



Research article

Secondary cities under siege: examining peri-urbanisation and farmer households' livelihood diversification practices in Ghana

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ABSTRACT

Land formalisation and commoditisation are influencing peri-urban growth in secondary cities. This notwithstanding, studies on peri-urbanisation have not prioritized secondary cities and how land transactions shape city expansion and engender livelihood diversification. Few perspectives in urban theory and practice are derived from such secondary cities, while trajectories indicate that such cities are becoming the new face of urbanisation in the Global South. Drawing evidence from Wa, Ghana, the study explores the dynamics of peri-urbanisation, and livelihood diversification through the lenses of land formalisation and a sustainable livelihood framework. Primary data were sourced from randomly selected households using questionnaires together with key informant interviews, focus group discussions and observation. To understand the spatial characteristics of peri-urban areas, Landsat satellite data were employed in analysing the land use land cover (LULC) change in Wa Municipality from 1986 to 2019. Descriptive statistics, thematic analysis and content analysis were deployed to analyse the quantitative and qualitative primary data gathered. The findings show substantial physical urban development and transition from the inner urban enclave into the periphery from the 1980s–2010s. The observed urban transformation was primarily motivated by land sales in the peri-urban areas. Despite the significant land conversion from agricultural to other uses, it was revealed that farming remained an integral livelihood activity for peri-urban households. The results indicate that embracing and applying the ideals of negotiated planning will be imperative in shaping the sustainable transformation in secondary cities.

1. Introduction

Peri-urban areas provide ecosystem services necessary for the survival of both residents and inner-city dwellers. They are also a source of fresh air, corridors of urban expansion and recreation as well as income generation opportunities (Pauleit et al., 2019). However, they are still less prioritised by urban planners and are sometimes arbitrarily categorised as rural or urban. This is because the peri-urban interface is a unique urban form where both rural and urban activities co-exist (Tacoli, 1999). Hence, it is often described as the rural-urban transition zone where urban and rural land uses as well as socio-economic activities co-exist and interact to produce a mosaic of rural-urban characteristics (Tacoli, 1999; Allen, 2003). Peri-urbanisation, therefore, refers to the process of transforming the socioeconomic and environmental aspects of the city's adjacent rural communities (Tacoli, 1999). The area, therefore, provides new livelihood diversification opportunities as more people and

businesses move there; but at the same time, residents face constraints such as rapid agricultural land conversion, limited access to social services, and poor access to critical public infrastructure (Allen, 2003; Oduro et al., 2015). The lack of these services and amenities inhibits the rapid transition of the urban poor out of poverty. Therefore, the efficient management of the peri-urban area and its endowments have significant implications for the livelihood and quality of life of peri-urbanites and for sustainable development (Allen, 2003).

As people migrate from rural to urban areas, coupled with the natural growth in urban population, more land is required to accommodate the increasing numbers. Therefore, the peri-urban interface supplies lands for urban residential and commercial needs. Due to the high demand and relatively lower cost of land in these areas, previous agricultural lands are being converted to uses that support emerging urban activities (Ravetz et al., 2013; Varkey and Manasi, 2019). It is worth noting, however, that land formalisation also fosters rapid peri-urban development and affects

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land-based livelihoods of peri-urban households in sub-Saharan Africa (Peluso et al., 2012; Serrat, 2017). Following Chambers and Conway (1992), livelihoods are seen as the assets, capabilities and activities people draw on to make a living. A livelihood is said to be sustainable when it can cope with and recover from stress and shocks; maintain or enhance its capabilities and assets; and provide sustainable livelihood opportunities for the future generations at both local and global levels (Chambers and Conway, 1992). Even though urbanisation at the peripheries endangers farm-based livelihoods, it creates new opportunities and choices that enable households to construct a portfolio of activities and social support services to survive (Eliss, 1998; Tacoli, 1999; Oduro et al., 2015). Some studies show that distressed people resort to livelihood diversification when their primary or traditional livelihood is under threat (Eliss, 1998; Aloba Loison, 2015). This has led Eliss (1998) and Loison (2015) to conclude that livelihood diversification is a sort of adaptation strategy for people in distress to spread risk; and in rural and peri-urban areas, the spread manifests in peoples' engagement in multiple livelihood activities such as petty trading, construction-related activities, and migration, among others.

Due to the multidimensional characterisation of peri-urbanisation, it has become a new face of urbanising economies as more people continue to live in urban areas now than ever in global history. The United Nations (2019) estimated that 4.2 billion people lived in urban areas in 2018, and this figure is projected to increase to five billion by 2028, before reaching six billion by 2041. It is also estimated that by 2050, the global urban population will reach 6.7 billion, with 1.5 billion of that population in Africa (see United Nations, 2018). Against this backdrop, unchecked urbanisation has drawn interest in the sustainable development discourse. To counter the increasing concern about urbanisation and the problems it brings, world leaders pledged to make inclusive cities a priority in their national development plans and agendas (United Nations, 2015). However, the current urbanisation patterns in sub-Saharan Africa and Asia raise concerns regarding the ability of countries in these regions to achieve the Sustainable Development Goal (SDG) on inclusive, safe and resilient cities by 2030. The scepticism is premised on the fact that rapid peri-urbanisation through land conversion leads to rapid depletion of natural resources and threatens land-based livelihoods (Ricci, 2012). In line with this, achieving 'inclusive' cities (SDG 11) would remain counterintuitive if the development challenges of secondary cities are left unaddressed and the rural-urban development gap continues to widen (Christiaensen et al., 2013; Christiaensen and Kanbur, 2017; Steinberg, 2014). This is because secondary cities, which are neither metropolitan nor rural areas, perform critical governance, logistical and production functions at the sub-national level that could catalyse the achievement of the aspirations of the SDGs by 2030 (Chen and Kanna, 2012).

Within the discourse of inclusive and sustainable cities, four areas of cross-fertilization are imperative: intra-city dynamics, peri-urban dynamics, new city emergence, and infrastructure corridors (Zoomers et al., 2017). Using perspectives from a secondary city, this paper explores the peri-urban dynamics component of the current urban agenda discourse. This study draws evidence from Wa, Ghana to examine peri-urban development and diversity in the livelihood practices of households in developing cities. Even though Wa is one of the youngest regional capitals in Ghana, it is among the fastest growing secondary cities in the country. The town epitomises a typical secondary city in the Global South and indeed it is captured as such in Ghana's secondary city support program undertaken by the World Bank (World Bank, 2015). The city serves a dual purpose of being the capital of the Upper West Region and the Wa Municipality and therefore performs social, educational, economic, and administrative functions as well as providing financial services to residents and those in the 10 other districts in the region. The presence of these amenities and functions are positive attractions to the city. Unlike some previous studies (e.g., Dapilah et al., 2019; Korah et al., 2018) that focused on urban expansion with limited attention on livelihood diversification, this current study draws insights from the ideals of land formalisation and a sustainable livelihood framework to understand

the processes of peri-urbanisation and farmer households' livelihood diversification practices. To achieve this, the following related research objectives were pursued: (1) to examine the nature and extent of the spatial expansion of Wa from the 1980s; (2) to explore the drivers of the spatial expansion of the city; and (3) to examine the livelihood diversification strategies pursued by farmer households.

This research is critical and contributes to the literature on urban planning and livelihood practices in three ways. Firstly, the research draws the attention of urban planners to recognise that spatial planning is central to fixing the urbanisation challenges of cities. The centrality of spatial planning, particularly in peri-urban areas in secondary cities, manifests in this study. The study also emphasises the need for urban theorisation to complement normative frameworks and planning contexts and practices in small towns. Furthermore, the research is of great value in helping planners pinpoint the multiple factors shaping peri-urbanisation in the Global South, the problems, and the corresponding outcomes to anticipate.

2. Conceptual overview and analytical framework

The concept of secondary cities has been studied variously in seeking to explain their characterisation and form in developing countries. The extant literature, therefore, shows that the conceptualisation of a secondary city varies. For Rondinelli (1983), secondary cities are urban settlements with at least 100,000 people, while other researchers consider them as neither a metropolitan city nor a rural community, but which perform critical governance, logistical and production functions and provide services to people in and around them (Chen and Kanna, 2012; Drewes and Campbell, 2021; Donaldson et al., 2020). Generally, secondary cities serve as trade nodes, transportation and technological hubs, and net receivers of rural migrants; and they provide more opportunities for jobs and employment and as such contribute more to poverty reduction and improved standards of living than larger cities (Christiaensen et al., 2016). The development of secondary cities is viewed as a crucial mechanism for stimulating local economic growth that could trickle down to the surrounding rural communities, slow down rural-urban migration and spread the benefits of the country's economic growth to all areas (Rondinelli, 1983). Despite their role in shaping the modern economic geography of cities, secondary cities have not received the required investments, infrastructure, services, and jobs opportunities (Roberts, 2014; Videla et al., 2020). They also suffer from institutional deficiencies, poor land governance, environmental degradation, poor enforcement of spatial planning frameworks, and unplanned urbanisation (Osumanu and Akomgbangre, 2020). These challenges stem from the fact that such cities have received little attention in urban studies (Bell and Jayne, 2009), especially the role of secondary cities in shaping peri-urban transformation and livelihood diversification practices. Yet, secondary cities have become the new face of global urbanisation, especially in the Global South (Bell and Jayne, 2009; Ammann et al., 2021).

The peri-urban concept is used to describe the geographical area that lies between the city and the rural hinterland where rural and urban activities take place simultaneously (McGee, 1987; Tacoli, 1998) and the processes leading to its creation is referred to as peri-urbanisation. The scale and level of peri-urbanisation varies from country to country. While it can cover a large expanse of land (up to 100 km radius) in some countries, it may cover just a few kilometres radius in others. The area is a hub for agriculture, complex infrastructure development, industrialisation, and suburban development leading to a dynamic co-existence of rural and urban livelihoods (McGee, 1987). Therefore, peri-urbanisation transforms rural areas on the edges of cities to semi-urbanised forms that accommodate the excess urban population resulting from natural population growth and migration of rural people to the urban centre to seek greener pastures. The areas are appealing to people because it is easy for migrants to acquire land since those in the urban core are expensive and beyond their reach. The availability of social amenities and infrastructure

also draw people to these areas leading to the springing up of housing accommodation and commercial centres (Oduro et al., 2015; Wolff et al., 2021). Some studies on peri-urbanism in sub-Saharan African and Asia are showing that peri-urbanisation leads agricultural land conversion from farming to urban uses and a transformation in livelihood patterns (Tacoli, 1998). However, peri-urban development creates opportunities for changes in livelihood patterns from rural to urban in which better-off households and or individuals can leverage to diversify and improve their livelihoods; but at the same time those living in poverty may lose out (Alobo Loison, 2015; Mondal, 2008; Ricci, 2019).

While livelihood comprises the set of assets and activities required to make a living, livelihood diversification entails the processes by which people, especially those living in rural and peri-urban areas, construct a diverse portfolio of activities to survive (Chambers and Conway, 1992; Ellis, 1998). However, Alobo Loison (2015) makes a case that livelihood diversification takes place at the local economic or individual levels. At the local economic level, it entails the structural transformation of the local economy from rural to non-rural activities, while securing more income through a variety of sources, which constitutes individual level livelihood diversification. Studies show that livelihood diversification serves as an adaptation strategy for poor households when their traditional or primary livelihood fails or risks losing its relevance (Ellis, 1998; Alobo Loison, 2015). It is, however, critical to point out that livelihood diversification can be constrained by a lack of cash or assets as these are critical enablers for households to adopt other activities so as to mitigate the risk of losing primary livelihood sources (Ellis & Freeman, 2004). Even though peri-urbanisation adversely affects agricultural livelihoods, it creates opportunities for individuals and households to adapt non-farm livelihoods to complement farm income (Cobbinah et al., 2015; Le and Dung, 2018).

The study draws on the ideals of land formalization and the sustainable livelihood framework (SLF) to analyse the data gathered (Chambers and Conway, 1992). Land formalisation concerns the state's laid down procedures and conditions of access to and registration of customary land (Peluso et al., 2013). The procedures and conditions manifest in the codification of the rights to own, access, or trade in land (Putzel et al.,

2015). This comes in the form of maps, rules, titles, and others that give the state and private individuals the power to exert an influence over customary lands and formalise all transactions therein (Peluso et al., 2012). This paves the way for customary land commoditisation, enabling parcels to be bought, sold, mortgaged, leased, or transferred through the liberalised market system (Putzel et al., 2015). Therefore, land formalization ensures security of tenure, wealth creation and the promotion of economic development (Abubakari et al., 2020; Antwi-Agyei et al., 2015; De Soto, 2000). However, many scholars argue that formalisation can create poverty by facilitating smallholders' land losses (Peluso et al., 2013). This study argues that formalisation is a critical driver of peri-urbanisation and livelihood diversification because it facilitates widespread land transactions. The subsequent development of these lands disrupts peri-urban farming activities; hence, may compel peri-urban households to adapt new livelihood opportunities.

In the context of this study, the opportunities and constraints embedded in peri-urbanisation, the influence of customary land tenure, and formalisation serve as the institutions and processes that mediate peri-urbanisation and livelihood strategies, while the translation of livelihood assets into livelihood activities constitute the outcomes. The study argues that even though urbanisation at the peripheries endangers local livelihoods, it also creates opportunities for new income generating opportunities, and diversification into non-farm activities such as retail trading, construction-related and personal services subsectors (Oduro et al., 2015; Wandl and Magoni, 2017; Ricci, 2019; Kuusaana and Eledi, 2015). Therefore, peri-urban development provides the context to understand how households respond to these opportunities and constraints. Secondly, the institutions and policies that manifest in government policies, formalisation, and customary land tenure mediate peri-urbanisation and livelihoods (See Figure 1). The study draws on formalisation because it grants private and state agencies the power over customary lands and consequently destroys primary livelihoods of farmer households. The concept of sustainable livelihood is relevant in this study because of the interplay of critical factors, namely customary land tenure, formalisation, land conversion and peri-urbanisation, which appear to pose a threat to the land related livelihoods of farmer households. However, at the same

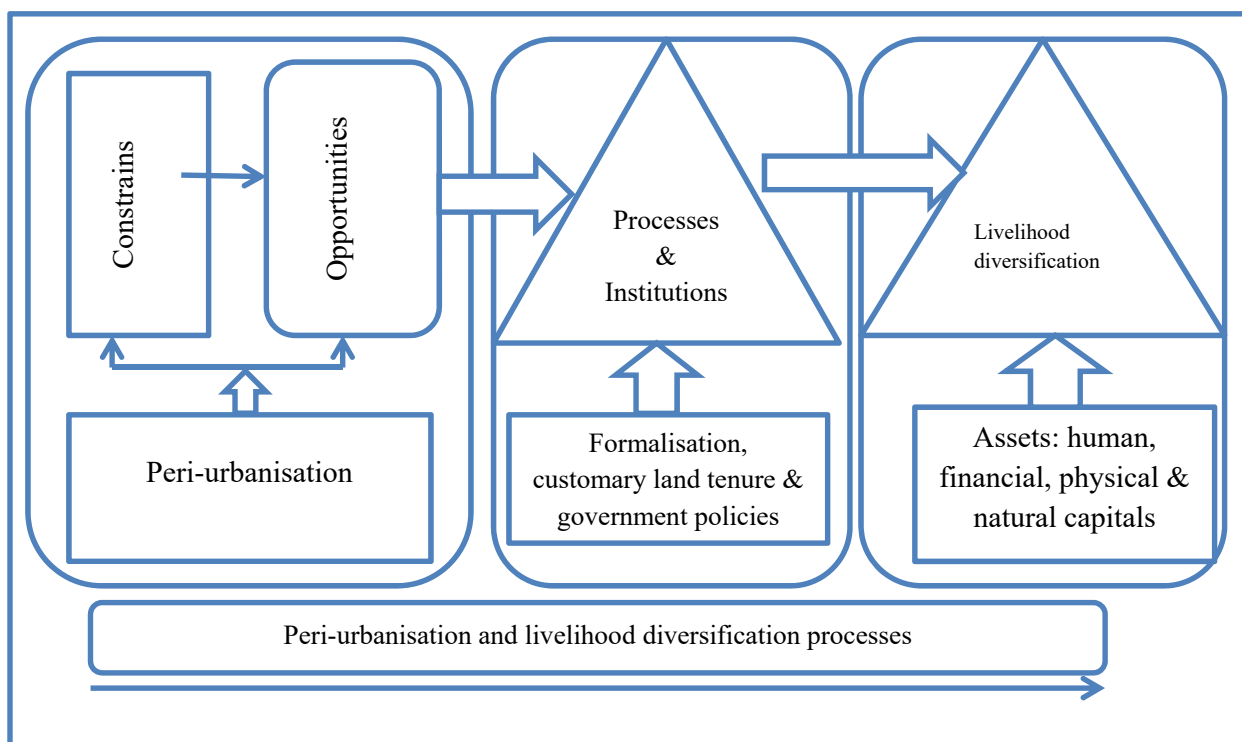


Figure 1. Peri-urbanisation and livelihood diversification processes.

time, this has created new livelihood diversification opportunities to compensate for farmland losses. In this situation, local farmer households draw on the combination of physical, financial, human, and natural capitals to eke a living even though some struggle to survive.

3. Materials and methods

3.1. Study area

In Ghana, settlements are classified as urban when those residing there reach 5,000 and more (Ghana Statistical Service, 2014a,b). However, cities are classified as conurbations, urban agglomerations, secondary cities, towns and villages (Akubia and Yankson, 2020). A secondary city is one that has a population ranging from 100,000 to 250,000 (World Bank, 2015). Given this definition, Wa, with a population of more than 100,000, falls within the secondary city bracket (Ghana Statistical Service, 2021). Wa is in the north-western part of Ghana and is about 686 km from Accra, the nation's capital. Wa is home to the Waala (natives). Wa has traced its history to the 15th Century, when it became the headquarters of the Waala State and a trading hub between the natives, Mande and Hausa traders (Songsore, 1985). By 1901, when Wa was annexed by the British as part of the Northern Territories, the town had established itself as a free political and business capital (Ahmed et al., 2020). However, it can be argued that the annexation marked the beginning of large-scale urbanisation in Wa (Figure 2).

Furthermore, the government's policy of compulsory land acquisition for the establishment of the Wa-Campus of the University for Development Studies (now SD Dombo University of Business and Integrated Development Studies), the Dr Hilla Liman Technical University, Nursing Training College, the new regional hospital, and several second cycle schools, have contributed to urban population growth in recent time (Ahmed et al., 2020; Akanbang et al., 2018). The establishment of these institutions has attracted private investment in hotels, student hostels, shopping centres, and residential housing to meet the needs of urban residents and immigrants. All these factors exerted pressure on peri-urban lands, resulting in the town's lateral expansion.

3.2. Study approach

The study adopted the pragmatist philosophical paradigm, which combined the positivist and interpretive paradigms, to carry out data collection, analysis, and draw inferences. While the positivists argue that the researcher should formulate a hypothesis to test for a causal relationship through independent observation, advocates of the interpretive approach seek to use words and observations to explain and understand people in natural settings (Amaratunga et al., 2002). The mixing of these paradigms enabled the researchers to use numbers to understand certain

aspects of the study (for example, physical expansion of Wa over the study period), and at the same time helped in explaining the reasons that accounted for the development. Naturally, the mixed method approach was used to conduct the study. The mixed method research approach entails the use of both quantitative and qualitative elements; using data collection, analysis, inferences, and ideas in a single study with the general objective of gaining a broader and insightful understanding of the phenomenon under investigation (Johnson et al., 2007; Schoonenboom and Johnson, 2017). Specifically, the sequential explanatory mixed method research design was deployed to carry out the study. The design involves the collection and analysis of the quantitative set of data first and then following it up with qualitative data that are integrated at the presentation stage (Toyon, 2021). In this respect, spatial data were obtained and analysed before we proceeded to collect and analyse the data from the household survey and interviews. The essence of adopting the approach was to use the spatial information as a guide to prepare and collect the data from households and subsequently interview participants to gain a deeper and broader understanding of urbanisation at the peripheries and livelihood diversification practices.

3.3. Sample determination and sampling procedures

Multiple sampling techniques were deployed to select communities, households and individual research participants. First, the study used a stratified sampling technique by dividing the peri-urban communities into smaller groups (strata) based on their proximity to each other (Sharma, 2017). As such, all the 19 peri-urban communities were stratified into four strata from which seven communities (Danko, Bamahu, Konpala, Nakori, Kpong, Sombo, and Mangu) were purposively selected to participate in the study. In selecting the communities, we were guided by previous studies (Akanbang et al., 2018; Abdulai, 2022), and our knowledge of the study area (see Table 1). Therefore, the communities

Table 1. Characteristics of satellite images used.

Year	Satellite	Sensor	Spatial Resolution	Bands	Date
1986	Landsat	Multi spectral scanner	30 × 30	4,3,2	March 27, 1986
1998	Landsat	Thematic Mapper	30 × 30	4,3,2	February 20, 1998
2006	Landsat	Enhanced Thematic Mapper	30 × 30	4,3,2	April 19, 2006
2019	Landsat	Operational Land Imager	30 × 30	5,4,3	January 13, 2019

Source: Based on United States Geological Survey Department, 2019

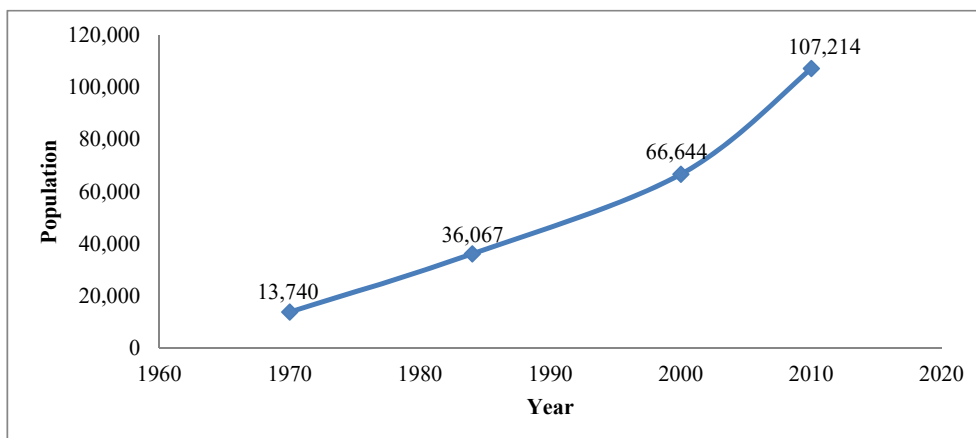


Figure 2. Wa's population growth from the 1970s to 2010s. Source: Ghana Statistical Service (2000; 2013; 2014).

were chosen because they exhibit both rural and urban characteristic, namely their proximity to the city, low population density, availability of farm and non-farm activities and limited social and economic infrastructure.

Next was the determination of the sample size. The number of people and or households to include in a study is an important consideration in scientific research. Sample size determination is critical for scientific research because it reduces the cost; ensures efficient use of time; and helps to make meaningful inferences from the data (Smith, 2020). It is, therefore, critical to determine the sample size to ascertain the number of households to contact for the study. In doing so, we obtained the data on the number of households in the study communities from the Community Health Planning Services (CHPS) and summed them up to obtain the total. The CHPS¹ data were used because the Ghana Statistical Service lacked current information on the number of households in the communities. In total, 3,375 peri-urban households were included in the sample frame. Using the Yamane (1967) sample size determining formula, a sample size of 358 was determined based on the sample frame. However, 15% of the computed sample size was added to account for non-responses from the randomly selected sample (see Fernandez et al., 2009). This resulted in a sample size of 412 households, which was proportionately distributed among the study communities. The second group to be sampled was the peri-urban farmer households. Each peri-urban farmer household was assigned a number based on the list obtained from the CHPS. The farmer households were randomly selected from each community using the fishbowl method without replacement until the allotted proportion was reached. Thirdly, the maximum variation purposive sampling technique was used to select key informants (officials from the Lands Commission, the Land Use and Spatial Planning Authority (LUSPA), heads of landowning families [Tendamba]², a chief and elders, and women's groups) for interviews and focused group discussions. These stakeholders were chosen to participate in the study because they had different in-depth knowledge and understanding of the urban expansion and livelihood practices of peri-urban households that they could share with us.

3.4. Data collection instruments and analytical procedures

A questionnaire was used to collect data from the farmer households. The questionnaire included questions about whether residents continued to farm despite urban encroachment, the type of farming practices used, and the non-farm activities undertaken by households. Furthermore, the household socio-demographic characteristics were solicited. Although household heads were conceived to participate in the survey, other older adults were also eligible to answer the questionnaire in the absence of the household head. Household heads (HHs) play a major role in the entire household decision-making process and livelihoods and may shape land use decisions within the larger community. Some of the items captured in the questionnaire included (1) Have you noticed urban encroachment on your community and farmlands? (2) What are the drivers of urban expansion? (3) How does urban encroachment on your farmlands affect your farming activities? (4) Were you engaged in crop farming in 1980s? (5) Do you still engage in food crop farming? (6) If yes, why are you still involved in crop farming? (7) If yes to question 5, what crops do you cultivate? (8) Apart from farming, what other livelihood activities do you engage in? (9) How do the other activities support your farming activities? (10) Why are you not undertaking farming activities now?

Additionally, an interview guide was used to collect data from key informants (officials from the Lands Commission, the Land Use and Spatial Planning Authority (LUSPA), heads of landowning families

[Tendamba]³, a chief and elders, and women's groups) to ascertain their perspectives and experiences regarding the interacting factors that influence urban expansion and how they negotiate their livelihoods. In total, four key informant interviews were conducted (one each from Lands Commission and LUSPA and two interviews with family heads). In addition, four focus group discussions were held with chiefs and elders (two each for the chief, elders, and women groups). The chiefs and elders and women leaders were constituted into four groups comprising six to 12 members. The interviews and focus group discussion lasted an average of 45 min. Some pertinent photographs were taken to corroborate respondents' assertions. Before the commencement of data collection, ethical clearance was obtained from the Institutional Review Board of the University of Cape Coast, in Cape Coast before the data collection instruments were used. In addition, verbal consent of the respondents who were illiterates was sought with the help of the assembly member of each community before the data were collected. This was after the objectives and purpose of the study were explained to the research participants and their anonymity assured. The entire data collection process lasted for about six months, January–June 2019.

Furthermore, spatial data were sourced from the United States Geological Survey Department (USGS EarthExplorer) to analyse the land use/land cover changes in Wa for three decades—from 1986 to 2019 (see Table 2). A total of four datasets were sourced for the study involving Landsat 5, 7 and 8 for the years 1986, 1998, 2006 and 2019. Instead of Sentinel images, Landsat data were used because of their easy accessibility, ready availability, and low cost of acquisition. Besides, Landsat images have been used by many scholars in executing similar tasks (see Osumanu et al., 2019). The various Landsat images (see Table 2) were first screened to ensure that they were cloud free, although a 10% cloud cover threshold was set in downloading the images. All the images downloaded were in the dry season during which time cloud cover was minimal giving the images high spectral signatures. Using images from different seasons may result in over or underestimation of the vegetative cover since the area is much greener during the rainy season. The first year (1986) was used as the reference date/season from which the rest of the images were chosen. The year 1986 was chosen because Wa was designated as the capital of the Upper West Region in 1983 and preliminary interview with officials from the Lands Commission and LUSPA revealed that although the first spatial plan of Wa was developed in 1985, implementation commenced in 1986. However, the respective years' images were chosen because there was no presence of cloud cover that could distract the capturing of accurate data on the spatial expansion of the city.

Erdas Imagine 2014 software was used to process the satellite images. The images were first taken through pre-processing algorithms involving Landsat gap-fill, radiometric correction, and calibration to further enhance the quality of the images. This helps to improve the brightness and contrast of the images to make the pixel colours clearer for identification of classification signatures. The images were further stacked according to their brands to create composite images for the respective years. A shapefile of the study area – Wa Municipality -was then used as the area

Table 2. Land use/cover category descriptions.

Land use/cover category	Description
Built-up areas	The non-vegetative part of the landscape comprising buildings, paved surfaces (roads, parking lots), commercial and industrial sites, and urban green spaces.
Open savannah woodland	It comprises short grasses, bushes, shrubs interspersed with short stature and scattered trees, and croplands.
Closed savannah woodland	Encompasses woodland with closed trees, shrubs, continuous grass and forest landscapes.
Bare ground	Land areas with barely any vegetation cover, no infrastructure and no buildings
Water bodies	Water bodies/or wetlands; rivers, streams, reservoirs/dams, dugouts, and ponds

¹ CHPS is the lower-level community health service facility.

² The Tendamba (Earth Priests) are the lands custodians in Northern Ghana and the Wa area. They are believed to be the first settlers of every community, and therefore are bestowed the rights of serving as a link between the living and the ancestors, and by leading in customary rituals and sacrifices.

of interest (AOI) to subset the extent of Wa out of the larger images. A signature file was generated where training samples were selected and used to perform a supervised classification using the land cover classification scheme (see Kafi et al., 2014). Initially, the images were classified into a minimum of 50 classes. Several of the classes were retained to form the classification scheme's initial five cover classes (see Fichera et al., 2012). Following that, the maximum likelihood classifier was used with ground control points (GPS points) sourced from the field and supported with Google Earth imagery for ground truth (see Fichera et al., 2012). Additionally, the Erdas Imagine 2014 software was used to generate areas for the classes. Thus, the images were geo-referenced and projected to the World Geodetic System (WGS84) and the Universal Transverse Mercator Zone 30 North. The images were classified into five land cover classes (see Table 3). ArcMap 10.4 was also used to create the maps and, supported with an excel spreadsheet, the statistics for the change detection analysis were calculated (Fichera et al., 2012; Kafi et al., 2014). The accuracy of multi-temporal change detection derived from multisensorial remotely sensed data was assessed. The assessment revealed an accuracy rate of 89% in 1986, 93% in 1998, 97% in 2006, and 95% in 2019.

Furthermore, the household data were coded and entered in the Statistical Package for Social Sciences (SPSS) version 20 for further transformation. Descriptive statistics, chi-square test for independence and cross tabulation were employed in analysing the quantitative data. In addition, the land use land covers maps produced was labelled as figures. For the qualitative data, the study draws on the five-phase thematic analysis approach (Braun and Clarke, 2006; Nowell et al., 2017; Kiger and Varpio, 2020) after the data were transcribed into English. In the first phase, we repeatedly read all the transcripts obtained from the interviews and focus group discussions. We did this alongside writing notes on the margins of the transcripts. The objective here was to familiarise ourselves with the general issues and to reflect on the patterns found in the data. In the second phase, we generated initial codes to be assigned to the relevant data. We then discussed and agreed on the codes to be assigned to the relevant patterns detected in the data. In the third phase, we searched for the themes in the data using the assigned to the codes. We initially identified five themes (perceptions, manifestation; drivers, impacts, and livelihood activities) though the codes assigned. The revision of the themes and consolidation of some of them resulted in three themes, which constituted the fourth phase. Naming the themes - drivers of urban expansion, impacts on land availability for farming, and the non-farm livelihood activities - represented the fifth phase. The final phase is marked by presenting the results and integrating narratives and quotations to illustrate how land formalisation shapes urban expansion and livelihood diversification at the peripheries. Furthermore, content analysis was applied to the images and the pictures taken to make inferences.

4. Results

4.1. The nature and extent of environmental change of Wa from 1980s to 2010s

From 1986 to 2019, the built-up areas, open savannah woodland, closed savannah woodland, bare ground, and water bodies all changed.

Table 3. State of the land cover (Ha) from 1986 to 2019 in Wa.

Year/Land use/cover	1986	1998	2006	2019
Built	471.92	875.34	1487.43	4,509.94
Open woodland	11,474.70	16824.90	20209.00	26445.00
Close woodland	45,468.60	39969.80	36321.90	26254.90
Bare ground	708.60	483.75	68.31	775.64
Water	8.70	22.23	55.71	52.43
Total	58,132.60	58,176.02	58,142.35	58,037.91

Source: Field data, 2019

In 1986, the built-up area was 471.92 ha. By 1998, it had grown to 875.34 ha. Between 1998 and 2006, the share of built-up area accounted for 8% of total land-use change. The built-up share of the land area increased by 15% between 2006 and 2019 and this accounted for 3,022.51 ha farmland loss (Table 4). This implies that more of the other land covers were converted to built-up areas, as evidenced by the decline in closed savannah woodland. The shrinking of the closed savannah woodland implies an increase in the open savannah woodland that made it easier to clear the vegetation covers for agriculture and housing construction. This led to the increase in the built-up area and the outward expansion of the city leading to the emergence of small patches of villages into peri-urban communities (see Osumanu et al., 2019). However, this development could compound the problem for planning for sustainable utilisation of land as more and more peripheral lands are converted unsustainably, according to an official from LUSPA (15th June 2019). The official further explained that:

“My observation and analysis of the first physical plan we have here show that the built-up area of Wa has been expanding over the years to the point at it has cross to the nearby communities that were considered as part of Wa. The city has outgrown to the official 1985 boundary, encroaching on nearby communities such as Danko, Bamahu, and Kpong, and to Nako and Siriyiri communities in the Wa West District. Through this horizontal expansion of the built-up area, the patches of villages around the Wa Township are now considered to be part of Wa, which makes it difficult for us to control urban development and enforce planning regulations at the peripheries”.

The quotation illustrates that the rapid expansion of the city has imposed challenges on the state institutions responsible for urban planning and management.

Open savannah woodland comprises grasses, shrubs interspersed with scattered trees, and croplands. The share of the open woodland areas increased (47%) from 1986 to 1998, and by 2006, open woodland had also increased by about 42% over the eight years (see this in Table 4). For 2006 and 2019, open woodland accounted for 31% of the total change that had occurred.

The increase in open savannah woodland could be attributed to its easy clearance for the construction of residential accommodation, commercial and agricultural purposes. The increase in open savannah woodland implies that the trees, shrubs, and croplands were being cleared to accommodate the horizontal growth of the town and the consequent transformation of the vegetative cover and natural physical environment to urban uses. This happened at the expense of farming and other land-based livelihoods of the local people. The danger is that the natural ecosystem that supported the primary livelihoods (food crop farming) of farmer households could be under threat from the rapid land conversion that prevails in the area. It can be argued that even though the increase in open savannah woodland through clearing of forest lands created the opportunity for easy housing construction to accommodate the increasing urban population, it derailed local livelihoods, especially those of households living in poverty due to their low capacity to adjust and fit into the emerging urban economy.

In addition, closed savannah woodland, which encompasses woodland with closed trees and forests, decreased by 47.9% from 1986 to 1998 (see this in Table 5) and 45.1% from 1998 to 2006. A similar trend is observed from 2006 to 2019, where the share of closed savannah woodland decreased by 50.3%. The continuing decline in closed savannah woodland can be ascribed to the persistent increase in the built-up area (see this in Figure 3) since savannah woodland can easily be converted into other uses, including residential accommodation for the growing population in the Wa Township. This development led to an increase in open savannah woodland, especially at the peripheries that hitherto were home to a variety of plants, animals, and croplands. The shrinking of the closed savannah woodland posed a danger to the survival of animals that depended on the natural environment for grazing.

Table 4. Land use/land cover change from 1986 to 2019.

Year	1986–1998			1998–2006			2006–2019		
	Change (ha)	% change	Rate of change	Change (ha)	% change	Rate of change	Change (ha)	% change	Rate of change
Built	403.42	3.5	0.29	612.09	7.6	0.95	3,022.51	15.1	1.16
Open woodland	5,350.2	46.6	3.88	3384.1	41.8	5.23	6,236	31.05	1.0
Closed	-5498.8	-47.9	-3.99	-3,647.9	-45.1	-5.63	-10067	-50.3	-3.86
Bare ground	-224.86	-1.9	-0.16	-415.44	-5.1	-0.64	707.332	3.5	0.27
Water	13.46	0.1	0.01	33.48	0.4	0.05	-3.285	-0.05	-0.001
Total		100			100			100	

Source: Field data, 2019

Table 5. Cross tabulation of education level and livelihood choice.

Education level	New livelihood activity				Total
	Commercial transportation	Retail trading	Personal services	Construction-related activities	
No education	131 (48.3%)	82 (30.3%)	35 (12.9%)	23 (8.5%)	271 (100%)
Basic school	38 (42.2%)	27 (30.0%)	10 (11.1%)	15 (16.7%)	90 (100%)
Secondary	24 (51.1%)	8 (17.0%)	3 (6.4%)	12 (25.5%)	47 (100%)

Chi-square test for independence results: χ^2 (6, n = 408) = 16.0, p-value = 0.014, phi = 0.198.

This is in the sense that it provides them an avenue for obtaining feed, water, and shelter, especially for those living in the wild. The area is also home to pollinating, seed dispersal, or cycling insects that are critical for plants as well as human survival. However, continuous clearing of the vegetation at the peripheries jeopardises the ability of animals and peri-urbanites to benefit from these important free services of nature.

Furthermore, the analysis shows that from 1986 to 1998, bare ground covered areas that were not covered by vegetation, infrastructure, or water decreased from 708.607 ha to 483.7 ha. Likewise, between 1998 and 2006, bare ground declined from 483.75 to 68.31 ha. However, it increased from 63.31 hectares to 775.642 ha between 2006 and 2019. The increase in bare ground can be attributed to the month in which the satellite image was acquired (January). For water bodies/or wetlands (all bodies of water, including rivers, streams, reservoirs/dams, dugouts, and ponds), the study showed that they covered 8.77 ha in 1986 but increased to 22.23 ha by 1998, accounting for 0.1% of the total change in water bodies over the period (Figure 4). The increase in water bodies may have been caused by the creation of ponds by sand miners in peri-urban communities and the construction of the "Wadia dam" (a dugout) along the Wa – Loho highway. Even though the ponds could serve as a source of water for animals (especially those in the wild), they pose a danger to small domestic ruminants during the raining season. The ponds could moreover be a breeding ground for mosquitoes that pose a health hazard to residents. However, the construction for the Wadia dam served as a source of all year round water supply for various purposes.

4.2. Drivers of spatial expansion: the role of land formalisation and commoditisation

Given that satellite images revealed a significant physical expansion of the city, it was necessary to ascertain the perceptions of households and stakeholders regarding the drivers of the spatial expansion. The peri-urbanisation in Wa occurs within the context of a customary land tenure regime where lands are communally owned. Consequently, land formalisation and the subsequent development of land markets are critical precursors of urbanisation at the peripheries. According to the household

heads interviewed, customary land is owned by families, clans, and individuals possessing land rights. However, through a system of negotiated planning practices, some family heads (Tendamba) collaborate with LUSPA to develop local planning schemes and layouts for some peri-urban land. This collaboration is necessary because, although the LUSPA is mandated to plan customary lands, the cost of the planning process is not currently covered by the state. Thus, family heads have become clients of LUSPA, providing finance for the preparation of their local planning schemes and layouts.

The creation of these schemes and layouts sort of formalise their ownership rights to the land and enables landowners and families to supply land to the land market. Planning layouts facilitate allocation and administration of land as well as allocate ownership and use rights in a manner that allows private individuals to acquire land. Due to the lower land prices in peri-urban areas compared to the inner city, the land market has become extremely appealing with a rush for land in peri-urban Wa, resulting in the proliferation of informal and uncontrolled housing developments. The lack of coordination in land sales between or within the same Tendamba families results in uncontrolled housing development. A chief stated that:

As you know, the Tendamba (plural for Tendaana) own community lands here. However, as this group has grown, they begun to share the land among themselves (families). And now, each family owns and has authority over specific portions of community’s land, which implies that they decide how to use their portion of the land. So, while some may wish to sell their land, others may retain it maybe for future use or for their children and grandchildren. Therefore, you can find houses on some portions of land, while other plots are not developed (Interview with a chief, 28th May 2019).

The quotation explains why Southern peri-urban areas do not experience a contiguous physical development. Considering this, physical development cannot be fully managed, planned, or controlled, particularly in the context of rising land values and customary-led land management systems. Peri-urbanisation therefore becomes difficult to control because of the predominantly family-level decisions about land allocation for urban use: meaning these urban fringes are not spatially predictable. The decisions about family land transactions are made on several levels at various times, and by multiple stakeholders at the family level. An official of the Lands Commission said that:

“My experience demonstrates that three factors influence and shape peri-urbanisation in Wa. I will begin by saying that private individuals purchase land to take advantage of the socioeconomic opportunities associated with the town’s rapid growth. Also, land speculation tends to fuel the mad rush to acquire peri-urban land in anticipation of the future increase in land values in those areas so that they can resell to make profit. I will add that the desire of landowners to take advantage of the booming land market to cash in has encouraged them to develop local plans, which enable them to sell at relatively higher prices” (Key informant from Lands Commission, 10th April 2019).

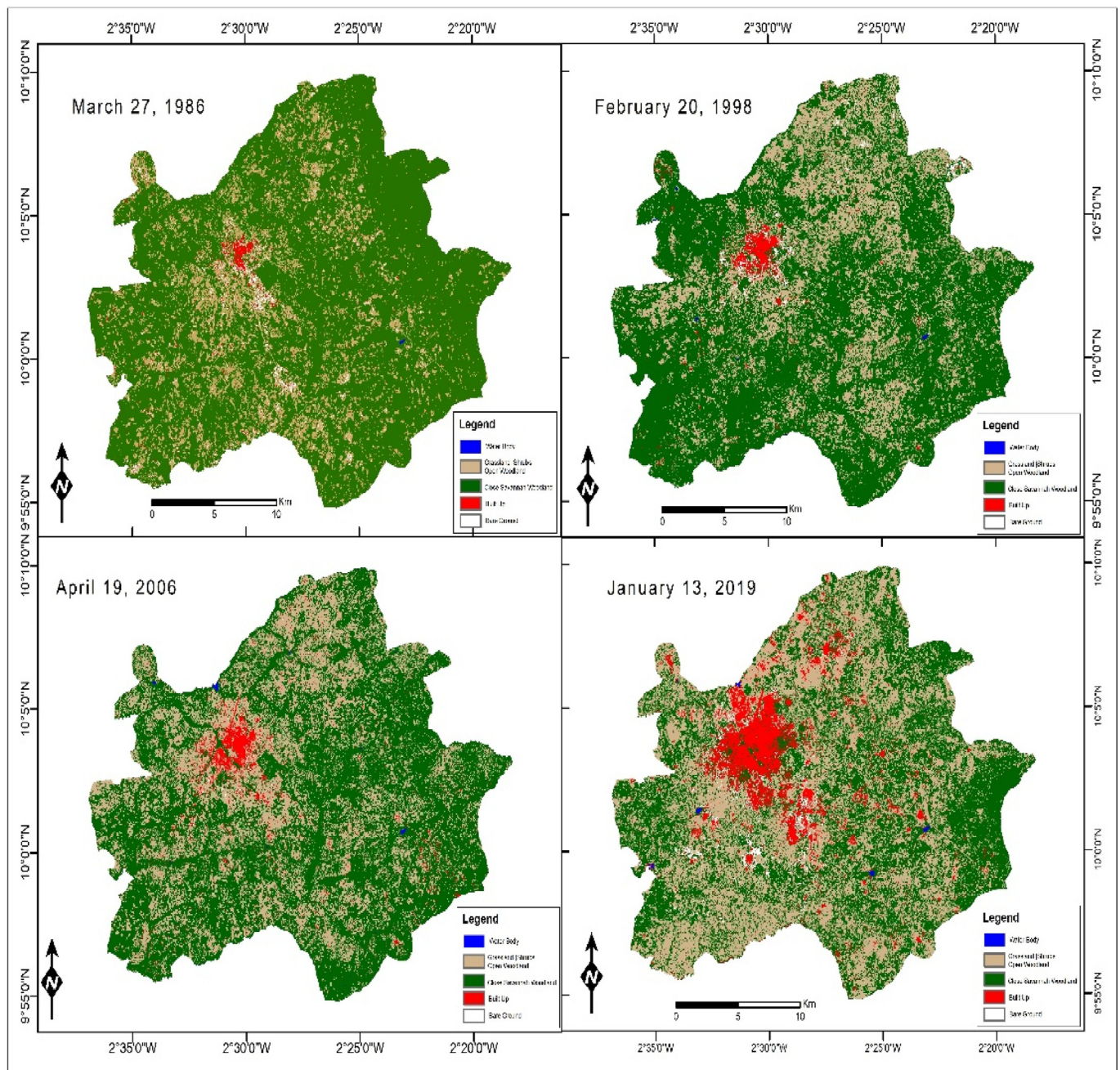


Figure 3. Land use land cover map of Wa from 1986 to 2019. Source: Authors' construct 2021.

Thus, peri-urbanisation in the Wa Township is made possible by the existence of both formal and informal land markets that allows the exchange of rights in land for agreed amounts of money and this is facilitated by high demand and widespread land formalisation. However, such decisions impact on the future opportunities of different rights holders, particularly women and young members of landowning families.

The establishment of major tertiary educational institutions on lands acquired through the government's compulsory land acquisition policy also sparked peri-urbanisation processes. The establishment of these institutions in some the peri-urban communities have created hotspots for urban land transactions. This is because of profit driven private investment in these communities through the construction of student hostels and other commercial activities targeting the students. This was confirmed during a focus group discussion when it emerged that:

“The establishment of the Dr. Hilla Liman Technical University and tarring of the road linking Wa to the community [Kpungu] opened the community, attracting private individuals seeking land for residential and commercial purposes to purchase land in Kpungu. This had led to the springing up of residential housing on previous farmlands” (Focus group discussion with women from Kongu, 9th May 2019).

The establishment of these critical educational infrastructures simulated ancillary developments, and investment in other social infrastructure and services. However, the emergence of land markets in these areas has implications for household land trading decisions regarding the land transactions. Investment in major public infrastructure in peri-urban communities also attracts land speculators and can potentially disrupt household land transfer decisions. According to the participants, land transactions near educational facilities became profitable because many

private people considered the students as a source of a residential rental market. A Tendaana explained that:

“The families lived in one large compound house and ate from the same pot. However, times have changed, and everyone desires to own a home. As families expand, young people will undoubtedly desire to leave the family home and construct their dwellings. Therefore, the male family members shared the land among themselves, and some ended up selling their portions” (Interview with a Tendaana from Nakori, 22nd June 2019).

The quotation reveals that the formalisation of ownership, through family level land demarcation and sharing, facilitates trade in land and the subsequent springing up of residential houses in the peripheral areas.

4.3. Impacts of peri-urbanisation on livelihood diversification in peri-urban Wa

Peri-urban agricultural land conversion due to urbanisation suggests that the primary source of traditional land-based livelihoods of households is consequently under siege. At the same time, new livelihood activities were pursued by the households. From the study, a larger proportion (98.7%) of the households was engaged in agricultural-related activities as their primary livelihood option in the 1980s. In comparison, a proportion (68%) of them were still engaged in agriculture-related activities in the 2010s suggesting that a significant proportion (30.7%) of the households abandoned agriculture, especially food crop farming over the period. The shrinking farmlands, reduction in farm income and loss of interest in farming by the youth were cited as reasons for the reduction in farming and its related activities. To understand the nuances of the decision to engage or not to engage in farming related activities in the face of the transformation in the communities, a chi-square test for independence was conducted to determine the association between gender and the decision to engage in agriculture activities. There was no significant association ($\chi^2(1, n = 408) = 0.34, p\text{-value} = 0.499, \phi = -0.006$) between gender and the decision to remain in agriculture. Signifying that the choice of livelihood activity is not dependent on the gender of the respondent as both men and women were engaged in similar activities to eke a living.

Even though land conversion has become a common feature in many peri-urban areas, some farmer households still engaged in agriculture. The motivations for some households' continuous involvement in agriculture (crop farming) were for household consumption (57.5%), for sale (29.7%) and easy access to land (12.9%). Traditionally, farmer households practiced land rotation as a land fertility rejuvenation mechanism. However, with the shrinking of land due to rapid conversion, the farmers resorted to farmland intensification; the practice of optimising every available portion of land by applying both organic and chemical fertilizers and adopting early maturing crop varieties to increase plant population and crop yield. However, the high cost of adopting intensive farming practices served as a barrier to its wider adoption among many farmer households. On the other hand, the households that exited farming mentioned unavailability of farmlands (30.9%), reduction in the size of farmlands (23.9%), lack of interest of the youth in farming (24.3%), and unprofitability of agriculture (20.9%). In the light of the unavailability of farmland for new farms or farm expansion, farmer households that cannot self-produce their food are compelled to purchase food from the market. A family head lamented that:

My son, we are not able to farm as much as we used to do in the 1980s because of our farmlands have been sold out and people have built on parts of them. You see, sometimes you may not be interested in selling your land but the pressure these people put on you compels you to sell part of your farmland. So, when the land is sold out you can't go and farm there anymore even if the person does not develop it (Interview with a family head from Mangu, 24th June 2019).

The quotation illustrates that the loss of farmlands due to urban encroachment has led to a decline in food production among peri-urban households. Therefore, some of households had to resort to the urban food market to meet their food requirements. However, obtaining food from the market poses a challenge for the rural and urban poor due to their limited income.

However, the peri-urban interface presents new livelihood opportunities for agricultural households to undertake several non-farm livelihood activities and paid employment to complement their farm income and to translate these into improved living standards. The results, as shown in Table 5 reveal that many of the respondents were engaged in Auto Rickshaw operators (see Figure 5) and into retail trading as livelihood diversification strategy. A family head from Sombo (24th June 2019) indicated that the importation of t Auto Rickshaws in the country and Wahad provided a window of opportunity for the young men in the peri-urban communities to undertake commercial transportation as a livelihood activity. It is critical to mention that the level of education attained by an individual provides the opportunity to be acquainted with new livelihood opportunities (Ayana et al., 2021); and as such it was crucial to understand its role in diversification choices of the urban and peri-urban agricultural households. A cross tabulation was conducted for education level and livelihood choices; with the results showing that more of those who attained secondary education (51.1%) were engaged in commercial transportation. Suffice to say, there was a significant ($p\text{-value} = 0.014 < 0.05$) association between level of educational and livelihood choices made by the research participants.

During an interview with a family head from Danko (27th June 2019) it emerged that the importation of Auto Rickshaws from China and India since 2015 had ameliorated the unemployment related hardships that would have otherwise arisen due to the loss of farmlands. Thus, the Auto Rickshaws provide the opportunity for men (especially the youth) to be employed as commercial drivers to complement basic farming activities. According to the participants, the use of the Auto Rickshaws eased the movement of people and goods in and around the Wa Township. Thus, the young men have taken advantage of the high commuting demand to provide commercial means of transport for those living far away from the urban centre. This finding supports the aspect of the analytical framework that shows that peri-urban development and its associated livelihood opportunities will enable farmer households to take advantage of the new livelihood opportunities in the informal sector to earn income to complement that from the farm (see Figure 1).

Besides, the opening of the communities through infrastructure provision such as roads and electricity have spurred entrepreneurship in retail trading and as such there has been a proliferation of micro businesses, especially in groceries, vegetables, hairdressing, dressmaking, and barbering salons. However, more women were involved in retail trading and other personal services sectors of the local economy as new urban economic opportunities emerge. Such initiatives can make a more positive contribution to farmer households' economic wellbeing and improved living standard since they have the dual objectives to meet people's social needs and make a profit. It is worthy to note that retail enterprises operate in heterogeneous infrastructure such as fabricated containers at the corridors of the main roads in the communities instead of shopping malls that are usually found in larger cities (see Figure 6).

5. Discussion

The discussion segment of this paper is structured around three related themes: nature and extent of environmental change from the 1980s to the 2010s; the drivers of urban change with special emphasis on the land formalisation; and the impact on livelihood diversification practices. The study shows that the built-up area of the city increased significantly over the study period resulting in the encroachment on peri-urban agricultural lands (See this in Figure 4). The increase in the built-up area is evident in the reduction in the closed woodland. It also

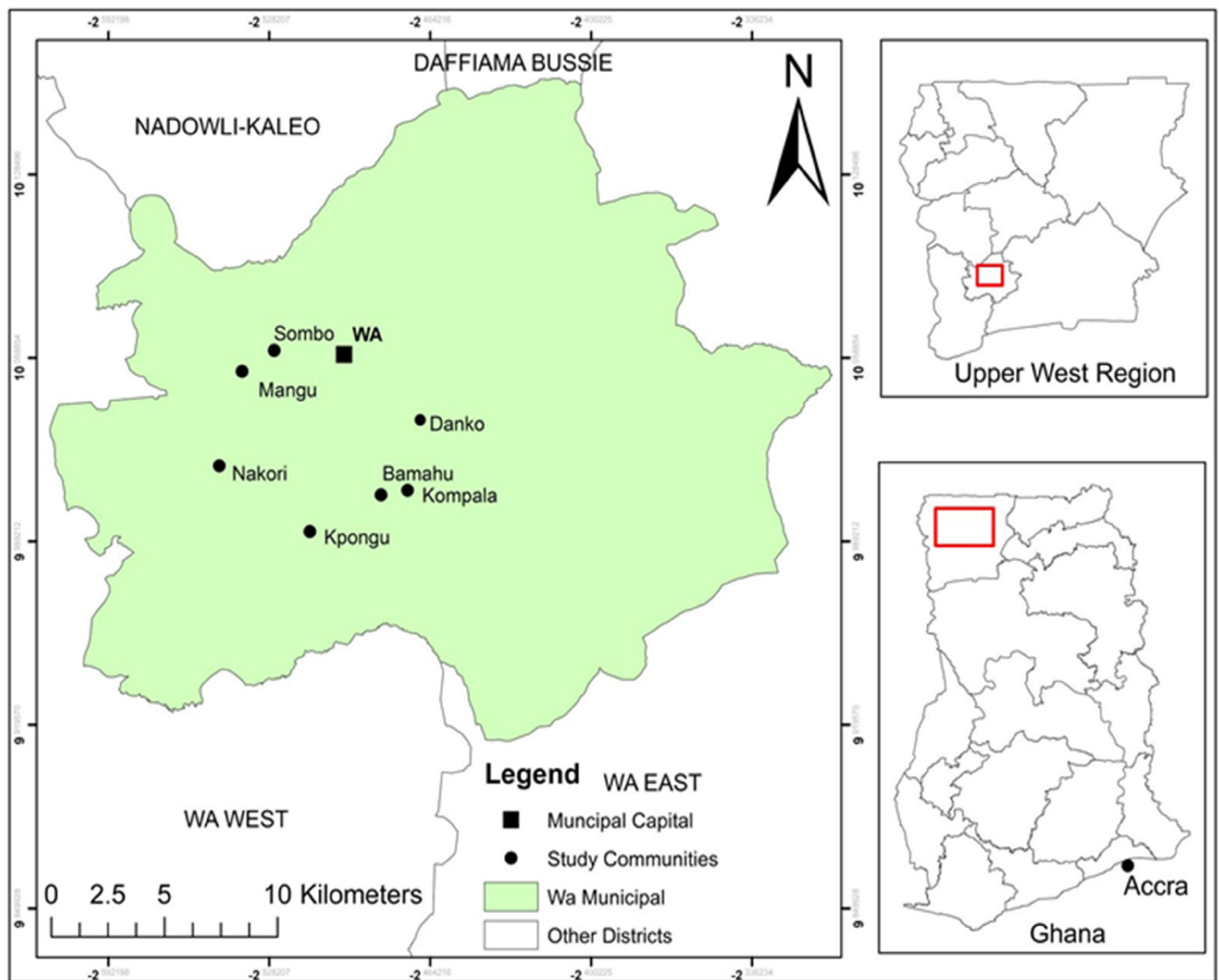


Figure 4. Study area in both regional and national context.

manifests an increase opened savannah woodland since it can easily be cleared for the construction of residential housing, civil, and commercial urban uses. The change in landscape through urbanisation at the peripheries affects the supply of free services of nature that supported human and animal survival (Yang et al., 2021). These processes of environmental change, particularly the expansion of the built-up area, led to many small peri-urban communities becoming part of the main city, which imposed urban planning and management challenges on state institutions. As the study had demonstrated, urbanisation at the peripheries is largely driven by the formalisation of customary lands, and this makes it imperative to understand the linkages of the cities' expansion to land formalisation, speculation, and peri-urbanisation. Therefore, the processes underlying peri-urban transformations should be understood as formalisation and land commoditisation, which produces a capitalist peri-urbanisation that consumes lands at the expense of farming. Unlike other studies (Korah et al., 2018; Dapilah et al., 2019), we argue that the processes of peri-urbanisation are embedded in neoliberal land markets, which emphasises land commoditisation and formalisation and permits private individuals and business to acquire titles to large parcels of land causing poor farmer households to lose out.

Again, peri-urbanisation is engineered by the customary land ownership arrangement, which grants individuals and families the right to formalise and allocate land to competing users and uses. The

arrangement leads to the development of vibrant neoliberal land markets in peri-urban areas, which excludes poor households due to the fierce competition from well-to-do persons (Peluso et al., 2013). However, family heads collaborate with the land sector agencies to prepare local planning schemes and layouts for most peri-urban lands. Once the schemes and layouts are prepared, it paves the way for the commencement of land transactions (Abubakari et al., 2020; Putzel et al., 2015). The land markets that emerge attract people to these areas, which serve as the basis for landowners and families to sell land, reflecting the complexities embedded in Ghana's hybrid land administration system (see Akaateba, 2018).

The creation of the land market through formalisation has led to the proliferation of uncontrolled housing developments and widespread splintering of informal developments. The preponderance of uncontrolled housing development in peri-urban areas results from the lack of coordination in land sales between different or within the same families. The forces of demand and supply created by the land market largely determine which plot a landowner will sell. However, a land transaction in the context of customary ownership creates and/or exacerbates existing inequitable land access and thus erodes and displaces existing land ownership arrangements that offer security for all members of land-owning families (Bromley, 2009). The government's policy of compulsory acquisition for the establishment of the tertiary educational



Figure 5. Commercial tricycle driver.

institutions reflects how the state uses formalised processes to exert its influence and control over large parcels of customary lands and triggered peri-urbanisation (see Peluso et al., 2013). The study, therefore, argues that formalisation and the consequent land commoditisation creates a capitalist urbanisation process that produces landlessness and jeopardises land-based livelihoods.

Clearly, the peri-urbanisation processes have political, social, and economic entanglements. Despite the rapid land conversion, the proportion of peri-urbanites found to be engaged in farming was higher than previously reported by Korah et al. (2018) in their study on food crop farming in peri-urban Wa. Although studies reported that urban expansion led to the decline in the importance of agriculture in peri-urban areas in Ghana (Appiah et al., 2014; Cobbinah et al., 2015; Oduro et al., 2015), this study shows that agriculture intensification has become prevalent among farmer households, thereby entrenching agriculture as a critical aspect of peri-urban livelihood. Non-farm activities commonly engaged in by peri-urban residents such as Auto Rickshaw operation,

petty trading, and personal services provision and construction-related activities have further provided opportunities for diversified livelihoods (see Table 5), which is consistent with the argument that secondary cities more easily provide opportunities for people to obtain employment than larger cities (Christiaensen et al., 2016). The peri-urban development and the associated opportunities therefore provide the context for households to utilise their livelihood resources to find space in the emerging monetised local economy to make a living (see Figure 1). Thus, they had to resort to the informal sector (commercial transportation, personal services, and retail trading) as income generation activities to secure their livelihoods and complement farm income (Chambers and Conway, 1992; Ellis and Freeman, 2004). This was made possible by the myriad of opportunities (see Figures 5 and 6) that have emerged in these areas (Cobbinah et al., 2015; Le and Dung, 2018). The prevalence of commercial means of transportation has not only eased the movement of people, but it has also created employment opportunities for the peri-urban households to make up for the loss in farmlands.



Figure 6. Retail shop in Bamahu community.

6. Conclusions and implications for urban theory, policy, and planning

The findings of the study show that there has been an expansion of the city over the period through the increase in the built-up area, reduction in closed savannah woodland and an increase in open savannah woodland. These developments have ramifications not only for food production but also for the natural habitat for grazing mammals and a variety of plants and vegetation that support human sustenance. It is critical to point out that the consequent consumption of peripheral lands was largely driven by formalisation and customary land commoditisation, government's compulsory land acquisitions policy as well as the provision of critical social and economic infrastructure influenced by observed urban expansion in the area. These developments led to the loss of croplands, which affected food production among farmer households at the peripheries. Notwithstanding the spatial transformation of the peri-urban landscape through land conversion, food crop farming remained an integral livelihood activity of households. This suggests that the farmer households may not suffer from food insecurity as a result of the rapid land conversion experienced in the area. It is worthy to note, however, that farmer households have also taken on non-farm livelihood activities, especially in the informal sector, to generate income in the new urban economy. Urbanisation at the peripheries has also created new livelihood opportunities in the formal and informal employment sectors even though the latter dominates. This enabled farm households to earn income from the informal non-farm activities to complement farm income as they seek to improve their living conditions.

These developments have implications for achieving sustainable transition in secondary cities. Firstly, city authorities in Ghana and sub-Saharan Africa need to recognise that customary land formalisation processes, combined with multilevel actors and political processes, shape urbanisation at the peri-urban areas. Secondly, unique to secondary cities in sub-Saharan Africa is the role of traditional authorities in facilitating land formalisation through negotiations with statutory agencies to establish planning schemes and zoning to make it easy for land sales. Thirdly, governments' efforts should aim at preserving livelihoods by providing equal access to physical and social infrastructure and essential services that engender new livelihood opportunities. Fourthly, the complexity of the land tenure regimes and the fact that secondary cities in sub-Saharan Africa are not sufficiently exposed to the forces of globalisation compared with larger metropolis, must be projected in urban theory to understand the unique problem spaces of such cities. Finally, urban planners need to leverage on the opportunities of SDGs to promote sustainable and inclusive urban development. Given this, better understanding of the complexities of urban processes of secondary cities in sub-Saharan Africa is imperative for sustainable and inclusive urban development.

The novelty of the study is premised on three important issues. Firstly, the study contributes to the on-going discussion about sustainable urbanisation by highlighting the trends of urban expansion and reduction in farmland availability using remote sensing technology. The result of the study could guide urban planning and management of urbanisation at the peripheries. Secondly, previous studies sought to downplay the role of commercial transportation as a livelihood diversification activity. This study highlights that the importation of tricycles from China and India has created a complementary livelihood activity to compensate for the loss of land. Finally, land formalisation as a driver of urban expansion has not been highlighted in previous studies. This study draws the attention of the academic community to the fact that the formalisation of customary land has created urban land markets that also drive land conversion in the peripheries. However, we acknowledge that the study failed to discuss how urbanisation at the peripheries affected the food security of farmer households. Therefore, future studies should concentrate on ascertaining how urbanisation at the peripheries facilitate or inhibit food security of farmer households.

Declarations

Author contribution statement

Ibrahim Abu Abdulai: Conceived and designed the experiments; Wrote the paper.

Abubakari Ahmed, & Elias Danyi Kuusaana: Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data.

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Data availability statement

Data will be made available on request.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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