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Effects of Urban Growth on Peri-Urban Agriculture: A Review

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ABSTRACT

Urban growth, characterized by the physical expansion of cities and metropolitan areas, profoundly impacts surrounding rural and peri-urban landscapes. Driven by demographic dynamics, economic development, and increased demand for housing and public amenities, this phenomenon often leads to the conversion of rural areas into urban land uses. In Africa, urbanization rates are projected to exceed 50% by 2037, with Nigeria experiencing significant shifts from rural to urban living. This study aimed to examine the effects of urban growth on agricultural activities in peri-urban areas. Key findings indicate that urban growth often leads to land-use conflicts, reduced agricultural productivity, and social issues in peri-urban areas. Case studies from Belgium, Portugal, India, Ethiopia, Kenya, Uganda, and Ghana reveal the adverse effects of urban expansion on agricultural land, emphasizing the need for strategic planning and policy interventions. Effective measures include zoning regulations, promoting vertical urban expansion, and protecting prime agricultural lands. The study concludes that balancing urban growth with agricultural sustainability requires comprehensive planning and policy frameworks. Urban agriculture, with its multi-functional benefits, plays a crucial role in mitigating the negative impacts of urbanization, fostering a sustainable integration of urban and agricultural landscapes. This approach not only addresses food security concerns but also enhances the overall resilience and sustainability of urban environments

Keywords: Urban Growth, Peri-Urban Agriculture, Food Security, Sustainable Urban Planning

1. Introduction

Urban growth is defined as the physical expansion of the geographical footprints of towns, cities, and metropolitan areas into the surrounding countryside, encompassing nearby villages and towns in the process (Angel, 2023). It represents the quantitative expansion of urban territories. It is often evident through the enlargement of urban boundaries, the conversion of formerly non-urban or rural areas into urban land uses, and the overall increase in the spatial footprint of urban landscapes. Urban growth is inherently connected to demographic dynamics and the population influx into urban areas, leading to the need for new housing, workplaces, and public amenities. Additionally, it is linked to economic development, as urban centres attract investments, industries, and businesses, driving further expansion. Urban growth can be categorized into three types: infill, extension, and outlying, with the latter further subdivided into isolated, linear, and cluster growth. Etim and Atser (2023) asserted that urban growth is often initially fragmented and may leapfrog over vacant open spaces. However, these open spaces on the urban fringe typically fill gradually as outward expansion continues. As cities grow, they expand outward, increasing the area and converting more land to urban use. A study of 30 cities on all continents has shown that their areas expanded 16-fold or more between 1800 and 2014 (Angel *et al*., 2016). For instance, Paris, France, increased its area 200-fold from 11 km^2 in 1800 to 2200 km^2 in 2014, while its population grew 22-fold, from 500,000 to 11 million. One key finding of recent urban expansion studies is that land consumption per capita has increased, accompanying economic development. As people become wealthier, they consume more housing, workspace, and facilities, increasing land consumption. Cheaper transport makes distant lands more accessible, allowing residences and workplaces to move away from dense city centres (Seto *et al*., 2011).

Urban expansion is the primary mechanism by which cities accommodate population growth. Urban expansion and the densification of existing urban footprints are complementary ways of making room in cities. The larger the share of the population accommodated through densification, the lower the share that needs to be accommodated through expansion, and vice versa (Angel, 2023). When an insufficient room is made available through densification and no natural or regulatory restrictions on expansion exist, the room is inevitably created through expansion. Conversely, if natural or imposed barriers to expansion exist and no regulatory, financial, or technological restrictions are imposed on densification, more room is created through densification. Densification, where possible, is better for the environment than expansion, as higher densities are associated with lower transport energy use. The higher the average density of a city, the shorter the distance between random locations; public transit becomes more feasible, as does cycling and walking, helping to reduce greenhouse gas emissions. Integral to this process is the conversion of productive agricultural lands, forests, surface water bodies, and groundwater resources, often leading to irrevocable losses in these essential components of the environment (Tali and Murthy, 2012). The rapid pace of urban development brings about exponential population growth and the proliferation of edifices within urban areas, accompanied by substituting natural terrains with impermeable surfaces. This transformative trajectory has yielded profound modifications in the natural milieu, predominantly by substituting

soil and flora with urban infrastructural elements such as concrete, asphalt, and buildings. This transition is underscored by human reliance on the physical environment to fulfil necessities, prompting actions and inactions that translate into land transformation, manipulation, and degradation, contributing to the impairment of both abiotic and biotic elements within the ecosystem.

Africa, the least urbanized continent, is emblematic of this global trend. Although a substantial proportion of Africa's populace resides in rural areas (60%), the velocity of migration to urban locales is alarming. During 2000-2015, Africa's urbanization rate averaged 3.5%, the highest worldwide, and it is predicted to exceed 50% by 2037 (African Development Bank, 2013). Urbanization rates are divergent across the continent, with Southern and Northern Africa achieving urban majorities, while Eastern and Central Africa remain less urbanized. In Nigeria, the trajectory of urbanization extends back to pre-colonial times, underscored by the movement of diverse ethnic groups driven by economic incentives and climatic conditions. The earliest urban centres were trade hubs along waterways or trade routes. They were often catalyzed by abundant agricultural output, resulting in their transition to centres of commerce and prosperity. The rapid pace of urbanization has become a defining characteristic of contemporary development, presenting challenges and opportunities. One of the most critical junctures lies at the intersection of urban expansion and agricultural activities. As urban areas rapidly grow to accommodate burgeoning populations and economic activities, they often encroach upon agricultural land, triggering substantial shifts in land use patterns, agricultural practices, and even livelihood strategies. This trend is particularly pronounced in developing regions, where urbanization strains a vital agricultural sector due to heightened land, infrastructure, and housing demands.

Agriculture refers to the systematic and controlled cultivation of land, including growing crops and rearing animals, to produce food, fibre, and other products. It involves various activities such as planting, tending, and harvesting crops and raising livestock for meat, dairy, and other agricultural products. Agriculture encompasses various practices, technologies, and methods to maximize the yield and efficiency of food production. In the context of the discussion about urban development and its impact on peripheral farming communities, agriculture is a central focus, as these communities rely on farming for their livelihoods and food supply. Agriculture serves four primary roles within cities: subsistence, economic contribution, recreational activities, and community building (Wadumestrige *et al.*, 2021). Consequently, it is intricately connected to various aspects of the urban environment, encompassing economic, social, ecological, and physical infrastructure components. The diverse functions of urban agriculture contribute to the potential sustainability of cities, prompting a growing inclination in urban planning to integrate agriculture as a means to address urban challenges. The multi-functionality of agriculture, referring to its ability to serve purposes beyond food and fibre production, has become a focal point in sustainable agricultural research and policymaking. The conversion of agricultural lands due to urbanization and sprawl poses challenges to traditional farming practices and may affect agriculture's overall sustainability and productivity in the affected areas.

Peri-urban areas are transitional zones situated between urban centers and rural landscapes. These areas are characterized by a mix of urban and rural land uses, including residential, industrial, and agricultural activities. They serve as critical buffers that accommodate urban expansion and provide essential functions such as food production, natural resource management, and recreational spaces. The diverse land use in peri-urban areas supports urban populations by supplying fresh produce, managing waste, and maintaining biodiversity, thus playing a pivotal role in sustainable urban development. However, peri-urban areas face significant challenges, primarily due to the pressures of rapid urbanization. These challenges include land-use conflicts, where agricultural lands are increasingly converted to urban uses, leading to a decline in local food production and loss of livelihoods for farmers. Additionally, peri-urban areas often experience inadequate infrastructure and service provision, environmental degradation, and social issues such as housing shortages and increased inequality.

2.0 Conceptual Framework

Urban agriculture refers to the practice of cultivating, processing, and distributing food in and around urban areas. This concept integrates agriculture into the urban environment, allowing residents to grow food in their backyards, rooftops, community gardens, and vacant lots. Urban agriculture provides multiple benefits, including increased access to fresh produce, enhanced food security, and the promotion of sustainable local food systems. Additionally, it can improve urban environmental quality by increasing green spaces, reducing the urban heat island effect, and fostering community engagement and education on sustainable practices.

Urban agriculture plays a crucial role in addressing food deserts in cities where access to fresh and affordable produce is limited. It also contributes to the local economy by creating jobs and business opportunities related to farming, food processing, and distribution. Moreover, urban farming can help mitigate some environmental challenges associated with urbanization, such as reducing carbon footprints through localized food production and promoting biodiversity. As cities continue to grow, urban agriculture presents a viable strategy for enhancing food resilience, promoting healthier lifestyles, and fostering a greater connection between urban dwellers and their food sources.

Figure 1.0 illustrates the various interconnected factors influencing urban development and its subsequent impact on peri-urban farming communities. Key driving forces include in-migration, natural or demographic growth, institutional failures, and specific parasitic theories that contribute to urban expansion, encroaching on peri-urban areas. Population growth, identified as the predominant force, leads to significant land use changes at the peri-urban interface, primarily resulting in the conversion of agricultural lands for urban purposes (DFID 2000). This expansion pressures peripheral farming communities, affecting their economy, socio-cultural dynamics, and ecological balance, which in turn impacts the food system and food security.

Urban growth exacerbates the challenges faced by farming communities located away from central business districts (CBDs). The sprawl results in reduced fertility and diminished arable land, negatively impacting crop productivity. Farmers are compelled to adapt by adopting new strategies, while government interventions must align with policy responses that emphasize strengthening institutional capacities. Addressing these challenges requires a

holistic approach, integrating strategic initiatives by farmers with responsive government policies to enhance institutional capabilities and mitigate the adverse effects of urban sprawl on agricultural land use.

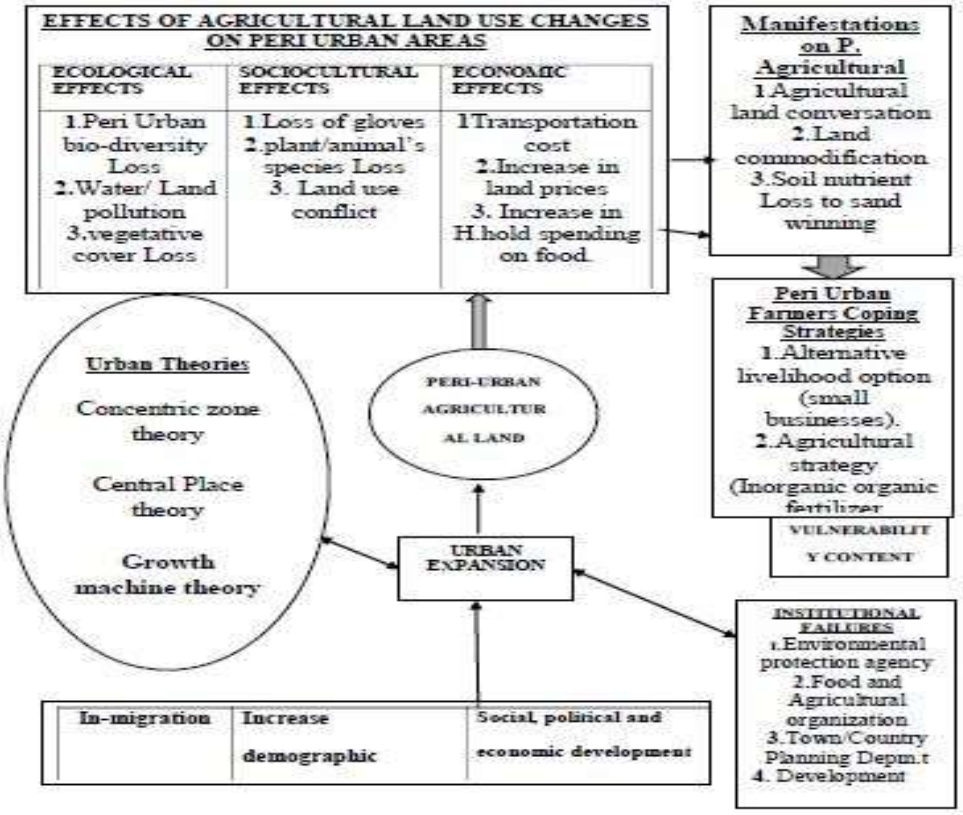

Fig 1. Conceptual framework

Adopted from Toku, 2018

Review and Discussions

Urban growth is a global phenomenon characterized by the rapid expansion of cities, which often encroach upon agricultural land, raising concerns about the sustainability of food production and the well-being of rural peri-communities. This subsection delves into the impact of urban growth on agriculture through the lens of empirical studies. Beckers *et al.* (2020) examined the consequences of urbanization on agricultural dynamics in Belgium. Their findings revealed that urban growth results in a continual loss of agricultural land, both directly through changes in land use and indirectly through the utilization of agricultural land for non-productive rural activities such as recreation, horse-keeping, or hobby farming. These urbanization processes pressure farmers, making agricultural activities more challenging due to reduced agricultural land, negative externalities, and heightened competition for land. A two-step methodology was employed to assess the impact of urbanization on farming practices in Belgium's peri-urban and rural areas. This method involved exploring existing qualitative literature on the future of urbanization and farming in Belgium, followed by the selection and downsizing of two contrasting storylines and a business-as-usual storyline. These were then quantified to assess the impact on individual farms using a cellular automata model on urbanization. Simulations until 2035 indicated a continuous decline in farmers, particularly in the rural-urban fringe.

Urban markets are pivotal in improving market access and adding value to products of farmers. The proximity to urban areas offers opportunities for farmers to sell their produce directly to consumers, eliminating intermediaries and potentially increasing income. Gomes *et al.* (2019) research work in Portugal highlighted the positive impact of proximity to urban areas on certain types of farming, emphasizing the potential benefits of this geographical relationship. The growth of urban areas attracts investments in agricultural technologies and infrastructure, fostering innovation in the farming sector. As urbanization advances, there is an increased focus on enhancing agricultural practices to meet the growing demand for food. Investments in technology and infrastructure can lead to improved productivity and efficiency, providing farmers with access to modern tools and practices that enhance their overall agricultural output. Urban demand often leans towards diverse and high-value agricultural products, encouraging farmers to diversify their crops and specialize in niche markets to cater to the specific preferences of urban consumers. By diversifying their offerings and focusing on high-value products, farmers have the potential to increase profitability, fostering a more resilient and adaptable agricultural sector capable of responding to changing market dynamics.

In India, agricultural lands have been found to tremendously reduced in the last four decades (Nilesh *et al*, 2022). Population explosion and changing land-use patterns were found to be core factors responsible for urbanization. The built-up area of Chalisgaon City observed a general increment of 19.64%

of the total area from 556 hectares to 920 hectares and the study area lost about 365 hectares of fertile agricultural land during the study period 1990 to 2020. The result of the study was meant to serve as basic information for policymakers and planners at the local level of administration to ensure that urban expansion information in Chalisgaon City is smart and sustainable.

Adugnaw (2021) assessed the impact of urban expansion on pre-urban farming communities in Lalibela town, Amhara regional state, Ethiopia. The results indicated rapid agricultural land conversions for urban use, leading to a decrease in agricultural lands with adverse implications for food production, food security, food prices, and employment rates. The study recommended addressing these issues through vertical urban expansion, compact development, zoning regulations, and the construction of condominiums by the government. Barbara (2016) assessed the effects of urban land use changes on agricultural land use in Kiambu County-Nairobi, Kenya using remote sensing data. The findings revealed significant land use/cover changes over 28 years, agricultural lands were rapidly lost to urban growth, with 61.5% of agricultural land converted to built-up land. This transformation resulted in declining agricultural land, loss of employment, changing social interactions and lifestyles, increased land values, and housing costs. Zoning for various land uses was proposed to mitigate rapid land use changes.

Urban expansion has profound implications for rural livelihoods, primarily involving the loss of farmland and increased competition for resources. Studies, such as Zoomers *et al*. (2017) and Dabie (2015), highlight the potential severity of this issue, pointing to the risk of up to 80% loss of land for subsistence farmers in urban expansion scenarios. The expansion of urban areas often brings increased employment opportunities, attracting individuals from rural communities to migrate in search of better prospects. While this urban migration can contribute to economic growth and improved living standards, it may simultaneously create a labour shortage in agriculture, impacting farm operations and productivity. Wu *et al.* (2011) research in China further illuminates this noteworthy trend.

Worku (2020) assessed the impact of urban expansion on the livelihoods of the society surrounding rural kebeles of Tefki town from 2015 to 2019. The research focused on the effects of town expansion on farmers' income, opportunities secured from town expansion, and the compensation process. Findings revealed significant effects on the livelihoods of surrounding farmers, including the loss of agricultural land and other assets. The expansion led to households losing an average of one hectare of farmland, impacting their livelihoods and livestock grazing land. Muchelo (2017) examined the rate of agricultural land conversion using land use/land cover (LULC) classification methods in Uganda. Initially, the rate of agricultural land conversion to built-up areas was determined through multi-temporal LULC classification of Landsat ETM+ and TM images. The LULC maps demonstrated a substantial expansion of the built-up area in Kampala, increasing from a mere 7.14% of the landscape in 1989 to 55.10% in 2015. This expansion came at the expense of agricultural land, which decreased from 48.02% of the landscape in 1989 to 16.69% in 2015. In Mbarara, the built-up area increased from 6.37% in 2002 to 30.96% by 2016, while agricultural land decreased from 39.92% to 32.08% of the landscape. The study recommended planning regulations to control the rapid expansion of cities, emphasizing the urgent need to preserve agricultural lands.

Toku (2018) examined how the urban expansion of Wa, Ghana has impacted on peri-urban agricultural activities. The study used GIS (Landsat images) to trace the extent of urban growth from 2000 to 2016. Heads of 370 farming households were sampled thorough simple random sampling for questionnaire survey. This was supplemented with in-depth interviews with key stakeholders connected with land-use management in the municipality, focus group discussions, and (non-participants). The results show that since 2000, the extent of expansion has engulfed many of the peri-urban communities including Bamaho, Kpongu, and Kperisi. The results further indicated that farm sizes and crop output had drastically been reduced with mean differences of 7.988 and 13.225 respectively. Farmers have been forced to adopt alternative livelihood activities such as the weaving of smock, sand weaning, and some formal sector jobs such as cleaners while others cope within agriculture by applying organic and inorganic fertilizers, tree cropping, and crop rotation. The study noted that if the rate of expansion is not managed properly, it could have a dire effect on food security in the municipality in particular and the region in general. The study recommended that stakeholders should have collaborative management approaches to land decision-making and increase extension programs to assist peri-urban farmers in addressing the challenges that come with urban expansion.

Naab *et al.* (2013) assessed the impact of rapid urbanization on agricultural lands in developing cities, focusing on Tamale, Ghana. Qualitative and quantitative methods, including interviews and questionnaires, were used to collect and analyze data from stakeholders in selected peri-urban areas in the Tamale city region. The study observed a succession syndrome triggered by rapid urbanization in Tamale, leading to the conversion of prime agricultural lands to other uses believed to be more lucrative. Urbanization pressures negatively affected predominantly poor farming communities in the Tamale region. The study recommended policy focus on protecting prime agricultural lands, recognizing their role as primary sources of livelihood. Iheke and Ukandu (2015) examined the effect of urbanization on agricultural production in Abia State, categorizing farmers' land tenancy status, analyzing urbanization's impact on agricultural productivity, and identifying constraints to agricultural productivity. Using a multistage random sampling technique, the study found that specific variables, including farm size, urbanization, fertilizer/agrochemical use, the land tenure system, land use duration, and farm land cost, significantly influenced productivity. The study recommended earmarking specific areas for agricultural use and protecting them from encroachment through appropriate legislation and policies.

Hashidu *et al*. (2019) investigated the impact of urban growth on agricultural land use in Gombe city, employing Geographic Information System (GIS) techniques to determine the pattern of urban growth. The "Paired T-test" inferred from the statistical analysis revealed that urban growth most affected agricultural land use in the study area. The study highlighted fragmented urban growth at the fringe areas, leading to a substantial increase in built-up areas, while the city centre experienced relatively compact growth. Urban growth in the study area was found to replace viable agricultural lands with residential land use, impacting agricultural land use at the urban fringes. The study recommended implementing measures to control the continuous growth of the study area in various directions, reducing the effects on agricultural land use and mitigating the shortage of urban food requirements.

Urban growth significantly impacts peri-urban agriculture by converting agricultural land into built-up areas, thereby reducing the availability of land for farming activities. This phenomenon leads to a decrease in food production, which in turn affects local food security. The expansion of urban areas often prioritizes residential and commercial development over agricultural uses, resulting in the loss of fertile land and biodiversity. For instance, in regions like Lahore, Pakistan, rapid urbanization has led to extensive changes in land use, damaging agricultural land and threatening food security by converting natural land into urban spaces. The decline in peri-urban agricultural activities due to urban sprawl also disrupts the local food supply chain, increases food prices, and forces urban dwellers to rely more on imported food, which can be less fresh and more expensive.

Furthermore, urban growth can create socio-economic challenges for peri-urban farmers. The encroachment of urban development often leads to higher land prices, making it difficult for farmers to afford or retain their agricultural land. This economic pressure can push small-scale farmers out of business, leading to a loss of livelihoods and traditional farming practices. Additionally, peri-urban farmers face challenges such as limited access to resources, infrastructure, and markets due to the urban-rural interface. However, there are opportunities to integrate peri-urban agriculture into sustainable development plans. Initiatives that support agroecological practices, provide training and financial support for new entrants, and safeguard agricultural land through appropriate planning policies can enhance the resilience of peri-urban agriculture and contribute to a sustainable food system

Town Planning Response

Town planners possess a significant and promising opportunity to bolster the sustainability of cities by actively including urban agriculture in their planning efforts. This integration should span various planning levels, from comprehensive master plans that shape the city's overall structure to more detailed plans addressing specific sites and neighbourhoods. Several examples worldwide showcase the successful incorporation of urban agriculture into urban planning policies. In Dar es Salaam, Tanzania, urban agriculture has been seamlessly integrated into land use planning, reflecting a deliberate effort to intertwine agricultural activities with the broader urban development strategy. On the other hand, Germany takes a more proactive approach, making urban agriculture a mandatory aspect of the urban planning process, underscoring its significance in the overall urban fabric (Mougeot, 2000). The American Planning Association has also recognized and endorsed the importance of weaving urban agriculture into the broader urban planning framework (Lovell and Johnston, 2009). This acknowledgment signifies a growing awareness among planning professionals of the multifaceted benefits that urban agriculture can bring to a city's sustainability. Cities like Havana, Cuba, have taken substantial steps by allocating significant land parcels, totaling 30,000 hectares within the city and its outskirts, to urban agriculture. This allocation demonstrates a commitment to integrating agricultural practices within the urban landscape, fostering local food production, and enhancing overall urban resilience.

In Bulawayo, the second-largest city in Zimbabwe, town planners have recognized the role of urban agriculture in addressing food accessibility issues for the urban poor (De Zeeuw *et al.*, 2011). As a proactive measure, the city council has permanently set aside 450 hectares of vacant municipal lands for urban agriculture, ensuring a dedicated space for disadvantaged urban residents to engage in productive agricultural activities. These examples collectively highlight the diverse ways urban agriculture can be embedded in urban planning initiatives, emphasizing its potential to address food production and broader issues related to sustainability, resilience, and social equity within cities.

Conclusion

This research explores the complex interplay between urban growth and agriculture, emphasizing the challenges and opportunities presented by unchecked urban expansion. Rapid urbanization, particularly in Africa, is transforming trade hubs into centers of commerce, with notable impacts on peri-urban agriculture. Agriculture, serving multifaceted roles in cities, faces challenges from the conversion of agricultural lands due to urbanization and sprawl, affecting sustainability and productivity. The literature review highlights global studies from Belgium, Portugal, India, Ghana, and Nigeria, revealing consistent patterns of agricultural land loss, altered dynamics, and challenges to rural livelihoods. Town planners can play a pivotal role in mitigating these challenges by incorporating urban agriculture into planning policies, as demonstrated by examples from Dar es Salaam, Germany, and Bulawayo. In Nigeria, addressing the challenges arising from rapid urbanization and its impact on agriculture requires a multifaceted and proactive approach. Firstly, there is a critical need to develop and implement comprehensive urban planning policies that prioritize the integration of agriculture within the urban landscape. This involves designating specific zones for agricultural activities, safeguarding fertile lands from rapid urban expansion, and promoting sustainable farming practices. Town planners should collaborate closely with local communities, policymakers, and agricultural experts to ensure that these policies align with the needs and aspirations of the people, fostering a sense of ownership and inclusivity.

Town planners also should actively engage in public awareness campaigns to educate both urban residents and policymakers about the importance of preserving agricultural lands. This involves highlighting the multi-functionality of agriculture in cities, not only as a source of food but also as a contributor to economic activities, recreation, and community building. Encouraging the adoption of urban farming initiatives, such as community gardens and rooftop farming, can further enhance food security and mitigate the adverse effects of urban sprawl on traditional farming practices. Additionally, advocating for the incorporation of green spaces and sustainable landscaping practices within urban planning can contribute to environmental conservation while maintaining a balance between urban development and agricultural resilience. Ultimately, fostering a holistic and collaborative approach to urban planning that considers the needs of both urban and rural populations is essential for achieving sustainable and inclusive urban growth in Nigeria.

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