



Urban encroachment in ecologically sensitive areas: drivers, impediments and consequences

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ABSTRACT

The drivers and consequences of unregulated urban expansion processes in Accra, Ghana, are examined together with the associated encroachment upon ecologically sensitive areas in the city's rapidly growing periphery. Three sites are considered which attracted settlers from vastly different economic segments of the urban population from the 2000s and onwards. A combination of geographical information system (GIS)-based analysis, evidence from a recent household survey, insights from a range of key informant interviews and field observations provide evidence for the dynamics of urban expansion and settlement consolidation. These dynamics wield significant pressure on ecologically sensitive areas, e.g. wetlands, riparian zones and coastal lagoons, which are transformed into housing development through drainage, landfilling, channelling of streams and construction of barriers. Encroachment upon ecologically sensitive areas is associated with intensifying flood hazards. Key impediments are identified for the preservation of ecologically sensitive areas within the specific urban governance context of Accra. Encroachment is not necessarily driven by poverty or low income; it occurs for several socio-economic situations. Governance and enforcement in planning need improvement. Such insights must inform efforts to promote more sustainable trajectories of urban expansion, allowing cities to accommodate rapidly growing populations while preserving ecologically sensitive areas and benefiting from crucial ecosystem services.

POLICY RELEVANCE

Critical impediments exist in planning urban expansion. Insights are provided on why ecologically sensitive areas are not sufficiently protected from urban encroachment. These include the intricacies of regulating land transactions in rural and peri-urban areas before incorporation into the built-up area of the city, the ambivalent and overlapping land administration systems, the strong incentives for traditional authorities

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KEYWORDS:

cities; ecologically sensitive areas; governance; informality; land use; spatial planning; urban expansion; Accra; Ghana

TO CITE THIS ARTICLE:

Andreasen, M. H., Agergaard, J., Kofie, R. Y., Møller-Jensen, L., & Oteng-Ababio, M. (2022). Urban encroachment in ecologically sensitive areas: drivers, impediments and consequences. *Buildings and Cities*, 3(1), pp. 920–938. DOI: <https://doi.org/10.5334/bc.210>

to commercialise marginal land, the unfeasibility of policing permanent structures, and the lack of cooperation and coordination among local government entities concerning the management of urban watersheds. Within the urban governance context of Accra, encroachment upon ecologically sensitive areas constitutes a ‘wicked’ planning problem that defies rational, technical solutions and which is fraught with multi-causality, multiple perspectives and diverging interests. Insights into these complexities must inform efforts to promote more sustainable trajectories of urban expansion.

1. INTRODUCTION

The continuous expansion of urban areas is a striking feature of contemporary transformations of African cities. Over the next 20 years, urban populations in Africa are likely to double (UNDESA 2018). In the same time period, urban densities are expected to decline, while urban land cover will potentially triple (Angel *et al.* 2011). Historically, an estimated three-quarters of global urban population growth in the 1990–2014 period was accommodated through spatial expansion (Angel *et al.* 2021). A third of land converted to urban uses in the 1970–2010 period consisted of natural areas, such as forests, water bodies and wetlands (Güneralp *et al.* 2020). This poses fundamental challenges for biodiversity and wildlife habitat (Seto *et al.* 2012; Güneralp *et al.* 2017) and for the sustainability, resilience and liveability of cities (Elmqvist *et al.* 2015; McDonald 2015).

Cities need well-managed natural areas to meet the needs and demands of growing populations. Natural areas within and around cities provide a wide range of benefits, commonly referred to as ecosystem services. This includes air filtration and purification, water filtration and purification, microclimate regulation, reduction of urban heat island effects, recreational spaces, and access to medicinal plants and food (Schäffler & Swilling 2013; Cilliers *et al.* 2013; Wangai *et al.* 2016; du Toit *et al.* 2018). Natural areas are also crucial for urban water management and flood risk mitigation because they provide natural water retention areas and contribute to ground water infiltration, evapotranspiration and soil water storage (Gupta & Nair 2011; Vachaud *et al.* 2019; Saraswat *et al.* 2016; Douglas 2018; Lwasa *et al.* 2014). Therefore, well-managed natural areas may serve as a crucial form of urban infrastructure, a notion encapsulated in increasingly popular concepts such as ‘green infrastructure’ (Ma *et al.* 2021; Silva & Wheeler 2017; Schäffler & Swilling 2013), ‘blue-green infrastructure’ (Bellezoni *et al.* 2021; Ahmed *et al.* 2019), ‘natural infrastructure’ (McDonald 2015; Bakarr 2019) and ‘ecological infrastructure’ (Elmqvist *et al.* 2015; Li *et al.* 2017).

It is well known that urban expansion processes are associated with widespread encroachment upon ecologically sensitive areas in cities of the Global South. Many studies apply remote sensing methodologies to quantify the scale and magnitude of natural areas lost in the growth path of major cities. Some of these have documented the reduction of wetlands (Ahmed *et al.* 2019; Basu *et al.* 2021; Kiran & Joshi 2013; Goswami *et al.* 2020), deforestation and forest degradation (Remondi *et al.* 2016; Ahrends *et al.* 2010), decrease in vegetation cover (Abass *et al.* 2020; Hou *et al.* 2016; Yao *et al.* 2019) and increasing fragmentation of natural areas (Kowe *et al.* 2021; Girma *et al.* 2019; Wang & Pei 2020). However, these studies offer limited insights into the drivers and dynamics of urban development in ecologically sensitive areas, why such sites are not sufficiently protected from encroachment and how more sustainable trajectories of expansion may be achieved. Relatively few studies examine encroachment upon ecologically sensitive areas from an urban governance perspective (notable exceptions include Schäffler & Swilling 2013; Afionis *et al.* 2020; and Guenat *et al.* 2019). There is a need for research concerned with the environmental consequences of urban expansion to engage with broader urban governance issues concerning land administration, development control and spatial planning.

Accra is Ghana’s capital city and dominant urban centre with an estimated population of 4.7 million people (GSS 2020). The city has experienced significant spatial growth in the past decades. The expansion in fringe areas is largely unplanned and unregulated (Møller-Jensen *et al.* 2020; Agyemang *et al.* 2017; Akubia & Bruns 2019).

This paper examines the drivers and consequences of unregulated urban expansion processes and the associated encroachment upon ecologically sensitive areas on the periphery of Accra. The context of Accra offers a prime example of a rapidly growing African city with widespread urban sprawl, unsustainable spatial practices and longstanding challenges with recurrent flooding. The analysis unfolds the dynamics of expansion and consolidation and the persistent encroachment upon ecologically sensitive areas. The key impediments to planning are identified for preservation of ecologically sensitive areas within the urban governance context of Accra. Such insights must inform efforts to promote more sustainable trajectories of urban expansion, allowing cities to accommodate rapidly growing populations while preserving ecologically sensitive areas and benefiting from crucial ecosystem services.

The specific focus is on natural areas, which are considered important by local informants for urban hydrological functions, water management and flood risk mitigation, *i.e.* water bodies of a certain size, including rivers, streams, wetlands and coastal lagoons, which are important for water management on-site and in downstream areas.

2. METHODS

A combination of methods are used in this study: geographical information system (GIS)-based analysis, evidence from a large-scale household survey, and insights from key informant interviews and field observations. Three sites in Accra's periphery are studied for the encroachment upon ecologically sensitive areas. They are known colloquially as New Legon, Ampax/River Estate and Glefe. These sites have attracted settlers from vastly different economic segments of the urban population from the 2000s onwards. The location of the sites is shown in Figures 1 and 2. The three sites were selected from a collection of 10 neighbourhoods clustered around four locations in Accra, which are investigated as part of a collaborative research project titled Climate Change Resilience in Urban Mobility (CLIMACCESS). Two of the selected sites are newly developing settlements, which were gradually incorporated into the built-up area of Accra from the 2000s onwards (New Legon and Ampax/River Estate). The third is a more consolidated settlement relatively closer to the centre, which was incorporated into the built-up area of Accra in the 1990s (Glefe). The selected areas differ in relation to the extent of ongoing consolidation processes, the socio-economic profile of housebuilders, and the type and quality of housing they develop for themselves and for rental purposes.

The historical expansion of Accra is visualised through maps illustrating the expansion of the built-up area for the reference years 1991, 2000 and 2014 (see Møller-Jensen *et al.* 2020 for a thorough discussion of the methodology). The encroachment upon ecologically sensitive areas within the selected sites is examined through visual inspection and comparison of historical satellite imagery from Google Earth. Insights on the drivers of encroachment are based on extensive qualitative data collection carried out during two rounds of fieldwork in January and November–December 2019. In all three sites, key informant interviews were conducted with a wide range of local informants (New Legon $n = 12$, Ampax/River Estate $n = 24$ and Glefe $n = 21$). Key informants include officers from the National Disaster Management Organization (NADMO) ($n = 7$), municipal planning officers ($n = 2$), elected members of the municipal assemblies ($n = 3$) and representatives from traditional authorities ($n = 7$), local branches of transport worker unions ($n = 12$) and local residents' associations ($n = 26$). A total of 57 key informants participated in formal interviews across the three sites. Informants do not appear under their own names and recognisable details are altered to ensure anonymity. All interviews were recorded and transcribed and, when necessary, translated from local languages into English. The interview material was analysed in QSR NVivo through an open coding process with the purpose of systematically analysing data for themes and concepts. Data collection also included extensive field observations, collected independently and accompanied by local informants, to document the characteristics of the physical environment. Field observations were systematically recorded with Global Positioning System (GPS) track logs, photographs and field notes.

Data are also presented from a household survey conducted in July–August 2021 in 10 selected neighbourhoods in Accra ($n = 1053$), including the three sites under scrutiny here (New Legon,

$n = 101$, Ampax/River Estate, $n = 101$, and Glefe, $n = 112$). The survey collected information concerning housing characteristics, socio-economic status, livelihood activities, mobility patterns and experiences with flooding. The online supplementary data file contains the survey questions and detailed responses. The survey questionnaire was set up and administered on the SurveyXact online platform. The survey was administered through in-person interviews by a team of trained enumerators led by researchers from the University of Ghana. The survey specifically targeted economically active adult household members over the age of 18 years. Most respondents (78%) were either the head of the household or his/her spouse. Among the remaining, 10% were children of the household head, 7% were otherwise related and 4% were non-relatives. The average household size was 4.4 members, consisting of an average of 2.7 adults and 1.7 children. The sample was gender-balanced with 48% male and 52% female respondents. Respondents' age ranged from 18 to 79 years, with a mean age of 40 years. The majority (72%) were between 30 and 60 years, while 21% were younger than 30, and 7% were above 60 years.

The survey was designed to be generalisable at the neighbourhood level and deployed a spatial approach to simple random sampling. For each neighbourhood, 300 random GPS points were generated in ArcGIS software and consecutively numbered. The team of enumerators successively located each GPS point in field, identified the nearest building and invited the occupants to participate in the survey. The enumerator team worked their way through the list of random GPS points until the target of at least 100 valid responses had been reached for each neighbourhood. If two or more buildings appeared equally close to a GPS point, a second round of randomisation was conducted by the enumerator in the field. If the nearest building was occupied by multiple households, each household was surveyed separately. If no occupants were home on the first visit, enumerators would visit the building a second time a few days later. Data collection was carefully organised to ensure that the team of enumerators collected interviews in all neighbourhoods on both normal weekdays and weekends to maximise the response rate. If more than one present household member fitted the survey's inclusion criteria, only one participated in the survey, with the present household members deciding among themselves who would participate. Overall, 71% of GPS points yielded valid responses; a total of 1478 GPS points were visited by enumerators to elicit valid response from 1053 respondents. About 8% of the GPS points pointed to buildings, where none of the occupants fitted the inclusion criteria. A total of 9% pointed to buildings, where occupants were not willing to participate or not at home on either first or second visits. The remaining 12% of GPS points either pointed to partially completed and unoccupied structures or to non-residential buildings such as schools or shops.

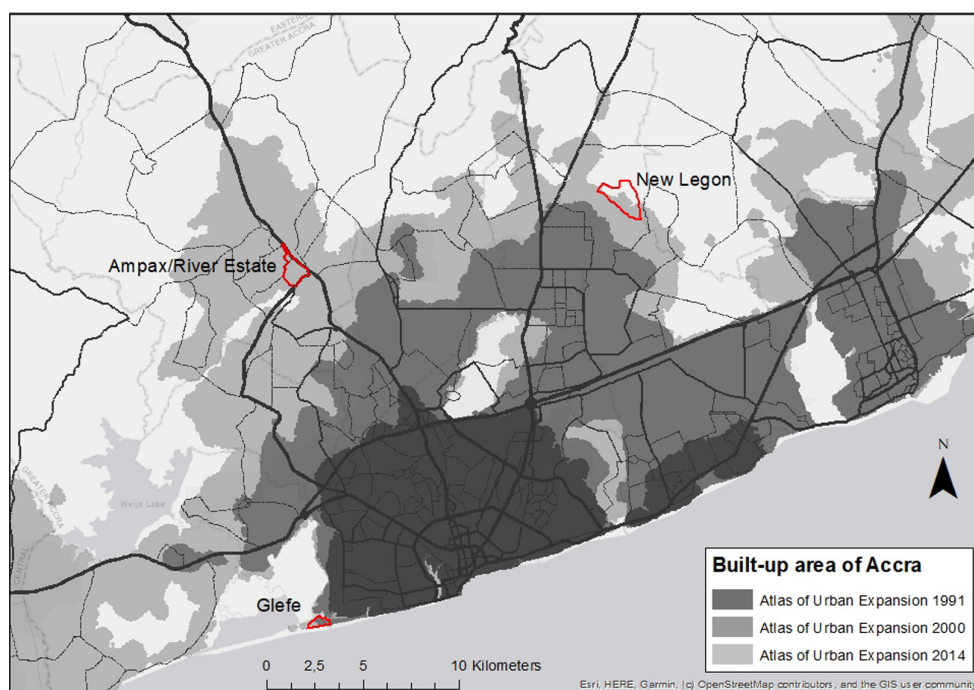


Figure 1: Historical expansion of Accra's built-up area.

Sources: Atlas of Urban Expansion (<http://atlasofurbanexpansion.org/>), vectorised end-products for 1991, 2000 and 2014. Road network from OpenStreetMap.

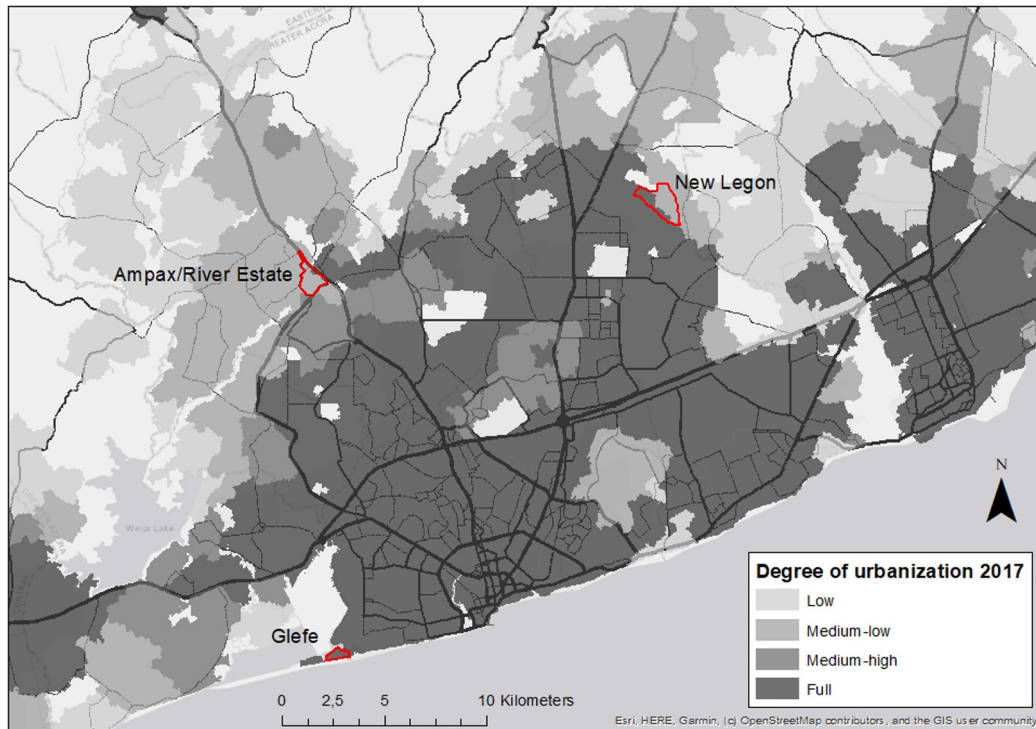


Figure 2: The degree of urbanisation in 2017 reveals the extent of completed or partially completed housing developments and road infrastructure.

Sources: Møller-Jensen *et al.* (2020). Road network from OpenStreetMap.

3. URBAN EXPANSION AND SETTLEMENT DEVELOPMENT

Accra has experienced significant spatial growth over the past decades, with different sources suggesting urban expansion rates of around 5–6% per year (Møller-Jensen *et al.* 2020; Agyemang *et al.* 2017; Akubia & Bruns 2019). The main driver of Accra’s expansion is the unregulated acquisition and development of land for residential housing, primarily by private individuals and households (Yankson & Bertrand 2011; Gaisie *et al.* 2019). The three sites under investigation here have attracted landowners and settlers from vastly different economic segments of the urban population, which is reflected in the types of houses developed and the characteristics of the physical environments.

New Legon has attracted many landowners and settlers from middle- and high-income segments of the urban population, despite its poorly accessible, interior location isolated from main roads. Emerging residential developments began initially in the southern and western parts closest to the main roads. These areas are characterised by a higher degree of consolidation at present (Figure 2). The pace of development increased after the extension of water pipes and the widening of the Accra–Dodowa Road in the early 2010s. The vast majority of residents have lived in the area for fewer than 10 years (Table 1). Field observations reveal a pleasant green environment dotted with spacious villas and serviced by wide access roads, which have gradually been improved with gravel or other materials over the years. The most common housing type is detached houses (62%). Many houses are large with three or more bedrooms (44.2%), outfitted with security gates and walls (45.5%) and have access to piped water within the dwelling (47.5%). New Legon’s residents are well-educated. A large share of residents have completed either tertiary education (25.7%), technical/vocational training (6.9%) or secondary school (55.5%). The high level of affluence among New Legon residents is also reflected in the high share of car owners, both normal cars, known colloquially as ‘saloon cars’ (31.7%), and four-wheel-drive cars (12.9%). Most residents are homeowners or tenants, though there is also a significant share of property caretakers or people living in rent-free arrangements. Affluent house owners in Accra commonly employ caretakers or let relatives occupy their house for security reasons if they are unable or unwilling to live in it themselves (Gough & Yankson 2011).

Ampax/River Estate has attracted landowners and settlers of more modest means compared with New Legon. The area enjoys a highly accessible location along the Accra–Nsawam highway adjacent to the old village of Pokuase. New residential developments began emerging around the village in the 2000s. Development picked up pace in the 2010s after the Accra–Nsawam highway was widened and improved. The low-lying, swampy terrain in Ampax/River Estate likely explains the relatively low levels

of consolidation in the area compared with adjacent hilly areas on the eastern side of the highway (Figure 2). Stagnant water commonly pools on interior access roads, even in the dry season, due to the swampy nature of the land. As in New Legon, the majority of residents have lived in the area for fewer than 10 years (Table 1). Field observations reveal a pleasant, green environment dotted with single-storey bungalows of varying sizes. Houses are more modest in size, with the majority residing in dwellings with one (35.7%) or two (38.8%) bedrooms. The most common types of housing are separate houses (47.7%) and shared compound houses (39.6%). The educational level is lower than in New Legon. A smaller share of residents have completed tertiary education (17%) and a higher share have received no education (10%). Vehicle ownership rates are also lower in Ampax/River Estate for both saloon cars (17%) and four-wheel-drive cars (7.0%).

Glefe has attracted many landowners and settlers from low-income segments of the urban population. The area offers a wide range of low-cost housing options relatively close to central Accra. There are good bus connections to central areas. Glefe is characterised by a higher level of consolidation compared with the two other sites. The area was partially incorporated into the built-up area of Accra in 2000 (Figure 1). Glefe has a high share of long-term residents (44.4%) who have lived in the area for more than 10 years (Table 1). There is also a busy rental market with a high turnover of tenants, according to local informants. Over half of Glefe's residents (52.7%) are tenants. The educational level is lower in Glefe compared with the two other sites. Only a small share of Glefe's residents have completed tertiary education (8%). Field observations reveal a densely developed environment with low-rise houses, limited free space and narrow footpaths. The predominant housing types consist of shared compound houses (81.3%). Dwellings are small, with the vast majority (70%) having only one bedroom. Sanitary conditions are generally poor, with fewer than a third having access to a toilet or improved pit latrine within their dwelling. Glefe has the lowest share of residents (31.3%) with access to piped water in the dwelling. Vehicle ownership rates are also considerably lower in Glefe, for both saloon cars (7%) and four-wheel-drive cars (0%).

	GLEFE	AMPAX/RIVER ESTATE	NEW LEGON
<i>Highest level of schooling completed by main respondent (p = 0.008)</i>			
Tertiary education	8.0%	17.0%	25.7%
Technical/vocational training	5.4%	1.0%	6.9%
Senior secondary school	17.9%	28.0%	20.8%
Junior secondary school	45.5%	35.0%	34.7%
Primary school	13.4%	9.0%	7.9%
No education received	9.8%	10.0%	4.0%
<i>Type of dwelling (p < 0.001)</i>			
Separate house	14.3%	47.5%	62.0%
Semi-detached house	3.6%	4.0%	10.0%
Apartment	0.9%	5.9%	4.0%
Compound house	81.3%	39.6%	19.0%
Improvised home (tent, container)	0.0%	3.0%	5.0%
<i>Number of bedrooms in the dwelling (p < 0.001)</i>			
1	70.0%	35.7%	28.3%
2	18.2%	38.8%	27.3%
3–4	8.2%	21.4%	31.3%
≥ 5	3.6%	4.1%	13.1%
<i>Tenure form (p < 0.001)</i>			
Owner-occupier	35.5%	52.0%	39.6%
Tenant	52.7%	37.0%	27.7%
Living rent-free	11.8%	5.0%	17.8%
Caretaker of the property	0.0%	6.0%	14.9%

(Contd.)

Table 1: Socio-economic characteristics of local populations.

Note: A chi-square statistic and associated *p*-value were computed for all socio-economic indicators. *p*-values < 0.05 indicate statistically significant differences between the three study sites.

	GLEFE	AMPAX/RIVER ESTATE	NEW LEGON
<i>Dwelling outfitted with the following amenities</i>			
Piped water ($p = 0.038$)	31.3%	34.7%	47.5%
Electricity meter ($p = 0.173$)	99.1%	95.0%	95.0%
Toilet or ventilated improved pit latrines ($p < 0.001$)	27.7%	87.1%	78.2%
Security gate and wall ($p < 0.001$)	11.6%	35.6%	45.5%
<i>Household owns one or more of the following vehicles</i>			
Saloon cars ($p < 0.001$)	7.1%	17.0%	31.7%
Four-wheel-drive cars ($p < 0.001$)	0.0%	7.0%	12.9%
Minibuses or trucks ($p = 0.207$)	0.9%	3.0%	5.0%
Motorcycles ($p = 0.016$)	5.4%	4.0%	13.9%
Bicycles ($p < 0.001$)	7.1%	9.9%	27.7%
<i>Length of residence in the area (years) ($p < 0.001$)</i>			
≤ 5	38.0%	49.0%	49.0%
6–10	17.6%	27.1%	36.7%
11–15	13.0%	10.4%	9.2%
16–20	15.7%	9.4%	5.1%
> 20	15.7%	4.2%	0.0%

4. PIECEMEAL ENCROACHMENT UPON ECOLOGICALLY SENSITIVE AREAS

The piecemeal encroachment upon ecologically sensitive areas is associated with settlement consolidation processes. Over time, more landowners complete construction and move into their newly built homes or allow tenants, caretakers or relatives to occupy the houses. Land prices and rents increase over time, as local populations grow, and networked services are extended into emerging residential areas. These subsequent dynamics of consolidation wield significant pressure on ecologically sensitive areas, which are continuously transformed into land for development through drainage, landfilling, channelling of streams and construction of barriers.

New Legon provides a good example of extensive encroachment on riparian zones. The terrain is criss-crossed by several streams flowing from the Aburi Mountains towards the Gulf of Guinea. A comparison of satellite images (Figure 3) reveals vegetated zones along the streams in 2008. By 2021, all the vegetated zones are significantly narrower and have in some cases almost disappeared. Field observations reveal that many landowners along the streams have erected barriers, such as walls or earthwork, to protect their land from swelling streams in the rainy season. As New Legon developed and consolidated, the riparian zones became more attractive for settlement, as explained by the area's assembly member:

The original landowners actually considered that no buildings should be too close to the streams, but after selling all the legitimate land, as human as we are, you will have people approaching you [...] oh, I want this portion of land, some kind of land to build something small. So, they started selling all those reserved lands that were supposed to be the buffers for the streams.

New Legon previously had many ponds originally created in the 1960s for irrigation purposes. Some of these ponds have been drained to make space for houses. Figure 3 illustrates the disappearance of one of these ponds between 2008 and 2013. Local informants explain that the pond was drained and its outlet altered after a loud blast sounded late one night. It is subject to local disagreement whether this was a natural process, caused by pressure from large water volumes, or deliberately arranged by landowners eager to prepare the land for development.

Ampax/River Estate illustrates encroachment on wetlands through extensive landfilling practices. The terrain is swampy and marshy because it is a low-lying area where two tributaries of the

Densu River converge before flowing towards the Weija Reservoir. Much of the area was effectively a wetland in 2000 (Figure 4). In 2013, housing developments had begun spreading into the wetlands, and in 2021 the wetlands had virtually disappeared. This was made possible through extensive landfilling undertaken by prospective house builders, as explained by a local homeowner:

Some of the elders committed certain mistakes by giving out the lands to individuals like myself. The second mistake is committed by us individuals buying the land, because this area used to be a wetland. People bought the plots and started filling them up so they could build. If you buy land here you have to fill it, or else the rivers will disturb you.

Glefe offers an example of encroachment on coastal lagoons through land reclamation practices. It is situated on a narrow sandbar forming a barrier between the Gulf of Guinea and shallow coastal lagoons forming part of the Densu Delta wetlands. In 1998, the Densu Delta wetland was declared a protected area as a Ramsar site under the International Convention for the Protection of Water Birds (Frick-Trzebitzky *et al.* 2017). The lagoons have shrunk considerably in size due to widespread land-reclamation practices (Figure 5). By 2021, it is clear that the built-up area of Glefe had extended northwards into the lagoon, while the neighbouring area of Mpoase had extended southwards. Land reclamation is made possible through landfilling with waste and materials extracted from the beachfront, as explained by a representative from one of the traditional authorities laying claims to Glefe:

This lagoon used to be known as Bu Gbe. As the population increased, many people started dumping sand and refuse into the lagoon, so they could claim a portion of it and erect some houses. People here throw their garbage around, because they cannot afford the amounts charged for waste disposal. That same garbage is used to reclaim the land from the lagoons.

The persistent encroachment upon ecologically sensitive areas is perceived as a primary cause of intensifying flood hazards. Across sites, flooding has become a recurrent hazard in the rainy season, where heavy precipitation events are frequent, the soil is often saturated from past rainfall and many streams carry significant water volumes. Within the past five years, about half of households in all three sites have experienced full or partial inundation of their dwelling (cf. Table 2). Among those affected, inundation of the dwelling lasted for an average of 6.8 days. Heavy precipitation events also cause inundation of low-lying road segments and transform unpaved dirt roads to slough, causing widespread disruptions to residents' daily mobility patterns (Andreasen *et al.* 2022). A high share of residents have been unable to travel in or out of their area within the past year due to heavy precipitation and water on the roads. Many also report that local roads became unpassable or suffer severe erosion due to heavy precipitation. Across sites, almost all informants highlight 'buildings in waterways' as a major cause of flooding. A representative from traditional authorities in Ampax/River Estate attributes flood hazards to housing developments along the rivers:

In the old days, we had no problems with flooding at all, but because of the housing developments, which have blocked the channel of the Nsaki River, for the past years, we have seen some serious flooding.

Similarly, a representative of a local residents' association in New Legon attributes flood problems to housing developments along streams:

When I first came here 15 years ago, flooding was an issue, but we were able to manage. Now it has gotten worse, because there are some new developments along that side of the stream that is causing some problems now.

In Glefe, local informants attribute flood hazards to land reclamation from the lagoons, though many feel that flood hazards have abated in recent years due to regular excavation and dredging as well as the recent construction of a seawall on the beachfront.

	GLEFE	AMPAX/RIVER ESTATE	NEW LEGON
Inundation of my dwelling for one or more days within the past five years ($p = 0.256$)	56.9%	47.8%	46.0%
Inability to travel in or out of my area for one or more days within the past year due to heavy precipitation and water on the roads ($p = 0.036$)	52.7%	41.8%	60.0%
Roads around my home or leading in or out of my area becoming impassable due to heavy precipitation and water on the roads ($p = 0.006$)	45.5%	49.5%	66.3%
Neighbourhood roads suffered severe erosion due to heavy precipitation ($p < 0.001$)	34.8%	40.6%	65.3%

Table 2: Share of respondents having experienced various flood hazards.

Note: A chi-square statistic and associated p -value were computed for all flood impact indicators. p -values < 0.05 indicate statistically significant differences between the three study sites.



Figure 3: New Legon: Satellite images from 2008 (a), 2013 (b) and 2021 (c) illustrate the encroachment on riparian zones and the drainage of a pond.

Note: Blue lines delineate streams; red lines delineate the neighbourhood of New Legon. Source: Google Earth.



Figure 4: Ampax/River Estate: Satellite images from 2000 (**a**), 2013 (**b**) and 2021 (**c**) illustrate the encroachment on low-lying wetlands along the Nsaki and Nsunkwa rivers.

Note: Blue lines delineate rivers; red lines delineate the neighbourhood of Ampax/River Estate.

Source: Google Earth.

5. IMPEDIMENTS TO PLANNING FOR PRESERVATION OF ECOLOGICALLY SENSITIVE AREAS

What are the key impediments to planning/protecting ecologically sensitive areas from urban encroachment? Within the urban governance context of Accra, encroachment upon ecologically sensitive areas constitutes a ‘wicked’ planning problem (Rittel & Webber 1973), which defies rational, technical solutions and is fraught with multi-causality, multiple perspectives and diverging interests.

First, land subdivisions in rural and peri-urban areas commence long before such areas are incorporated into the city’s built-up area and attract more attention from urban planners. As in most West African countries, land administration in Ghana is characterised by legal pluralism and



Figure 5: Glefe: Satellite images from 2002 **(a)**, 2010 **(b)** and 2021 **(c)** illustrate the densification of housing development and gradual reclamation of land from the lagoons.

Note: Red lines delineate the neighbourhood of Glefe and provide a fixed line for comparison of land reclamation processes.

Source: Google Earth.

coexisting customary and statutory tenure systems. Despite the changing influence of traditional authorities in Ghana, over 80% of the land is still legally and administratively under the control of chiefs and family heads, who hold the land in trust on behalf of their people (Campion & Acheampong 2014). In practice, most land on the periphery of Ghanaian cities and beyond is 'stool land', which is under customary ownership and controlled by traditional authorities (Gough & Yankson 2000; Bartels *et al.* 2018; Denchie *et al.* 2020). Traditional authorities have the authority to sell or allocate land to interested buyers. During the early years of land subdivision, buyers commonly acquire land directly from traditional authorities, though subsequent transactions between private landowners are also common. Some prospective buyers are interested in a plot for housebuilding, while others may have speculative gains in mind. Informal transactions with customary land on the outskirts of cities is a principal channel for urban land delivery in many

African cities (Durand-Lasserve *et al.* 2015; Rakodi 2006). Land subdivision processes result in increasing fragmentation of landownership claims and ‘de facto privatisation’ (Bartels *et al.* 2018) of land formerly owned communally by customary landholders.

These processes of ‘invisible sprawl’ (Bon 2021) entail hectic activity on the land market, while emerging residential developments may appear scattered and far apart for many years. The delay in construction activity is related to the practices of incremental construction, as most housebuilding projects are financed primarily through personal savings. Many housebuilders delay construction until they have gathered the capital required for construction. Some choose to wait until an area has become more populated and better serviced, as is explained by a representative of a residents’ association near Ampax/River Estate:

I have been here for the past few years, and it is only now that we are seeing more development around Pokuase. Some years ago, this place was not that big; people had their plots all right, but they were not coming to develop, because it was quite a village.

The piecemeal and incremental development of residential housing by private individuals and households has been coined ‘peripheral urbanisation’ (Caldeira 2017). This is a pervasive mode of urban development, not only in Accra but also across cities in Africa and elsewhere in the Global South (Sawyer 2014; Andreasen *et al.* 2017; Mbatha & Mchunu 2016; Bartels 2019; Andreasen & Agergaard 2022).

Second, land subdivision processes and emerging residential developments in soon-to-be urban areas unfold under customary land tenure systems meant for the administration of rural land. In Accra and other Ghanaian cities, land-use management and spatial planning is the jurisdiction of metropolitan, municipal and district assemblies (Owusu 2015; Cobbinah *et al.* 2020). In practice, land subdivision processes are often allowed to proceed largely unregulated and unguided by spatial plans, as explained by a municipal assembly member in New Legon:

The problems started long ago before the assembly [Adenta Municipal Assembly] came into existence. The municipality was created only in 2008. New Legon was developing already, but back then we were under Tema, and they could not supervise things that were going on back then.

Consequently, most aspiring housebuilders develop their land without having title deeds or building permits in place. This governance void during the early years of subdivision makes it extremely difficult for the planning authorities to step in at a later stage and reserve space for purposes of societal relevance. The unregulated nature of urban expansion processes resonates with similar experiences in other African cities (Andreasen *et al.* 2020; Three City Land Nexus Research Team 2020). In Accra’s periphery, landowners are usually able to evoke legitimacy through long-held agreements with various traditional authorities. Typically, regulation of land use in consolidating areas is complicated by the many competing claims and land disputes common within the customary system. For example, in New Legon, a large land tract, which is considered part of the riparian zone by the municipal planning authorities, has long been a subject of contestation between a real estate developer and several individual landowners. Similarly, in Glefe, the problematic practice of reclaiming land from the lagoon was fuelled by a bitter chieftaincy dispute, where rivaling groups sought to secure profits from land transactions. This is explained by an assembly member:

When the chiefs started selling part of the lagoon, this problem arose because there was a chieftaincy dispute involving three chiefs. All of them were claiming that they were chiefs. We had a Ga chief, an Ewe Chief, and an Ada chief, so they were each doing things their way.

While land-tenure disputes are not the preserve of land markets in Ghanaian cities (Agegnehu *et al.* 2021), Ghanaian land markets are characterised by a high level of contestation and ‘landguardism’, which involves the use of violence and threats to protect and guard property rights (Ehwi & Mawuli 2021).

Third, the dynamics of consolidation create strong incentives for traditional landholders, and the emerging landguards, to commercialise land in ecologically sensitive areas, such as wetlands, riparian zones and coastal lagoons. Such land may initially be perceived as marginal land unsuitable for construction and habitation. As the surrounding areas consolidate, this changes the economic calculations associated with marginal land. For traditional authorities, it becomes increasingly profitable to sell marginal land and/or prepare it for development. This is evident in the practice of draining ponds in New Legon and the widespread land reclamation occurring in Glefe. For aspiring housebuilders, it becomes more feasible to make the investments needed in land filling or protective barriers, compared with paying a premium for land in adjacent areas. Some late-arrivers elect to tolerate flood hazards and additional investments in order to acquire affordable land in desired locations. For others, this may not be an active choice but a matter of living with past choices made when the terrain was different. Flood hazards associated with a particular land tract can worsen over time as surrounding areas develop and consolidate, as explained by a house owner in New Legon:

When I first came to this place, the stream was not like this, it was very small. If I had known how much it would cost us, I wouldn't have bought the land. But I've already bought the land, so there is nothing to do about it now. I am here, managing.

Those exposed to regular inundation of their dwellings endure considerable economic costs and emotional distress. The costs of repairing and rebuilding inundated dwellings pose a drain on household savings and may undermine efforts to relocate from hazardous locations.

Fourth, it is widely perceived as unfeasible to demolish permanent structures once they have reached a certain level of consolidation. From the onset, municipal development control is highly ineffective, bordering on non-existent. In Ampax/River Estate a visibly frustrated NADMO official pointed out evidence of new buildings under construction:

The municipal assembly has the mandate to demolish, so we write a report, take pictures and inform the assembly. We advise them to demolish the buildings and stop the work, because these are the developments that are causing flooding, but as you see, no action has been taken yet.

Most informants highlight encroachment on water bodies as the primary cause of intensifying flood hazards. Indeed, most informants, both municipal planners and local residents, regard some extent of demolition 'a necessary evil' to prevent perennial flooding. However, such demolition campaigns are also considered politically controversial and economically unfeasible, as explained by an assembly member in New Legon:

We will have to find a way to get rid of all such buildings along the waterways, but that is something that our government will not have the will power to implement. It is very, very hard to evict people. If you want to do it, and do it well, you will have to find alternative arrangements for them, and this is something the assembly is not able to afford.

Without generous compensation schemes, effective development control would likely have detrimental impacts on small landowners. Many small landowners place a significant share of their household savings in their land and house (Andreasen *et al.* 2022). It is also hard to imagine that such policies would be implemented without some measure of selective enforcement and corrupt practices. Municipal measures to reduce flood vulnerability are often selective and tend to prioritise territories developed and inhabited by resourceful groups (Møller-Jensen *et al.* 2022). Research in other cities also documents selective enforcement of development control and demolition campaigns, which are disproportionately skewed toward settlements accommodating low-income groups, while encroachment from commercial developments and high-income residential areas is blatantly overlooked (Weinstein *et al.* 2019; Alvarez & Cardenas 2019; Batubara *et al.* 2018; Padawangi & Douglass 2015).

Fifth, the identification, designation and preservation of ecologically sensitive areas is severely challenged by the general lack of cooperation among local government entities, which are

responsible for managing urban watersheds and ecologically sensitive areas. Within the context of Ghana's decentralisation programme, Accra has seen an ever-growing number of smaller local government entities (Owusu 2015). A total of 29 local government entities within the Greater Accra Region are listed in the 2020 census projection (GSS 2020). Effective collaboration between local government entities is often mediated by political interests and turnover of administrations in relation to election cycles, as is also reported for Nigeria (Essien 2022). Further, these assemblies may also be operationally too small to foster a comprehensive perspective on ecologically sensitive areas. The implications of urban encroachment for flood risk mitigation commonly transcend assembly boundaries. For example, central Accra has experienced an increasing intensity of flood hazards in recent years (Asumadu-Sarkodie *et al.* 2015; Accra Metropolitan Assembly 2019). The loss of water retention areas in upstream, peripheral areas such as New Legon and Ampax/River Estate is likely a contributing factor. The rescaling and fragmentation of urban governance have exacerbated challenges with regard to citywide planning and coordination (Owusu 2015, Gaisie *et al.* 2019). The relations between various assemblies are notoriously fraught with boundary disputes and a lack of cooperation (Owusu 2015). The incessant redistricting may cause a lack of clarity with regard to which jurisdiction a particular territory falls under, further contributing to the governance void in areas under conversion to urban uses.

6. CONCLUSIONS

Unregulated urban expansion processes and associated encroachment upon ecologically sensitive areas occurs in Accra's periphery. The research documents significant pressure on ecologically sensitive areas, which are continuously transformed into land for development through drainage, landfilling, channelling of streams and construction of barriers. Encroachment upon ecologically sensitive areas occurs in a wide range of neighbourhoods, which have attracted settlers from vastly different socio-economic segments of the urban population. As such, nothing suggests that encroachment is associated with poverty and marginalisation or spatially concentrated in low-income areas. Instead, encroachment appears to be an ingrained and normalised practice associated with urban expansion and settlement consolidation, as rising land values change the economic calculations associated with marginal land. Encroachment upon ecologically sensitive areas is associated with intensifying flood hazards, which affect houses close to water bodies, low-lying access roads and downstream housing developments. Urban expansion in Accra offers an illustrative example of 'peripheral urbanisation' processes where residents themselves take the lead in developing their houses as well as their wider neighbourhoods. This research illuminates how persistent encroachment on ecologically sensitive areas is part of this mode of urban development, a finding which is unlikely to be unique to Accra. As such, insights from the research will likely also have relevance for other cities in the Global South, managing rapid urban growth and unregulated urban expansion processes in a context of dual-tenure systems and inefficient land administration.

Insights on why ecologically sensitive areas are not sufficiently preserved and protected from urban encroachment offer crucial lessons for policy and planning on how more sustainable trajectories of urban expansion may be achieved. It is evident that effective policies to curb encroachment on ecologically sensitive areas will need to engage with the intricacies of regulating land transactions in rural and peri-urban areas long before such areas are incorporated into the city's built-up area and usually command more attention from urban planners. Efforts to regulate land subdivision in rural and peri-urban areas will need to address the complications arising from ambivalent and overlapping land administration systems. To prevent the fervent commercialisation of marginal land, it is necessary to curb or moderate the profits associated with land transactions and consider alternative ways for traditional landholders to generate land revenue during settlement consolidation. It is also evident that more proactive development control is needed from local government authorities in order to prevent emerging residential developments in ecologically sensitive areas before they reach consolidation and become almost impossible to regulate. Further, the identification and designation of ecologically sensitive areas, which are important for urban water management, should be in place long before such areas are at risk of being included into the built-up area of the city.

Finally, it is important to acknowledge that preservation of ecologically sensitive areas poses complex planning dilemmas. Encroachment practices are associated with significant infill development and densification of formerly sprawling, peripheral settlements. Compact urban development is often heralded for decreasing the ecological footprint of cities, reducing urban energy consumption and limiting loss of natural areas (Ahlfeldt *et al.* 2018). In the context of Accra's rapid population growth, it is likely that effective development control in ecologically sensitive areas would induce more people to accommodate themselves in newly developing areas, thereby contributing to urban expansion processes. Preservation of ecologically sensitive areas within and around the city should be balanced with other legitimate policy concerns and the need to accommodate growing populations. In some cases, the social and economic benefits associated with density and accessibility may outweigh the loss of ecologically sensitive areas. It is crucial to weigh such trade-offs and promote other modes of densifying peripheral settlements, while preserving and protecting ecologically sensitive areas.

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COMPETING INTERESTS

The authors have no competing interests to declare.

DATA AVAILABILITY

The survey questions and responses are provided in the supplemental data online.

ETHICAL CONSENT

All data collection activities for this project were approved by the Ethics Committee for the Humanities, University of Ghana (approval code ECH 182/17-18, approved 29 June 2018).

FUNDING

This research was funded by a grant awarded by the Ministry of Foreign Affairs of Denmark.

SUPPLEMENTAL DATA

Supplemental data for this article can be accessed at: <https://doi.org/10.5334/bc.210.s1>

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TO CITE THIS ARTICLE:

Andreasen, M. H., Agergaard, J., Kofie, R. Y., Møller-Jensen, L., & Oteng-Ababio, M. (2022). Urban encroachment in ecologically sensitive areas: drivers, impediments and consequences. *Buildings and Cities*, 3(1), pp. 920–938. DOI: <https://doi.org/10.5334/bc.210>

Submitted: 25 February 2022

Accepted: 31 October 2022

Published: 16 November 2022

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