extension programs are recommended.

Keywords: Urbanization, Land use/Land Cover Change, Food Security, Remote Sensing, GIS, Household Determinants, Nigeria.



INTRODUCTION

Urbanization is a significant, and indeed the most important, direct influence of land-use change in developing nations. Nigeria, the most populous country in Africa, is one of the most rapidly-urbanizing, and rapid urbanization in Nigeria see Christiansen 2009 for the implications of urban/urbanizing Nigeria for local food systems in particular is thus occurring in a context in which cities and state capitals are competing with agriculture for land, water and labour, with effect on local food systems (Christiansen, 2009). But Nigeria is also home to a global high burden of acute food insecurity: national estimates estimate, within crisis-level ranges of food insecurity, tens of millions of Nigerians are food-insecure, a result of conflict, climate shocks, poverty and land pressure, all reflecting the expanding urban area: '...food-price inflation, growing incidence of poverty and degradation of the land base upon which agriculture depends,' variously, have all worked together to make the urban area expansion of Nigeria also the rapid loss of farmland.

The link between urbanisation and food security is however unevenly conceptualised. A significant amount of literature, for instance, looks at food security in terms of agriculture, or nutrition and distribution, while a second field looks at urbanisation in terms of is economic and demographic change; little work has focused on the interdisciplinary nexus that explores the quantification of land-use change in tandem with household food-security impacts. This is true especially for the secondary towns and state capitals of Nigeria, where the interface of land-use change and household food security is relatively under-theorised. Most studies look at urbanisation and food security taking the macro view, or focus on mega-cities like Lagos or Abuja, with little attention paid to administratively smaller but rapidly transforming capitals like Lafia.

Since the state's creation, the LGA of Lafia has seen consistent settlement expansion attributable to the aggregation of federal and state institutions (a federal university, a federal teaching hospital and a cargo airport), intermediary tertiary colleges, and the LGA seat of government in Lafia town. This growth for administrative reasons is the most proximate cause of the conversion of farmland into urbanized land uses within the study area, a phenomenon of many of Nigeria's state capitals but seldom studied with multi-decadal, household scale spatio-temporal mapping.

This research makes a contribution to fill this knowledge gap by combining a forty-year (1984–2024) remote-sensing investigation of land use/land cover change with a household level investigation of food security and its socio-economic predictors in Lafia LGA. Specifically, the research (i) maps the spatial variations of land use/land cover change in Lafia from 1984 to 2024; (ii) quantifies the nature and magnitude of land use/land cover change from 1984 to 2014; (iii) describes the socio-economic characteristics of the sampled households; (iv) determines the status of household food security; and (v) estimates the socio-economic predictors of food security. By unveiling physical land-cover change evidence together with household survey information, the research provides an integrated body of knowledge required to guide food-sensitive urban planning in Lafia city and similar secondary cities in Sub-Saharan Africa.

CONCEPTUAL AND THEORETICAL FRAMEWORK

Food security is usually defined as a situation when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and preferences for an active and healthy life. Food security is maintained by four causes, which are availability, access, utilization and stability of food supply; and they are mutually reinforcing mechanisms. Urbanization is defined as increase of the proportion of populations living in towns and cities relative to rural areas, while urban expansion is shrinking of the agricultural and natural land by the artificial or built-up areas. It provides basis for the interconnection between food security and urbanization or urban expansion,



because the urban expansion influences both the land area for food production and income sources to enhance access.

Mixed but generally supportive evidence exists for this hypothesis. For example, in China and other fast-growing developing countries, although the pace of urbanization has been found to be positively associated with the pace of agricultural modernization and national food security (Christiansen, 2009), at the local and household level, urban expansion tends to take out peri-urban smallholder production systems that are essential for peri-urban food security. In cities of Sub-Saharan Africa, lack of income rather than unavailability of food as such has been determined as the main cause of urban food insecurity by investigations of the demand side: as urban consumers allocate a relatively high proportion of their gross expenditures to purchased food rather than own production, hence income poverty rather than food unavailability should be the main determinant of urban food insecurity in Sub-Saharan cities (Frayne et al., 2010; Engdaw & Kebede, 2019). Status of formal and informal employments was linked to food-insecurity prevalence, too (Blekking et al., 2020).

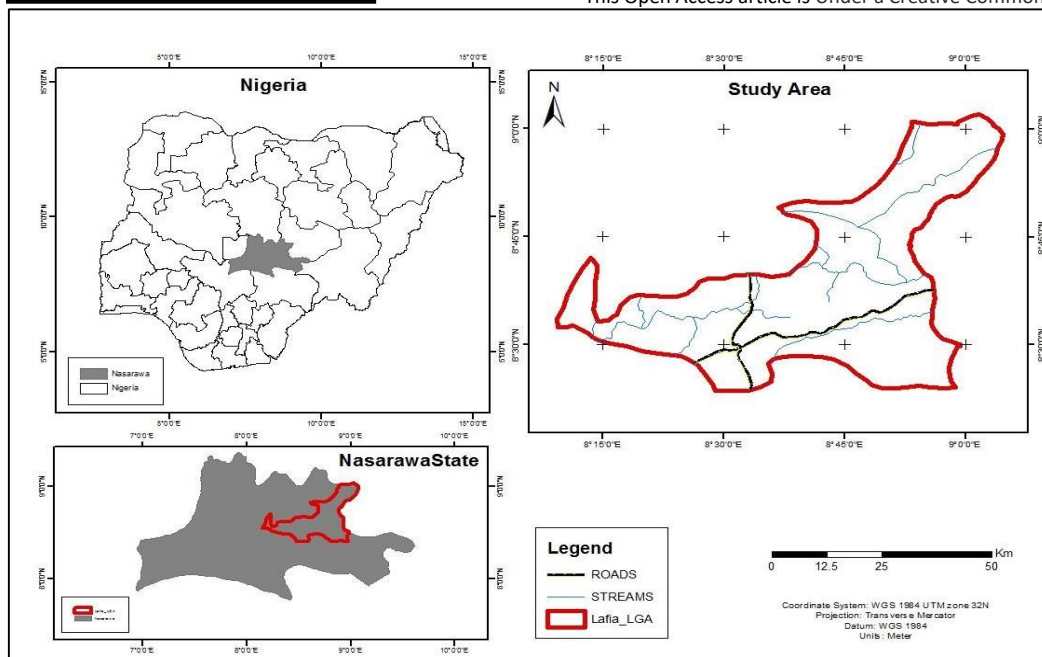
This study is underpinned by the concept of Environmental Security Theory and the perspective that environmental and resource pressures (including land-use change) are causative factors in human insecurity (including food insecurity). From this perspective, a loss of farmland to urban land take is viewed as a resource-security shock which impacts upon household access to food, through local food production, market dependence and exposure to changing food prices. This interaction is operationalized through the two contrasting strands of evidence; a physical indicator (land-use/land-cover change derived from satellite imagery) and a socio-economic indicator (a food security index derived from and capable of explaining, indicators of the causal relation of concern here).

MATERIALS AND METHODS

Study Area

Lafia LGA is the capital of the Nigerian state of Nasarawa and situated in the Guinea Savannah ecological zone (as defined by the Federal Ministry of Environment), largely between latitude 8 °–9 ° N and longitude 8 °–9 ° E. The LGA experiences a wet season, between April or May and October. The mean annual rainfall is 1,288 m, the mean annual temperature is 32 °C. The documented population (2006 census) for the LGA is 348,095, it is estimated that the population has grown to 509, 30 in the year 2024, due to a considerable in-migration in response to the LGA capital, educational and economic (market-place) functions (Lafia LGA is the capital of Nasarawa State, Nigeria). The economy of the LGA remains overwhelmingly agrarian, with household cropping activities based on upland crops (millet, sorghum, groundnut, cowpea, cassava and yam) and dry-season vegetables production, as well as of livestock production (Malam and Mohammed, 2018) see Figure 1. Figure 1: Map of Lafia Local Government Area. Source: NASRDA, 2025.





Data Sources and Collection

The data used were a combination of primary and secondary sources. Data obtained from primary sources included GPS referenced boundary coordinates of sampled farm households and other household data was obtained through a structured questionnaire, oral interview and field observation while secondary data sources included topographic maps obtained from Nasarawa Geographic Information System (NAGIS), population data was obtained from the National Population Commission while Landsat satellite imageries (bands 2, 3 and 4) for 1984, 2004, 2014 and 2024 were obtained from the USGS archive.

Size of Household sample refers to the number of households who received the survey questionnaire. This was determined using the Taro Yamane formula based on the projected population of the LGA. From this a target of 400 households was arrived at and these were then randomly sampled using a structured questionnaire which aimed at collecting the following data: household demographic data, land tenure system, farming characteristics, food expenditure and perception of Land Utilization change with urbanization.

Image Processing and Classification

Landsat bands were combined in ArcGIS (band combination 4-3-2) to create false-colour composite images of the Lafia LGA for each year of the study period (from the respective shapefile of the study year) and then the Lafia LGA boundary was digitized. A supervised classification was carried out using ERDAS Imagine with the maximum-likelihood determination maximum-likelihood method, and training samples were identified for five LULC classes (built-up zone, farmland, vegetation, rock outcrop and water body). The output of each classified image was then used to derive the class areas (ha) for each LULC class and each study year for comparison of land-cover change process over the period (1984–2024).

Food Security Measurement

Household food security status was measured according to expenditure-based food security index, as done in previous food security assessment in Nigeria (Oguntona et al 2008). Two-thirds of the mean monthly per-capita food expenditure of the sample was used

as a dividing point. According to this index, households with per-capita food expenditure greater than or equal to this dividing point were considered food secure, whereas households with per-capita food expenditure less than this dividing point were considered food insecure. That is:

$$Fi = (\text{per-capita food expenditure of household } i) / (2/3 \times \text{mean per-capita food expenditure of all households})$$

Where $Fi \geq 1$ indicates a food-secure household and $Fi < 1$ indicates a food-insecure household.

Determinants of Food Security

A binary logit regression model was estimated for the identification of determinants of household food security status (using model specification as found in other Nigerian based studies on agro-food systems); the focal variable was binary as these was food security (1) and food insecurity (0) while the independent variables were age of household head, years of education received by HH head, farm size, time spent on farming activity, total household size, access to credit, sex of household head, average monthly income, extension contact and membership of cooperative. The socio-economic variables were summarized using frequency, percentage and mean.

RESULTS

Land-Use/Land-Cover Change, 1984–2024

The Landsat classifying of the images into five Land Use Land Cover (LULC) classes reveals a persistent pattern of built-up spread and farmland loss between the years across the study period (Table 1). Changes in built-up and farmland extent have been positive and negative respectively throughout the study period with the extent of farmland reducing as we speak, thereby implying farmlands are fast being converted into built up areas in Lafia. The total extent of the study area (265,595.85 ha) remained constant across all four periods thereby enabling for an accurate comparison of class level change over time.

Table 1. Land-Use/Land-Cover Class Area (Hectares), 1984–2024

LULC Class	1984	2004	2014	2024
Built-up	193,240	907,970	993,450	1,043,553
Farmland	5,822,596	46,041,808*	3,860,561	2,370,561
Rock outcrop	1,787,392	1,251,939	12,229,037	1,111,058
Vegetation	178,689	1,716,842	1,212,364	1,102,214
Water body	15,163	17,314	43,601	41,601

Source: GIS/Remote Sensing Analysis, 2025.

These quantitative findings are supported by land-cover representations; built-up areas are visible to concentrate near the historic urban core in 1984 and radiate outward into peri-urban and formerly expanding agricultural areas by 2024, indicating a unidirectional pattern of urban expansion as a function of time and population growth, as with the cases cited earlier.. Population growth, for example, increased from an estimated 330,712 (midlate 2000s) to an estimated 509,300 (2024), visible in the northern part of the urban environment, further emphasizing the role of demography, together with sites of institutional influence, in stimulating land-take.

Socio-Economic Characteristics of Sampled Households

Of the 400 households surveyed the overwhelming proportion of respondents (86.7%) were male household heads, consistent with male dominance in land holding and headship prevalent in the study region. The vast majority of respondents (77.5%) were married, with 18.3% single, 2.5% separated, and 1.7% widowed. Approximately 70% of respondents had formal education (24.2% primary education, 22.5% secondary education,

23.3% tertiary education), and the remaining 30% had no formal education. The median household size was six persons, with 48.3% of households having between one and five persons, and 40.8% of households between six and ten persons. Cooperatives were registered by 24.2% of respondents. The mean farm size was 2.6 hectares, with most farmers cultivating one to three hectares (76.7%), consistent with a smallholder farming system. Land being held mostly by inheritance (82.5%), and farmers consumed most of their own food (85.0%), although many (57.5%) bought additional food from markets.

Table 2. Selected Socio-Economic Characteristics of Sampled Households (n = 400)

Variable	Category	Percentage (%)
Gender	Male	86.7
	Female	13.3
Marital status	Married	77.5
	Single	18.3
Education	No formal education	30.0
	Primary	24.2
	Secondary	22.5
	Tertiary	23.3
Household size	1–5 persons	48.3
	6–10 persons	40.8
Cooperative membership	Yes	24.2
Farm size	1–3 ha	76.7
Land ownership	Inheritance	82.5

Source: Field Survey, 2025.

Household Food Security Status

Applying the expenditure-based food security index, the two-thirds mean per-capita monthly food expenditure threshold was ₦40,712.50. Households with per-capita monthly food expenditure at or above this threshold were classified as food secure. Table 3 shows that 61.7% of sampled households were food secure, while 38.3% were food insecure. This prevalence of food security is more favourable than national estimates of food insecurity in Nigeria, plausibly reflecting Lafia's status as a state capital with comparatively better access to markets, infrastructure and non-farm income opportunities than more remote rural areas. Nonetheless, the finding that nearly two in five households remain food insecure—within a relatively well-served urban/peri-urban setting—signals a meaningful residual vulnerability.

Table 3. Household Food Security Status

Food Security Status	Frequency	Percentage (%)
Food insecure (below threshold)	153	38.3
Food secure (at or above threshold)	247	61.7
Total	400	100.0

Source: Field Survey, 2025.

Determinants of Household Food Security

A binary logit regression of the socio-economic factors influencing household food security status was estimated (Table 4). The sign of the pseudo R² for the model was 0.492, implying the extent to which the explanatory variables jointly explain variations in food security status. The positive and significant coefficients for log of annual household income (8.745; P=0.005) and cooperative membership (0.287; P=0.002) suggested that an increase in household income and cooperation participation significantly increased the likelihood that a household is food secure at the 1% level of significance. The other positive but



insignificant coefficients were the log of years of formal education (0.008), years of farm work experience (0.019), farm size (0.043) and household size (0.036). A negative but insignificant coefficient was observed for the vector of extension contact (−0.008) and gender (−0.453). The insignificant coefficients implied that the current extension activities provided by the extension agency did not reach farming households efficiently and that socio-economic parity among the two gender groups needed to be appraised.

Table 4. Binary Logit Regression Estimates of the Determinants of Food Security

Variable	Coefficient	Std. Error	t-stat	Sig.
Constant	1.011	0.375	2.692	0.008
Years of formal education	0.008	0.019	-0.410	0.683
Farming experience	0.019	0.045	0.413	0.681
Annual income	8.745	0.000	3.654	0.005**
Farm size	0.043	0.071	0.603	0.548
Household size	0.036	0.030	1.223	0.225
Extension contact	-0.008	0.183	-0.043	0.966
Gender	-0.453	0.280	-1.614	0.110
Cooperative membership	0.287	0.047	6.085	0.002**

Source: Field Survey, 2025. Significant at the 1% level. Pseudo-R² = 0.492.

DISCUSSION

The results demonstrate that land change manifested as an expansion of urban areas by directly reducing the amount of farmland in Lafia Local Government Area (LGA) between 1984 and 2024, a trend which is aligned with the land use trajectories observed in other fast growing Sub-Saharan African cities where the urban built-up accounts for the systematic contraction of peri-urban agricultural areas (Christiansen, 2009). The coexistence of population growth with built-up expansion in time affirms the inference that demographic pressure the urban pull factors (i.e. administration, education and infrastructure) in the specific context of Lafia City is causally antecedent of farmland conversion. Given that 95.8% of the sample households are smallholder farmers averaging 2.6 ha of farmland who produce a dominant share of their food consumption, high levels of farmland loss will continue to pose a supply-side structural threat to food production.

These are further evidence that in rapidly urbanising environments, household food security is more strongly facilitated by income and social capital access than by plot size or education per se. The strong, highly significant, positive relationship between co-operative membership and food-security is line with findings that participation in co-operatives enhances smallholders' access to credit, inputs and collective marketing, stabilising household income and thus food access (Blekking et al., 2020; Frayne et al., 2010). The weak, negatively signed coefficient of the extension-contact variable indicates that the formal agricultural extension system in Lafia appears not to be delivering quantified food-security benefits for farming households, a phenomenon also observed by research carried out in similar low-resourced agricultural extension programs in other parts of Nigeria. The negative (though not significant) correlation between gender and food security echoes other research in Sub-Saharan Africa, which shows that African women's lack of land, credit and extension access can hinder food security situations experienced by female-headed households (Doss et al., 2018).

In total, the land-cover and household-level evidence suggest the existence of a fundamental tension between Lafia's trajectory as a state capital, and the resilience of the local food system. And while expansion of the urban area in Lafia is associated with real development gains (new physical infrastructure, institutions, and markets) that seem to absorb the impact of farmland loss in the overall settlement (by providing households with

increased opportunities in the nonfarm economy), the continuous decline in farmland area means this buffering effect cannot be expected to persist into the future in the face of further urban growth and growing demands on peri-urban land resources.

CONCLUSION

Using four decades of Landsat-derived land-cover data and a survey of 400 households, this research has demonstrated that the process of urbanization in Lafia LGA has been characterized by a gradual but persistent growth of built-up land cover and a decrease in cropping land, and that household food security in Lafia LGA is determined not as much by the availability of land as by income and the social capital of cooperation. While 61.7% of the surveyed households are reported as food secure, the fact that 38.3% of the households remained food insecure, isolated with a decreasing land resource base for several decades, highlights an underlying structural vulnerability that must be tackled in a proactive manner through planned urban growth.

RECOMMENDATIONS

With respect to the findings, recommended actions are:

Institutionalising regular (annual or bi-annual) GIS-based land use monitoring to enable rapid assessment of urban sprawl and farmland loss.

Formal land-use zoning practice and policies which institutions protection of (peri-urban) farm land, green belts and farmland away from unauthorised sprawl, including the creation of a legally protected Agricultural Land Reserve.

Periodic (five year or so) land use land cover auditing with land use land cover change data fed directly into urban master plans.

Promising support for cooperative groups and micro-farmers who have shown statistically significant associations with household food-security.

Diversification of household income via support for non-farm livelihoods and micro-enterprises; and (vi) agronomic extension service reform, with gender-responsive approach, to bridge the gap between extension contact and actual food-security outcomes. Taken collectively, they can facilitate unabated growth in Lafia as well as other secondary cities in Nigeria and Sub-Saharan Africa without compromising local land and food security.

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