



Original Research

Farming under Urban Pressure: Stressors, Adaptive Strategies and Municipal Support for Urban Agriculture in Wa Municipality, Ghana

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Abstract

Urban Agriculture supports food production and livelihoods in expanding African cities, yet farmers often operate under environmental pressures, insecure access to resources, and limited institutional support. This study examined the stressors confronting urban farmers in Wa Municipality, Ghana, their adaptive strategies, and the policies, programs, and support provided by municipal institutions. A qualitative design was employed, involving semi-structured interviews with 20 urban farmers and five municipal officials. Data were analyzed using reflexive thematic analysis, with ATLAS.ti used to support data organization, coding, retrieval, and analytical memoing. Farmers reported interconnected stressors, including seasonal water scarcity, flooding, pests and diseases, declining soil fertility, insecure land tenure, inadequate finance, high input costs, and limited extension contact. They responded through crop diversification, manure application, crop rotation, residue retention, irrigation adjustments, fencing, livelihood diversification, and collective assistance. However, the effectiveness and sustainability of these strategies were shaped by unequal access to secure land, reliable water, finance, information, infrastructure, and municipal support. The findings also revealed a gap between nominal provision and effective access: municipal officials described several agricultural interventions, while many farmers reported limited awareness, participation, or benefit. Strengthening adaptive capacity requires secure land-access arrangements, improved water infrastructure, consistent extension services, transparent program delivery, and the integration of urban agriculture into municipal development and land-use planning.

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Statement of Sustainability: This study contributes new evidence on how urban farmers in a rapidly growing secondary African city navigate interconnected land, water, financial, climatic, and institutional stressors, while also examining the municipal structures intended to support them. By linking farmers' adaptive strategies with local governance responses, the study extends understanding of urban agriculture beyond food production alone. Its findings contribute particularly to SDG 2 (Zero Hunger), SDG 11 (Sustainable Cities and Communities), and SDG 13 (Climate Action) by identifying locally grounded pathways for strengthening resilient and inclusive urban food systems.

1. Introduction

Urban growth is reshaping land use, livelihoods and food systems, particularly in rapidly expanding cities where competing demands for land and infrastructure are increasing (W. Smit, 2016; UN DESA, 2019). In 2018, approximately 55% of the global population lived in urban areas, and this proportion was projected to reach 68% by 2050 (United Nations, 2018). Much of the expected increase will occur in Africa and Asia, where rapidly expanding cities already face considerable pressure on land, housing, infrastructure, employment and essential services (UN DESA, 2019). Ghana reflects this broader transition. The proportion of the country's population living in urban settlements increased from 50.9% in 2010 to 56.7% in 2021 (GSS, 2021). As cities expand, agricultural land is increasingly converted to residential, commercial and infrastructural uses, raising concerns about urban food access, livelihood security and the future of farming within and around cities (Abdulai et al., 2025; Ziem Bonye et al., 2021, 2021).

Urban Agriculture (UA) remains one of the ways through which some households supplement food supplies, diversify livelihoods and respond to economic pressures in rapidly growing cities (Orsini et al., 2013; Zezza & Tasciotti, 2010). It encompasses crop



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cultivation, livestock production and related activities undertaken within urban areas and their surrounding peri-urban zones, using resources and markets that are closely connected to the urban system (Mougeot, 2000). In many developing countries, UA supplements household food supplies, generates income, reduces some food expenditures and provides livelihood opportunities for people with limited access to formal employment (Orsini et al., 2013; Zezza & Tasciotti, 2010). It may also support urban greening, organic-waste recycling and the retention of agricultural knowledge within urban communities (Azunre et al., 2019). These benefits are not automatic, however. Their extent and distribution vary according to the scale and purpose of production, household characteristics, access to productive resources and the institutional setting in which farming occurs (Poulsen et al., 2015; Stewart et al., 2013; Zezza & Tasciotti, 2010). Given this variation, UA is better understood as one component of a wider urban food system rather than as a complete solution to urban food insecurity (Poulsen et al., 2015; Stewart et al., 2013).

The capacity of UA to support livelihoods is constrained by multiple land-related, economic, environmental and institutional stressors (Davies et al., 2021). Across sub-Saharan Africa, urban farmers commonly face insecure land tenure, the conversion of farmland to non-agricultural uses, inadequate access to water, limited finance, rising input costs, weak extension services, pests and diseases, and uncertain recognition within formal urban planning systems (Davies et al., 2021). Climate variability adds another layer of pressure, particularly in semi-arid environments where agricultural production remains highly dependent on rainfall (Derbile et al., 2022). In north-western Ghana, farming households are increasingly exposed to erratic rainfall, prolonged dry periods, rising temperatures, declining soil productivity and other forms of environmental change that affect both crop and livestock production (Derbile et al., 2022). These pressures may interact and reinforce one another because farming outcomes are shaped by interconnected environmental, economic and institutional conditions (Davies et al., 2021; Hodbod & Eakin, 2015). For example, insecure land tenure can constrain long-term production planning, while limited finance reduces farmers' ability to obtain inputs, technologies and other productive resources (Bolang & Osumanu, 2019; Davies et al., 2021).

Urban farmers nevertheless employ different strategies to sustain production under difficult conditions. These may include crop diversification, mixed crop–livestock production, changes in planting practices, livelihood diversification and reliance on household or community networks for labor, information and productive resources (Abdoulaye et al., 2017; Naazie et al., 2024; Salifu, 2022). The effectiveness of these responses depends on farmers' adaptive capacity, including their access to productive assets, knowledge, finance, social relationships and supportive institutions (Hodbod & Eakin, 2015; Natarajan et al., 2022). Adaptation is therefore not simply a matter of individual choice; it is shaped by unequal access to resources and by the institutional conditions that enable or restrict farmers' options (Hodbod & Eakin, 2015; Natarajan et al., 2022). Municipal authorities are particularly important because their decisions concerning land-use planning, development control, agricultural extension, irrigation, environmental management and market infrastructure can either support urban farming or make it increasingly difficult to sustain (W. Smit, 2016; Vidal Merino et al., 2021). Evidence from Ghana suggests that UA is often governed through overlapping relationships involving municipal institutions, agricultural departments, traditional landowners, farmers and non-governmental organizations. Weak co-ordination, limited policy recognition and competition over land frequently leave farmers operating under uncertain conditions (Ahmed et al., 2020; de Oliveira & Ahmed, 2021; Nchanji, 2017).

Existing studies in Wa have examined urban expansion, agricultural land conversion, participation in urban farming, food security, livelihood adjustment and responses to climate variability (Bolang and Osumanu, 2019; Bonye et al., 2021; Naazie et al., 2024; Ziem Bonye et al., 2021). Taken together, this literature provides an important foundation, but these dimensions have often been examined separately. Less attention has been given to how environmental, socioeconomic, and institutional stressors are experienced simultaneously by urban farmers, the ways in which they respond to these stressors, and the extent to which municipal interventions enable or constrain their adaptive capacity. There is also limited qualitative comparison between farmers' experiences of support and municipal officials' accounts of the policies and programs available to them.

To examine these relationships, the study draws on adaptive capacity as a conceptual framework. Adaptive capacity concerns the resources and conditions that enable individuals or systems to adjust to changing conditions, reduce potential losses, and take advantage of available opportunities (Nelson et al., 2007; Smit & Wandel, 2006). It is shaped by access to land, water, finance, technology, information, infrastructure, knowledge, social relationships and supportive institutions and is therefore unevenly distributed (Brooks et al., 2005; Engle, 2011; Yohe & Tol, 2002). In this study, adaptive capacity is distinguished from adaptive strategies: the former refers to the conditions that make responses possible, whereas the latter refers to actions farmers undertake in response to experienced or anticipated pressures.

The analysis also distinguishes among short-term coping, incremental adaptation and more transformative forms of change. Coping refers to responses primarily used to manage immediate disruption, while incremental adaptation involves adjustments to existing practices intended to reduce recurring risks (Fedele et al., 2019). Transformative adaptation involves more substantial changes in the structures or development pathways that generate vulnerability (Fedele et al., 2019; Kates et al., 2012). These categories are used as analytical distinctions rather than fixed labels because the study did not follow farmers longitudinally to determine the longer-term outcomes of individual responses.

Against this background, the study examines the major stressors confronting urban farmers in Wa Municipality, the strategies through which they respond, and the extent to which municipal policies, programs and institutional arrangements enable or

constrain their adaptive capacity. By bringing farmers' experiences into conversation with municipal officials' perspectives, the study seeks to clarify how everyday adaptation is shaped by access to productive resources and local governance in a rapidly expanding secondary city.

2. Methodology

2.1. Research Design and Study Setting

The study employed a qualitative case study design. Qualitative inquiry is considered appropriate because the study sought to understand participants' experiences, interpretations, and institutional relationships rather than quantify the prevalence of particular stressors or responses (Creswell & Creswell, 2017). A case study design is also suitable because UA is embedded within a specific social, environmental, and institutional setting and cannot be adequately understood in isolation from that context (Crowe et al., 2011)

The study was conducted in Wa Municipality in the Upper West Region of north-western Ghana (Figure 1). The municipality is located in the southern part of the region, approximately between latitudes 9°55' N and 10°10' N and longitudes 2°35' W and 2°10' W, and covers a land area of approximately 579.86 km² (Iddrisu & Sumani, 2026; Wa Municipal Assembly, 2026). The municipality had a population of 200,672 according to the 2021 Population and Housing Census (GSS, 2021). Agriculture remains an important component of the municipal economy, although production is constrained by reliance on rainfall, inadequate irrigation, limited extension support, and difficulties accessing markets and storage facilities. The municipality is also undergoing continued physical development, creating competing demands for land and other resources used by urban and peri-urban farmers (Wa Municipal Assembly, 2026). These conditions made Wa an appropriate setting for investigating the interaction between urban farming stressors, adaptive responses and municipal governance. Figure 1 show the map of Wa Municipality.

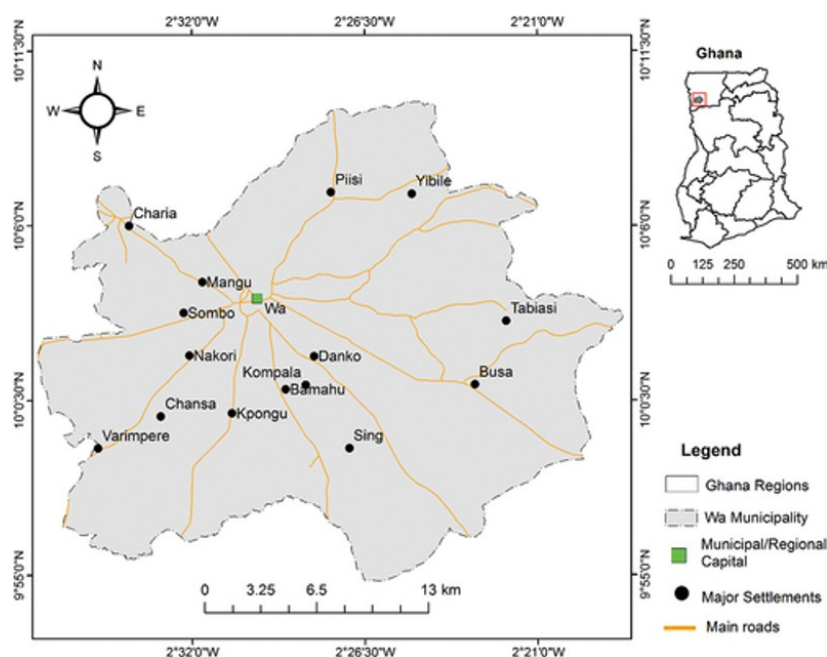


Figure 1. Location of Wa Municipality in the Upper West Region of Ghana (Source: Dongzagla et al., 2023)

2.2. Participant Selection and Recruitment

The study involved 25 participants, comprising 20 urban farmers and five municipal officials. Participants were selected purposively because the research required individuals with direct experience of urban agricultural production or specialized knowledge of the institutions and programs affecting it. Purposive sampling is appropriate in qualitative research when participants are selected for the relevance and depth of the knowledge they can contribute rather than for statistical representativeness (Creswell & Creswell, 2017).

Farmers were eligible to participate if they were at least 18 years old, actively engaged in crop production, livestock keeping or mixed farming within the urban or peri-urban areas of Wa Municipality, and had sufficient experience to discuss the challenges associated with farming in the municipality. The five municipal officials were selected from institutions whose responsibilities



related to agricultural extension, development planning, physical planning, environmental management or the implementation of programs affecting farmers. Their inclusion provided institutional perspectives against which farmers' experiences of municipal policies, services and support could be examined.

Sample adequacy was considered using the principle of information power, which proposes that the number of participants required in qualitative interview research depends on the specificity of the sample, the focus of the research questions, the quality of dialogue, the theoretical basis of the study and the intended analytical strategy (Malterud et al., 2016). The study addressed a focused set of questions, and participants were purposively selected because of their direct experience of urban farming or their institutional responsibilities relating to agriculture and municipal planning. Across the farmer interviews, central patterns concerning land insecurity, water constraints, finance, production risks and farmer responses recurred, while meaningful variation associated with farming activity and scale remained visible. Interviews with the five officials provided complementary accounts from municipal functions relevant to agricultural support and planning. Taken together, the depth, recurrence and diversity of the material were considered adequate for the focused case analysis. This judgment concerns the information value of the dataset rather than statistical representativeness or a claim that all possible perspectives were exhausted.

2.3. Data Collection

Data were collected through semi-structured, in-depth interviews conducted between July 2024 and August 2024. Data collection therefore occurred during the rainy-season production period. However, participants' accounts were not limited to conditions occurring on the dates of the interviews. Farmers described recurring production constraints across seasons and drew on their farming experience to explain how these conditions changed throughout the agricultural year. Semi-structured interviews combine a consistent set of topics with the flexibility to probe individual experiences, clarify responses, and pursue relevant issues that were not anticipated during the preparation of the interview guide (DeJonckheere & Vaughn, 2019; Kallio et al., 2016).

Separate interview guides were developed for farmers and municipal officials. Interviews with farmers explored their farming activities; access to land, water, labor, finance, inputs and markets; environmental, climatic, economic and institutional stressors; the consequences of these stressors; and the strategies used to manage or adjust to them. Farmers were also asked about their access to extension services, government programs, farmer organizations and informal support networks.

Interviews with municipal officials examined the recognition of UA in municipal planning, existing policies and programs, departmental responsibilities, and the financial, logistical and administrative constraints affecting support for farmers. The officials were also asked to reflect on how urban development, land-use change and access to productive resources affected the future of agriculture within the municipality.

Interviews with farmers were conducted in person at locations agreed upon with them, while those with municipal officials were conducted via Zoom. With participants' consent, the interviews were audio-recorded, while field notes were taken to document contextual observations and preliminary analytical reflections. The recordings were transcribed verbatim and checked against the original audio files for accuracy.

Farmer interviews were conducted in English or Waale according to participants' language preferences. Interviews conducted in Waale were transcribed and translated into English by the author, who is fluent in both languages. Translation focused on preserving the contextual meaning of participants' accounts rather than producing mechanically literal word-for-word equivalents. Where expressions or agricultural terms did not have direct English equivalents, their meaning was interpreted in relation to the surrounding discussion and checked against the original audio recording and field notes. No formal back-translation was undertaken.

Researcher positionality was considered throughout data collection and analysis. The author had prior familiarity with Wa Municipality and the agricultural context within which participants operated and was able to communicate with participants in Waale. This familiarity facilitated rapport and supported interpretation of locally specific farming practices and expressions, but it also created the possibility that some experiences could appear familiar or be taken for granted. To reduce this risk, interviews used open-ended questions and follow-up probes rather than assuming shared meanings, while field notes and analytical memos were used to record contextual observations, emerging interpretations and assumptions requiring further consideration.

2.4. Data Analysis

The interviews were analyzed using reflexive thematic analysis following Braun and Clarke's six-phase approach (Braun & Clarke, 2006, 2022; Byrne, 2022). Reflexive thematic analysis was selected because it provides a flexible approach for identifying and interpreting patterns of shared meaning across qualitative data while recognizing the active role of the researcher in the production of themes. Analysis was recursive rather than strictly linear, involving repeated movement between familiarization with the transcripts, coding, development of candidate themes, review of themes, refinement and naming of themes, and interpretation of the findings.

Coding was primarily grounded in participants' accounts, while the adaptive-capacity literature provided sensitizing concepts



that informed analytical attention to issues such as access to resources, knowledge, social relations, flexibility, and institutional support. These concepts were not applied as a predetermined codebook or fixed analytical framework. Instead, the author moved iteratively between the transcripts, coded extracts, developing patterns and the conceptual literature, allowing participants' accounts to extend, qualify or challenge theoretically informed expectations. This approach enabled both anticipated issues, such as access to land and water, and patterns developed through comparison across interviews, such as the difference between the formal availability of municipal interventions and farmers' effective access to them, to be incorporated into theme development.

All transcripts were imported into ATLAS.ti version 25. The software was used to organize the transcripts, apply and retrieve codes, compare coded extracts and maintain analytical memos. ATLAS.ti supported management of the dataset but did not generate the themes; coding, interpretation and theme development remained the responsibility of the author.

2.5. Ethical Considerations

Ethical approval was obtained from the Northern Arizona University IRB Office, approval number 2181953-2, before data collection. Administrative permission was also obtained from relevant municipal departments. Participants were informed of the purpose of the study, the nature of their involvement, the intended use of the information collected, and the measures adopted to protect their confidentiality. Oral informed consent was obtained before each interview. Participation was voluntary. Participants were informed that they could decline to answer any question or withdraw from the study without penalty.

3. Results

3.1. Characteristics of the Participants

The study involved 25 participants, comprising 20 urban farmers and five municipal officials. The farmers varied in sex, age, farming experience, production activity, location and scale of operation. They cultivated vegetables, cereals and other food crops, kept livestock or combined crop and livestock production across backyard, open-space and peri-urban settings. Farm sizes ranged from 0.30 to 28 acres, reflecting considerable heterogeneity between small backyard or open-space producers and farmers operating larger peri-urban holdings. These forms of production were included because they were functionally connected to the Wa urban system, but they were not assumed to constitute a homogeneous production system. Where relevant, the analysis therefore considered how differences in scale shaped farmers' options, particularly their ability to fence plots, expand production or invest in irrigation infrastructure. Participant characteristics are summarized in Table 1.

Table 1. Characteristics of study participants.

Characteristic	Urban farmers	Municipal officials
Number of participants	20	5
Sex	13 males; 7 females	5 males
Age range	20-60 years	40-50 years
Experience	3-20 years	10-30 years
Main activities or responsibilities	Vegetables, maize, livestock and mixed farming	Extension, planning and program implementation
Models of urban farming practiced	Backyard, open space, peri-urban farming	
Farm size	0.30- 28 acres	

3.2. Interconnected Stressors Shaping Urban Agriculture

The interviews identified environmental, socioeconomic and institutional stressors as interconnected rather than isolated constraints. Declining soil fertility, pests and diseases, rainfall disruption, seasonal water scarcity and localized flooding affected production directly, while land insecurity, limited finance, high input costs, livestock damage and uneven extension contact influenced farmers' ability to respond. The interaction among these stressors was particularly evident where farmers lacked the resources needed to compensate for environmental losses. Table 2 summarizes the major themes and subthemes emerging from the interviews.

Declining soil fertility was commonly associated with continuous cultivation and limited opportunities for fallowing. Farmers reported using manure, household organic materials and crop residues to improve soil conditions, but many continued to depend on synthetic fertilizer to maintain production. One farmer explained:

"One of our most important challenges is that our farmlands are degraded. Our forefathers have been cultivating these lands for so many years. As a result, the land has lost its fertility. ... we don't get good harvests due to this problem. That is why we need support to buy fertilizers" (Urban farmer).

Pest infestation affected both cereals and vegetables, with maize farmers frequently reporting Fall Armyworm and vegetable producers mentioning worms, grasshoppers and snails. Participants often relied on commercially available pesticides and their own experience, particularly where extension advice was limited.



Table 2. Major themes and subthemes emerging from interviews.

Major theme	Subthemes
Environmental stressors	Declining soil fertility; pests and diseases; drought; dry-season water scarcity; flooding
Socioeconomic stressors	Limited access to land; insecure land tenure; lack of credit; high input costs; livestock damage; poor market access
Institutional stressors	Inadequate extension services; weak implementation of agricultural interventions; absence of UA-specific policies
Farmer adaptive strategies	Soil conservation practices; crop and livelihood diversification; collective action; irrigation adjustments; fencing and livestock control
Municipal and external support	Input programs; conservation agriculture training; revolving credit; irrigation infrastructure; farmer sensitization and planning
Gaps in municipal support	Limited municipal funding; inadequate staff development; weak local policy framework; uneven access to programs
Horizontal support but weak vertical institutional connections	Strong farmer-to-farmer cooperation versus limited contact with extension officers, municipal programs and formal financial institutions
Scale- and location-dependent vulnerability	Larger farms more difficult to fence; low-lying farms exposed to flooding; vegetable farmers more dependent on dry-season water; peri-urban farmers exposed to land conversion and uneven extension coverage

Rainfall disruption was especially consequential for farmers dependent on rain-fed production. One farmer described the effect of a prolonged interruption in rainfall after investing in planting and fertilizer:

“The last time I went there, I literally shed tears because all my crops had been destroyed. If it were raining, I would have harvested them by now, sold some and stored some for food” (Urban farmer).

The account illustrates how rainfall failure affected production, expected income and anticipated household food supplies simultaneously. Flooding represented a more spatially concentrated problem. Farmers operating in low-lying areas described repeated crop losses following heavy rainfall, while a municipal official linked some flooding to the obstruction of natural waterways by urban development.

Water availability also varied sharply by season. Vegetable farmers commonly depended on hand-dug wells that filled during the rains but became increasingly unreliable during the latter part of the dry season. As one farmer explained:

“We don’t have water issues during the rains. Everybody has hand-dug wells...but in February we begin to experience water scarcity. By March, only a few of us are able to produce” (Urban farmer).

For some farmers, the consequence was a reduction in cultivated area or complete suspension of vegetable production until water became available again.

Land availability and tenure security were another central constraint. Participants associated reduced access to farmland with residential, commercial and infrastructural development, particularly in peri-urban locations. The difficulty extended beyond the amount of land available to the security with which it could be used. Some farmers cultivated land through informal permission and could lose access when owners sold or decided to develop the land. One participant explained:

“You go to beg somebody to give you the land to farm...but later...somebody will come and tell you that the land is his and that he wants to build on it...This means I have to vacate the land with all my investments wasted” (Urban farmer).

Municipal officials similarly described much agricultural land as being controlled by individuals and families, limiting the Assembly’s direct authority over conversion decisions. Land insecurity was therefore experienced through both declining availability and uncertainty over the duration of access.

Limited finance compounded these difficulties. Farmers reported problems purchasing improved seed, fertilizer, pesticides, irrigation equipment and other inputs, while officials also described formal agricultural credit as difficult to obtain. Stray livestock created additional losses, particularly on unfenced plots. Smaller farms could sometimes be protected using locally available fencing materials, whereas larger holdings required quantities of labor and materials that many farmers could not provide. A farmers stated:

“What worries me a lot is the issue of animals causing destruction to my farm. Take a look at this vast land. I can cultivate it all, but how am I going to monitor and prevent these stray animals from destroying the crops? Even with these three acres, it is very difficult to prevent them from entering the farm.”

Institutional support was also unevenly experienced. Some farmers reported access to agricultural information, but others described infrequent or absent extension contact. A farmer in a peri-urban location stated:

“Sometimes, we will be here, and an officer will pass by us to another community to teach them. But there are so many farms here, and we need their support” (Urban farmer).

Some participants also questioned the implementation and fairness of government agricultural interventions. These accounts



were perceptions of program delivery rather than independently verified evidence of beneficiary-selection practices, but they contributed to farmers' broader concerns about whether formally available support was practically accessible to them.

3.3. Coping and Adaptive Responses

Farmers responded to these stressors through a combination of immediate coping strategies and adjustments intended to sustain production under recurring stress. Immediate responses included reducing the area cultivated when water became scarce, temporarily suspending dry-season production, closely monitoring fields exposed to livestock damage and supplementing farm income with other livelihood activities. These responses helped farmers manage immediate constraints but did not necessarily reduce the underlying sources of vulnerability.

Other responses involved adjustments within existing farming systems. Farmers diversified crops, applied animal manure and household organic materials, retained crop residues, practiced crop rotation and adjusted irrigation practices. Crop diversification commonly combined staple crops for household consumption with legumes, vegetables or other crops for sale, reducing dependence on a single crop or source of agricultural income.

Water-management options varied according to financial resources. Most vegetable farmers relied on hand-dug wells and manual irrigation, reducing production as water levels declined. A smaller number were able to use mechanized boreholes or pipe-borne water. One farmer described the significance of reliable irrigation:

"If this irrigation channel were functional, or if I had money, I would have drilled a borehole... This is a full-time job. I could produce so many tomatoes and peppers to sell" (Urban farmer).

The contrast indicates that farmers facing similar seasonal water constraints did not have equal access to the infrastructure required to respond.

Collective support also formed part of farmers' responses. Farmer groups exchanged production information and mobilized labor when members were sick or unable to work. One participant explained:

"Any time a group member is sick and cannot work on his or her farm, all group members will dedicate one day and go together and work on that farm for free" (Urban farmer).

Such arrangements provided labor and social support that individual farmers might otherwise have been unable to mobilize. Their usefulness, however, was primarily in areas where resources could be pooled informally; they did not directly resolve problems such as insecure tenure or inadequate irrigation infrastructure.

Fencing represented another practical adjustment to livestock damage. Farmers with smaller plots constructed barriers from branches, wooden poles and other locally available materials. The strategy became more difficult as farm size increased because of the labor and materials required. Farmers operating larger holdings therefore relied more heavily on monitoring fields and engaging livestock owners where the animals could be identified.

3.4. Municipal Support and Gaps in Farmer Access

Municipal officials described a range of agricultural interventions operating within Wa Municipality, although most were general agricultural programs rather than initiatives designed specifically for urban agriculture. These included central-government programs, externally supported projects, training and sensitization activities, irrigation infrastructure and forms of credit or input support.

Officials identified Planting for Food and Jobs Phase 2 as an important central-government intervention through which farmers could obtain inputs and services. They also referred to the Ghana Agricultural Sector Investment Program, which had supported conservation-agriculture training and equipment, as well as the Market-Oriented Agriculture Program and the Social Cohesion Project. Some nongovernmental and development organizations were reported to support farmer groups through revolving-credit arrangements.

Irrigation investment was another area of institutional intervention. Officials described borehole development in selected dry-season farming communities, including Zingu, Nakore and Kpankole. Agricultural information was also provided through radio programs, community sensitization and extension activities, while the Research Extension Linkage Committee was described as a mechanism for communicating farmers' priorities into agricultural planning.

Farmers' accounts, however, showed that the presence of these interventions did not result in uniform access. Some participants reported little direct support, limited awareness of available programs or infrequent interaction with extension personnel. Others questioned how program beneficiaries were selected. The results therefore show a contrast between the range of interventions described institutionally and the uneven experiences of farmers expected to benefit from them.

Municipal officials also acknowledged important constraints on local support. The Assembly had no policy specifically dedicated to urban agriculture at the time of the interviews. As one official stated: *"In terms of UA policies at the municipal level, no, it's not existing" (Municipal official).*



Officials additionally identified limited municipal revenue, competing spending priorities and inadequate opportunities for professional development among agricultural staff. The institutional picture was therefore not one of complete absence of agricultural activity, but of general agricultural interventions operating alongside limited explicit recognition of the distinctive land, water and planning pressures confronting urban farmers.

4. Discussion

The study established that the vulnerability of urban farmers in Wa Municipality is produced through the interaction of environmental stressors, unequal access to productive resources, and institutional constraints. Farmers identified drought, seasonal water scarcity, flooding, pest pressure, and declining soil fertility as stressors to production. The consequences of these stressors, however, varied according to farmers' access to secure land, finance, irrigation, information, extension services, and public support. Vulnerability was therefore not determined by environmental exposure alone but by the conditions that shaped farmers' ability to anticipate, manage, and recover from its effects (Engle, 2011; Smit & Wandel, 2006). The findings further reveal a consequential difference between the formal availability of agricultural support and farmers' ability to access and benefit from that support. Together, these results suggest that adaptive capacity depends not simply on the strategies farmers employ or the programs institutions report, but on whether the resources required for adaptation are practically accessible.

Land insecurity emerged as a foundational constraint because it affected several other dimensions of adaptive capacity. Farmers cultivating borrowed or informally acquired plots faced the possibility of losing access after investing in seed, labor, fencing, irrigation, or soil improvement. Their experiences reflect broader transformations in the peri-urban landscape of Wa. Ziem Bonye et al. (2021) found that urban expansion had converted agricultural land to residential and infrastructural uses, reducing access to farmland and affecting the food security of peri-urban farming households. Studies on customary land governance in Wa also show that peri-urbanization has generated uncertainty over farming rights and access to economically important shea resources (Kusaana, 2022). Among non-indigene smallholders, land appropriation, speculation, and covert sales have transformed previously stable usufructuary arrangements into access that is increasingly temporary and conditional (Abdulai, 2024). Although Abdulai's study focused specifically on non-indigene farmers, it provides a relevant comparison with the tenure uncertainty reported by participants in the present study.

These parallels indicate that farmers' land difficulties are not merely household-level problems. They form part of a wider process in which agricultural land is increasingly commodified and converted to urban uses. Farmers' accounts indicate that temporary access and the prospect of displacement make it more difficult to justify investments whose benefits extend over several seasons. Land insecurity consequently restricts more than the area available for cultivation; it shortens farmers' planning horizons and increases the risks associated with investments in irrigation, fencing, and soil improvement. Access to land must therefore be understood in terms of both physical availability and the security required to benefit from present investments in the future.

Farmers responded to these pressures through practices that served adaptive functions, including crop diversification, manure application, crop rotation, residue retention, irrigation adjustments, fencing, livelihood diversification, and collective assistance. Similar patterns have been reported in Wa, where mixed crop–livestock production and crop diversification were interpreted as measures through which urban farmers reduced the risk of production failure under climatic uncertainty (Naazie et al., 2024). These responses demonstrate farmers' practical knowledge and agency, but their existence should not automatically be interpreted as evidence of sufficient adaptive capacity. In this study, adaptive capacity is understood as the resources and conditions that make adaptation possible, while adaptive strategies refer to the specific actions farmers use to manage experienced or anticipated stressors (Engle, 2011; Smit & Wandel, 2006). The number of strategies reported therefore provides limited information about whether those responses are affordable, effective, accessible, or sustainable over time.

The distinction between coping and incremental adaptation helps explain why the presence of multiple farmer responses should not be equated automatically with strong adaptive capacity (Fedele et al., 2019; Kates et al., 2012). Reducing cultivated area, suspending dry-season production or temporarily shifting labor away from farming may enable households to manage immediate disruption, but these responses do not necessarily reduce future exposure. Crop diversification, soil-management practices and investments in reliable irrigation can represent more durable adjustments where they reduce recurring production risks. Yet the feasibility of these responses depended strongly on land security, finance and water access. The findings therefore suggest that adaptation in Wa is not determined simply by farmers' willingness to change practices, but by the resources and institutional conditions that determine which adjustments they can realistically sustain.

These results provide less evidence of transformative adaptation at the individual farm level. More substantial transformation would require interventions beyond individual farms, including stronger protection of agricultural space within land-use planning, more secure land-access arrangements, reliable irrigation infrastructure and institutional mechanisms that improve farmers' access to agricultural services. Moreover, these findings show why encouraging farmers to adopt additional practices will have limited effects when the structural conditions constraining those practices remain unaddressed.

Access to irrigation provides a clear example of how adaptive capacity was unevenly distributed. Farmers with greater financial resources could mechanize boreholes or obtain relatively reliable water supplies, whereas those with limited resources depended



mainly on hand-dug wells that became unreliable during the dry season. Farmers operating within the same broad climatic setting therefore did not have equal means of responding to the environmental pressures they reported. This is consistent with evidence that household resources and socioeconomic characteristics influence farmers' adaptation decisions and the range of measures available to them (Below et al., 2012). It also demonstrates how constraints reinforce one another: inadequate finance limits irrigation investment, while uncertain tenure makes that investment riskier. Environmental pressure and resource inequality should therefore be understood as interconnected rather than separate sources of vulnerability.

Social relationships partly moderated these constraints. Farmer groups facilitated knowledge exchange, collective labor, and assistance when members were unable to work. Such horizontal relationships within farming networks can support adaptation by facilitating cooperation and access to shared knowledge and resources (Adger, 2010). Their contribution, however, had clear limits. Mutual assistance could not replace secure land, reliable irrigation, affordable inputs, or consistent extension services. Farmers' limited extension contact and difficulties accessing municipal programs also suggest less effective vertical connections with some institutions controlling technical and financial resources. The effectiveness of social networks was therefore shaped by the wider material and institutional environment within which farmers operated.

One of the most important findings is the divergence between municipal officials' descriptions of agricultural support and farmers' experiences of that support. Officials identified training, input distribution, credit arrangements, boreholes, radio sensitization, and farmer engagement as existing interventions. Farmers, in contrast, reported limited extension contact, inadequate information, restricted program coverage, and difficulty obtaining benefits. Some farmers also perceived beneficiary selection as politically influenced.

This divergence is conceptualized here as a gap between nominal provision and effective access. While nominal provision refers to programs or services that institutions report as operational, effective access exists when farmers are aware of these interventions, understand their requirements, can participate in the selection process, and receive assistance that is timely and useful. From an administrative perspective, introducing a program may demonstrate that institutional support exists. From farmers' perspective, however, the program acquires practical value only when its benefits are reachable. The formal presence of an intervention therefore does not necessarily strengthen adaptive capacity. Its contribution depends on communication, coverage, targeting, continuity, transparency, and responsiveness to farmers' needs.

The farmer–official divergence is consistent with wider concerns about urban agricultural governance in Ghana, although the institutional context of Wa should not be assumed to be identical to that of other municipalities. Studies in Tamale show that UA is governed through negotiated and overlapping relationships among public agencies, customary authorities, farmers, and nongovernmental organizations, while remaining weakly supported by formal law and policy (Nchanji, 2017; Nchanji & Bellwood-Howard, 2018). Comparative research involving Kampala, Tamale, and Cape Town similarly identifies stakeholder participation, institutional coordination, strategic planning, and accountability as important features of governance arrangements capable of supporting UA (Vidal Merino et al., 2021). This study extends this literature by showing that institutional performance should be assessed not only by whether programs have been introduced, but also by whether intended beneficiaries can access and use them.

Municipal officials reported that Wa had no policy or planning framework specifically dedicated to UA at the time of the interviews. This does not mean that agriculture was entirely absent from municipal planning. The Assembly's 2026 program-based budget recognizes agriculture generally and provides for interventions involving extension, farmer training, technology dissemination, nursery development, and small-scale irrigation support (Wa Municipal Assembly, 2026). The documentary evidence therefore qualifies, rather than contradicts, the interview finding. It shows that agriculture receives general administrative and budgetary recognition, while UA remains insufficiently differentiated within that broader framework. General agricultural interventions may benefit some urban farmers, but they do not necessarily address the spatial and institutional pressures associated with farming in an expanding municipality, including land conversion, insecure tenure, competing land uses, flooding risks, and livestock intrusion. The findings consequently point not to a complete absence of municipal agricultural support, but to limited explicit integration of UA into municipal development and land-use planning. Evidence from Tamale similarly shows that UA can remain informally and pluralistically governed without being adequately integrated into statutory planning (Nchanji, 2017; Nchanji & Bellwood-Howard, 2018).

The study therefore makes two related contributions. First, it demonstrates that adaptive capacity among urban farmers is relational and institutionally mediated. The effectiveness of farmers' knowledge, initiative, and social networks is shaped by their access to land, water, finance, infrastructure, information, and responsive institutions. Second, it distinguishes nominal institutional provision from farmers' effective access to support. Agricultural programs contribute to adaptive capacity to the extent that farmers can obtain relevant, timely, and sustained benefits from them. The findings consequently challenge assessments that treat the number of strategies adopted or programs introduced as sufficient evidence of adaptation. Understanding adaptation requires attention both to what farmers do and to the structural conditions that determine what they can realistically sustain.

Several limitations should be considered when interpreting these findings. The qualitative case-study design was intended to examine experiences and institutional relationships in depth rather than estimate prevalence or establish causal effects. Consequently, the study cannot determine the magnitude of the effect of tenure insecurity on investment or establish the longer-term effective-



ness of the strategies reported by farmers. The distinction between coping and adaptation is therefore analytical rather than a longitudinal assessment of outcomes. Similarly, farmers' concerns about political influence in the allocation of agricultural support represent participants' perceptions; program records and beneficiary-selection procedures were not independently audited. The institutional perspective is based on five municipal officials, all of whom were men, and may not capture the full diversity of views within municipal institutions. The unequal numbers of farmers and officials should also not be interpreted as a symmetrical comparison between equivalent groups, as officials were included to provide institutionally informed accounts against which farmers' experiences of services and programs could be examined. Finally, the broad category of urban agriculture included farming systems ranging from small backyard and open-space plots to substantially larger peri-urban holdings. Although this diversity reflects the local urban agricultural system, differences in scale and production conditions may shape both exposure to stressors and the feasibility of particular responses.

5. Conclusion

This study makes two principal contributions to understanding urban agriculture under conditions of rapid urban change. First, it shows that farmers' adaptive capacity is relational and institutionally mediated. Farmers responded actively to environmental and socioeconomic pressures, but their ability to sustain these responses depended on access to secure land, reliable water, finance, information, infrastructure and social and institutional support. The presence of multiple adaptive practices should therefore not be interpreted independently of the conditions that make those practices feasible.

Second, the study identifies an important distinction between nominal institutional provision and effective farmer access. Although municipal officials described several agricultural programs and services, farmers experienced their reach and accessibility unevenly. Strengthening urban agriculture consequently requires more than introducing additional interventions. Municipal action should improve the accessibility and transparency of existing support while addressing secure land access, irrigation, extension coverage, and the explicit integration of urban agriculture into development and land-use planning.

Author Contributions

Sufyan Suleman conceived and designed the study, conducted the investigation, analyzed and interpreted the data, and prepared and revised the manuscript.

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