



# Microclimatic Effects of Green Spaces and Urban Quality of Life Resilience in Ghanaian Cities

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## **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## **ABSTRACT**

The phenomenon of rapid urbanization in Ghanaian cities, Accra and Kumasi, has had negative impacts on heightened environmental stressors, such as temperatures, poor air quality, and a decline in public health. In this context, urban green spaces perform essential ecological and social functions that are being progressively acknowledged in international urban planning practice. This study systematically reviews existing literature to synthesize the effects of green spaces on urban microclimates and residents' quality of life with particular reference to Ghana. Using a systematic search of five academic databases, the review collates empirical and theoretical research from 1984 to 2025. Some limitations were realized. Most notably, there was the risk of publication bias as a result of the restriction of grey literature and non-English sources. Secondly, even though there is

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increased interest in urban environmental planning in Ghana, empirical studies specific to Ghana remain scarce. The findings are that green infrastructure significantly reduces ambient temperatures, improves humidity balance, air quality, and affects wind circulation, and reduces the urban heat island effect. Green infrastructure also benefits physical and mental health, social cohesion, and civic engagement. Disparities in access, particularly among low-income and marginalized populations, represent a significant barrier to achieving equitable urban development. The study highlights the necessity of integrating green spaces into Ghana's urban planning policies as a strategy for enhancing climate resilience, public health, and environmental justice. The policy priorities demand the foregrounding of native vegetation, equitable access, and mainstreaming of green infrastructure into broader sustainability agendas.

**Keywords:** *Urban Green Spaces; urban microclimates; quality of life; climate resilience; ghana; environmental justice.*

## 1. INTRODUCTION

Urbanization is indeed altering the character of cities worldwide, presenting both economic prospects and environmental challenges (United Nations, 2018). Urban development, particularly in Sub-Saharan Africa, has caused population densification, widespread environmental degradation, and escalating public health problems within cities. Perhaps the most significant consequence of urban development is the enhancement of the Urban Heat Island (UHI) effect, in addition to worsening air quality and the destruction of natural ecosystems (Onyango, 2022).

Urban green spaces, including parks, gardens, and urban forests, provide a sustainable resolution for most environmental challenges (Bowler et al., 2010). They naturally regulate climate via shade and evapotranspiration cooling, improve air quality, and promote social and psychological well-being. Green infrastructure has been a major element of sustainable urban planning in advanced economies (Reyes-Riveros et al., 2021). Yet, in most African cities, as in Accra, the incorporation of green spaces continues to be constrained by competing land use demands, poor urban governance, and socio-economic disparities (Raghad et al., 2024).

Urbanization in Ghana is taking place at a very fast rate, with cities such as Accra and Kumasi recording accelerated growth in their populations, increased land scarcity, and incessant encroachment of public green areas (Mensah, 2014). Against the backdrop of increasing information on the environmental and health advantages of urban greenness, empirical research investigating green space's role in

influencing urban microclimates and the quality of life of the inhabitants is limited (Matthias et al., 2017).

This study seeks to address this gap through a systematic review of the literature on the impact of green spaces on urban microclimates and the health of city residents in Ghanaian cities. Specifically, it examines green infrastructure's ability to regulate temperature and humidity, filter air quality, and promote physical, mental, and social health outcomes. By emphasizing the Ghanaian experience, this paper aims to add to the growing body of literature on sustainable urban development in the Global South and to inform urban planning policy that promotes environmental equity and resilience.

## 2. LITERATURE REVIEW

### 2.1 Historical Context of Urban Green Spaces

Urban parks have been at the forefront of city development throughout history, stretching back to ancient Greece and Rome, where gardens were a component of city planning for aesthetic and recreational purposes (Castagnoli, 2021). The nineteenth century witnessed a change, however, with the heightened urban environmental stresses of industrialization. Emblematic projects like Central Park in New York functioned to demonstrate a growing acknowledgment of the necessity for public access to nature for all classes (Arlinda, 2020).

In the 20th and 21st centuries, the definition of green space extended beyond entertainment and scenery (Woolley, 2003). Increasingly, planners and researchers have viewed them as fundamental to environmental sustainability,

particularly in managing microclimates, air quality, and mental health (Tzoulas et al., 2007). Contemporary planning emphasizes green infrastructure, including green roofs, vertical gardens, and urban forests, as key features for climate adaptation and sustainable urban futures (Livesley et al. 2016).

## 2.2 Theoretical Frameworks

Several theoretical frameworks describe the role of green areas in urban systems: The Biophilia Hypothesis (Wilson, 1984) presumes the existence of an innate human affection for nature. Exposure to natural environments has been linked to reduced stress, improved mood, and psychological resilience (Kaplan & Kaplan, 1989). Environmental Psychology is concerned with the physical environment's impact on cognition and behavior. Urban greening can add to thermal comfort, aesthetic enjoyment, and perceived safety, which are all factors that contribute to residents' satisfaction and health (Gifford, 2014; Tzoulas et al., 2007). The Ecosystem Services Framework classifies the services of green infrastructure into four categories: provisioning, regulating, supporting, and cultural services (Millennium Ecosystem Assessment, 2005). Green areas supply crucial services, including air filtration, climate regulation, and recreational opportunities. Place Attachment Theory discusses the affective ties individuals develop with specific locations. Parks and urban gardens can be key sources of community identity and cohesion, generating a sense of belonging as well as facilitating civic engagement (Manzo & Perkins, 2006). Collectively, these frameworks speak to the multifaceted significance of green space and demand an integrative model of understanding their contribution to urban microclimate formation and general quality of life.

## 2.3 Green Spaces and Urban Microclimates

Urban green spaces significantly influence local microclimates through multiple mechanisms:

### 2.3.1 Temperature regulation

Vegetation cools the environment through shading and evapotranspiration. Studies show temperature reductions of 2–5°C in urban areas with adequate green cover (Akbari et al., 2009; Gromke & Ruck, 2007). Medium-sized, tree-dense parks are especially effective in mitigating

the Urban Heat Island effect (Kirschner et al., 2023).

### 2.3.2 Humidity and moisture control

Vegetation contributes to localized humidity, improving comfort during hot and dry periods. Buyadi et al. (2015) found that tree canopies could raise humidity by 5–15%, enhancing microclimatic stability.

### 2.3.3 Air quality improvement

Trees filter harmful pollutants, including nitrogen dioxide and particulate matter. In the U.S., urban forests remove over 700,000 tons of air pollutants annually (Nowak et al., 2006). These effects contribute to cleaner air and reduced disease burden in dense urban environments.

### 2.3.4 Wind and ventilation

Strategic vegetation placement affects wind speed and pollutant dispersion. Trees can function as windbreaks or ventilation corridors, improving urban airflow and energy efficiency (Teimouri et al., 2023; Erell et al., 2017). These findings collectively support the view that urban green spaces are critical assets for climate regulation and environmental health in cities, particularly those facing increasing heat stress due to climate change.

## 2.4 Green Spaces and Quality of Life

Beyond environmental benefits, green spaces profoundly impact human health and social well-being:

### 2.4.1 Physical and environmental health

Vegetation improves air quality and lowers exposure to extreme heat, thereby reducing cardiovascular and respiratory illnesses (Tzoulas et al., 2007; Rosenfeld et al., 1997). Biodiversity in urban parks also enhances ecological resilience and ecosystem services like flood mitigation and pest control (Castelli et al., 2021).

### 2.4.2 Mental health and well-being

Access to green spaces is linked with lower levels of stress and greater life satisfaction. Attention Restoration Theory (Kaplan & Kaplan, 1989) suggests that natural environments help restore cognitive function. Multiple studies affirm

the long-term psychological benefits of living near greenery (Van den Bosch & Meyer-Lindholm, 2020; White et al., 2013).

#### 2.4.3 Social cohesion and civic engagement

Urban parks promote social interaction, inclusiveness, and community bonding. When residents engage in the co-management of green spaces, it strengthens social capital and pride in local environments (Putnam, 2000; Benedict & McMahon, 2006). However, unequal access remains a challenge, particularly for low-income and marginalized communities (Wolch et al., 2014). These insights underscore the need to prioritize equitable access to high-quality green spaces, particularly in fast-growing cities in the Global South, where planning often overlooks the social dimensions of environmental infrastructure.

### 2.5 Conceptual Framework Explanation

The conceptual framework guiding this study is grounded in four interrelated theoretical perspectives that collectively explain urban green spaces' significance and multifaceted impacts (Zhang, Tan, & Diehl, 2017). These are: the Biophilia Hypothesis, Environmental Psychology, the Ecosystem Services Framework, and Place Attachment Theory, as shown in Fig. 1. Each of these theories contributes to understanding how and why green spaces influence both environmental and human systems in urban contexts.

**Biophilia Hypothesis:** According to Gaekwad et al. (2022), the Biophilia Hypothesis posits that humans have an innate connection with nature. This connection underpins the psychological and emotional benefits derived from exposure to green environments, such as stress reduction and enhanced mental well-being (American Psychological Association, 2025).

**Environmental Psychology:** Environmental Psychology focuses on the interaction between people and their surroundings, highlighting how urban greenery contributes to comfort, perceived safety, and positive behavioral outcomes (Braubach et al., 2017). It explains how physical environments influence cognitive function, health perceptions, and satisfaction with urban life (Matthews, 2021).

**Ecosystem Services Framework:** The Ecosystem Services Framework categorizes the

tangible and intangible benefits that green spaces provide, including climate regulation, air purification, biodiversity support, and recreational opportunities (Baró et al., 2014). These ecosystem services are directly linked to environmental quality and health outcomes in urban settings (Lindgren & Elmqvist, 2018).

**Place Attachment Theory:** Place Attachment Theory explores the emotional bonds individuals form with meaningful places. Urban parks and communal green spaces foster social cohesion, civic engagement, and a sense of belonging, which are critical for inclusive and resilient urban communities (Qi & Vasconcelos, 2024).

These theoretical lenses converge on the concept of urban green spaces, conceptualized here as a central mediating variable. Green spaces, in turn, influence two primary outcome domains:

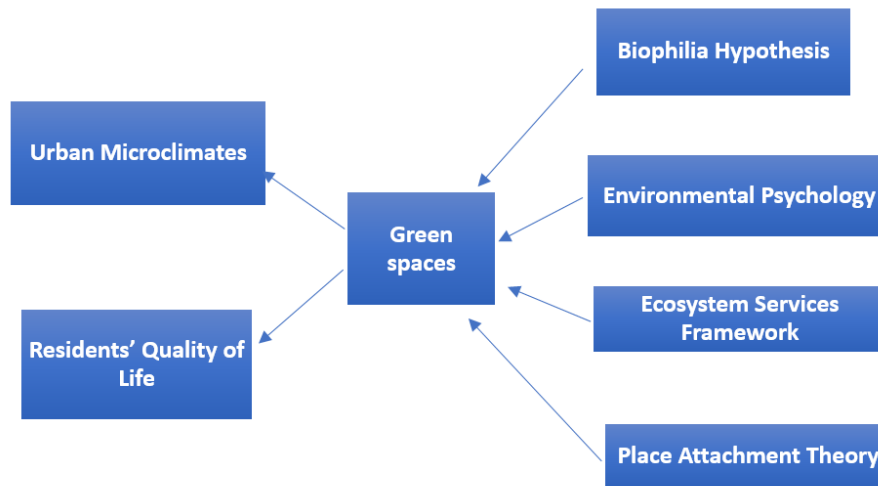
**Urban Microclimates:** Green spaces regulate temperature, increase humidity, filter air pollutants, and influence wind patterns, factors critical in mitigating the urban heat island effect and enhancing overall climatic comfort in cities (Kraemer & Kabisch, 2022).

**Residents' Quality of Life:** Green spaces positively affect mental and physical health, promote recreational activity, encourage social interaction, and strengthen community identity. These impacts contribute to overall well-being and satisfaction with urban living (World Health Organization, 2016).

This framework provides a holistic lens for analyzing how urban green infrastructure supports both environmental resilience and human well-being, particularly in the context of rapidly urbanizing Ghanaian cities. It also informs the organization of this study's analysis and thematic synthesis.

### 3. METHODOLOGY

This study applied a systematic review approach to investigating the impact of urban green spaces on microclimatic regulation and quality of life of residents with specific reference to the Ghanaian context. The systematic review approach was employed due to its strength in accumulating existing knowledge from various sources based on an explicit and reproducible protocol. The review aimed to determine key environmental and social results of green infrastructure and how these contribute to urban sustainability and resilience.



**Fig. 1. Conceptual framework: Effects of Green Spaces on Urban Microclimates and Quality of Life**

*Source: Authors' Construct*

In an attempt to obtain pertinent literature, an extensive search was carried out on major academic databases, such as Scopus, Web of Science, ScienceDirect, PubMed, and Google Scholar, as indicated in Fig. 2. The research strategy utilized the application of the following keywords: "urban green spaces," "microclimate," "temperature regulation," "humidity," "air quality," "quality of life," "health," "well-being," and "Ghana." The application of Boolean operators was utilized to enhance the search parameters' specificity. Only English-language articles were included, and the search was limited to publications from 1984 to 2025 to encompass both older and newer perspectives.

The selection criteria for the studies targeted research that had investigated the effects of green spaces on urban microclimates or residents' health and wellbeing, with a priority on Sub-Saharan Africa's urban areas or other comparable developing world cities. The review incorporated peer-reviewed articles, scholarly books, organizational reports, and empirical case studies. Nonetheless, opinion articles, non-academic literature, research that did not meet the general themes, and duplicate articles were not included in the review.

Following the identification of qualifying studies, data was extracted with the assistance of a structured coding scheme. This included the recording of details about each study's author(s), publication year, research objectives, methodology, key findings, and its applicability to the Ghanaian or African urban experience. This

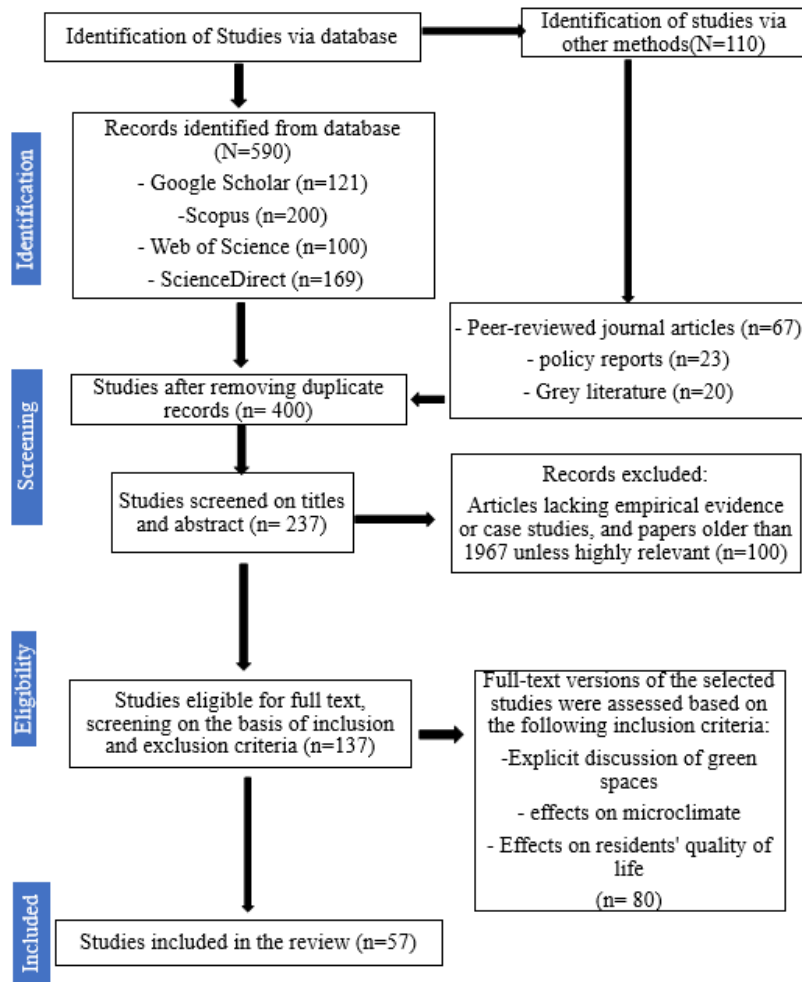
was followed by thematic synthesis on the data that was extracted. The findings were always classified under two broad dimensions: first, the environmental impacts of green spaces, including their function in regulating temperature, humidity, air quality, and wind patterns; and second, the social outcomes pertaining to quality of life, including determinants of physical and mental health, social cohesion, and political engagement.

Although the systematic review approach guarantees some degree of academicity and comprehensiveness, some limitations were realized. Most notably, there was the risk of publication bias as a result of the restriction of grey literature and non-English sources. Secondly, even though there is increased interest in urban environmental planning in Ghana, empirical studies specific to Ghana remain scarce. This gap highlights the necessity for more localized studies exploring the intricate link between urban green infrastructure and sustainable city development in Ghana.

Yet the methodological approach taken in this research offers a solid foundation for syntheses of current knowledge and formulating insights that are relevant to both scholars and policymakers. It also enables the identification of key themes and evidence gaps that can guide future research and urban planning initiatives.

### 3.1 Contextual Focus on Ghana

Ghanaian urbanization has accelerated in the past three decades, much of it being in the



**Fig. 2. PRISMA Flow Diagram**

Source: Authors' construct

bigger cities such as Accra and Kumasi. Urbanization has created stress on environmental, land, and infrastructural systems. Unplanned spatial growth, together with rapid population growth, has contributed to rising ambient temperatures, poor air quality, and green cover loss (Cobbinah & Odei, 2018). These transformations have increased the exposure of urban residents to climate-associated hazards, including extreme heat, poor airflow, and contact with pollutants.

In this context, urban green spaces are becoming well-known for having the capacity to moderate local climates and enhance quality of life. Ghanaian studies have started showing that urban vegetation can have a significant role in reducing surface temperatures, enhancing humidity balance, and enhancing the quality of air, particularly in densely

urbanized locations (Ernst et al., 2022; Wemegah et al., 2020). Urban green infrastructure in cities like Accra also offers space for recreation, social connection, and psychological recovery, particularly in low-income communities (Cernicova-Bucă et al., 2023). These benefits are in line with international research; nonetheless, they are conditioned by local environmental, socio-economic, as well as governance patterns.

Despite their widely recognized benefits, green spaces in Ghana continue to be limited, fragmented, and poorly managed. Most existing parks and public gardens are under threat of encroachment by infrastructure development, spontaneous settlement, and commercial development. Moreover, the distribution of access to quality green space is disproportionately skewed since more affluent

districts typically have more public landscaping and tree cover than less affluent residential ones (Mensah, 2015). This case reflects broader patterns of environmental injustice, in which disadvantaged groups suffer greater exposure to urban heat and air pollution while having less access to the mitigating benefits of nature.

The limited focus on green infrastructure in the urban planning arena in Ghana is a significant setback. Inadequate policy implementation, fragmented land use planning, and insufficient public investment have undermined the development and sustenance of green spaces (Gagakuma and Takyi 2025). These are further exacerbated by insufficient public knowledge of green spaces' environmental and health benefits, and low stakeholder involvement in green infrastructure decision-making processes.

However, recent research and pilot initiatives have pointed to promising directions. Work by Száraz (2014) and Addas (2023) identifies the potential for integrated green infrastructure strategies to support climate adaptation alongside overall social well-being in Ghana's urban areas. These findings underpin the broader argument presented here: that green space must be regarded as essential public infrastructure for the development of climate-resilient, inclusive, and sustainable cities in Ghana.

## 4. RESULTS AND DISCUSSION

Table 1 summarizes the themes of temperature regulation, humidity and moisture regulation, air quality improvement, wind patterns and ventilation, environmental health benefits, mental health and well-being, and social interactions and community engagement, with relevant articles organized under each theme. Each entry is summarized to provide key insights relevant to green spaces on urban microclimates and residents' quality of life.

### 4.1 Green Spaces and Microclimates

The results of the systematic literature review are synthesized around two main domains: (1) the effects of green spaces on urban microclimates and (2) their influence on residents' quality of life. These domains are organized into thematic areas reflecting recurring patterns in the literature.

#### 4.1.1 Temperature regulation

A theme that appears throughout much of the literature is the role of urban green space in temperature mitigation, primarily through the processes of evapotranspiration and shading. Research repeatedly illustrates temperature reductions of 2 to 5°C in green spaces relative to nearby urban conditions (Akbari et al., 2009; Gromke & Ruck, 2007). Of note is that Kirschner et al. (2023) established that medium-sized parks with dense tree canopies provide the best cooling. Additionally, Grilo et al. (2020) demonstrated that small green spaces have measurable cooling impacts in a 60-meter radius. These kinds of results have important ramifications in the urban environment of Accra, where heat stress and ambient temperature increases are becoming more common.

#### 4.1.2 Humidity and moisture regulation

Greenery also plays a crucial role in urban humidity mitigation. Buyadi et al. (2015) demonstrated that tree cover has the potential to increase local humidity by 5–15%, particularly in hot and dry climates. Similarly, Berardi et al. (2020) reported that green canopies raise relative humidity during heatwaves and lower air temperature concurrently. This twofold potential is particularly applicable in Ghanaian cities during the Harmattan season when dry air increases discomfort and health risks.

#### 4.1.3 Air quality improvement

Literature provides strong proof that vegetation is a significant factor in the filtration of air pollutants, including nitrogen dioxide, sulfur dioxide, and particulate matter. Nowak et al. (2006) estimate that urban forests in the United States eliminate over 700,000 tons of air pollutants every year. In Ghana, where car emissions and reckless burning of waste fuels worsen the decline in air quality, green spaces can act as a natural filter to pollution and the increasing rate of respiratory illnesses.

#### 4.1.4 Wind patterns and ventilation

Strategically positioned green areas possess the ability to influence airflow in urban spaces as ventilation corridors or windbreaks. Teimouri et al. (2023) and Erell et al. (2017) underscored the contribution vegetation placement has towards pollutant dispersion and heat control. For Accra and Kumasi's densely populated residential

**Table 1. Green Spaces Impact**

<b>Author(s)</b>	<b>Year of Publication</b>	<b>Objectives</b>	<b>Methodology</b>	<b>Key Findings</b>	<b>Relevance</b>
<b>Green Spaces and Microclimates</b>					
<b>Theme 1: Temperature Regulation</b>					
Akbari et al.	2009	Examine the cooling impact of vegetation in urban areas	Empirical study on urban greenery	Urban vegetation reduces air and surface temperatures by 2–5°C	Highlights the role in mitigating the urban heat island effect
Gopinath et al.	2024	Assess temperature differences between rural and urban parks	Temperature comparison study	Cooling depends more on canopy density than size	Guides future park vegetation planning
Grilo et al.	2020	Model the spatial extent of park cooling	High-resolution simulation	The cooling effect (1–3°C) extends up to 60m from parks	Even small green spaces are beneficial
Gromke & Ruck	2007	Assess temperature differences in shaded vs unshaded areas	Comparative study	Shaded areas are significantly cooler	Encourages tree planting to improve thermal comfort
Kirschner et al.	2023	Identify the most effective green space types for cooling	Urban climate zone classification	Medium-sized, tree-dense parks have the highest cooling efficiency	Informs green space design for optimal thermal performance
Taha	1997	Study the impact of surface albedo on heat retention	Analytical assessment	High-albedo surfaces like green roofs reduce heat accumulation	Supports green roofs and reflective surfaces in cities
<b>Theme 2: Humidity and Moisture Regulation</b>					
Berardi et al.	2020	Evaluate greenery impact on air temperature and humidity during heatwaves	Mesoscale/microscale modeling	Greener areas lower air temps by up to 2.3°C and raise humidity by 10–12%	Critical for climate adaptation during extreme weather
Buyadi et al.	2015	Explore the humidity effects of tree canopies	Field measurements	Tree canopies increase local humidity by 5–15%	Moisture regulation improves thermal comfort in dry urban areas



Author(s)	Year of Publication	Objectives	Methodology	Key Findings	Relevance
<b>Theme 3: Air Quality Improvement</b>					
Hallett et al.,	2024	Investigate urban forests' role in carbon sequestration	Theoretical analysis	Forests reduce atmospheric CO <sub>2</sub> , improving air and microclimate	Urban forests are vital for climate and air quality goals
Nowak et al.	2006	Quantify air pollutant removal by urban forests	National-scale quantitative modeling	Urban trees remove over 700,000 tons of pollutants per year in the U.S.	Strong evidence of urban greening for air purification
<b>Theme 4: Wind Patterns and Ventilation</b>					
Erell et al.	2017	Analyze the vegetation's impact on thermal and wind profiles	Modeling study	Greenery modifies urban microclimates and improves energy efficiency	Supports passive design through vegetation
Teimouri et al.,	2023	Assess how green space design affects wind patterns	Observational analysis	Proper vegetation design enhances airflow and pollutant dispersion	Encourages wind-sensitive landscape planning
<b>Green Spaces on Quality of Life</b>					
<b>Theme 1: Environmental Health Benefits</b>					
Castelli et al., et al.	2021	Evaluate ecosystem services from biodiversity	Empirical assessment	Biodiversity supports cleaner air, water retention, and health	Justifies biodiversity corridors in cities
Goddard et al.	2010	Examine biodiversity's impact on environmental health	Conceptual analysis	Biodiversity enhances ecological resilience and service provision	Supports integrating biodiversity into urban design
Rosenfeld et al.	1997	Examine vegetation's environmental impact	Empirical studies	Cooling and air purification through vegetation	Encourages vegetation as environmental infrastructure
Tzoulas et al.	2007	Review links between urban green spaces and health	Literature review	Greenery reduces the risk of respiratory and cardiovascular disease	Strengthens public health policy on urban greening

Author(s)	Year of Publication	Objectives	Methodology	Key Findings	Relevance
<b>Theme 2: Mental Health and Well-being</b>					
Chake Lam	2024	Assess the green space impact on subjective well-being	Urban social study	Green areas support relaxation, social bonds, and improved well-being	Relevant for community-focused urban development
Kaplan & Kaplan	1989	Propose Attention Restoration Theory	Theoretical framework	Natural environments help restore cognitive function and reduce stress	Foundational theory for therapeutic landscape design
Librett et al.	2003	Examine the link between park access and happiness	Meta-analysis	Green space access correlates with higher life satisfaction	Strong case for equitable green infrastructure
Manvelyan	2024	Study green space impacts in Yerevan residential areas	Review and urban observation	Improves mental and physical health, strengthens social connections	Advocates for inclusive and maintained green spaces
Ulrich et al.	1991	Study nature's effect on mood and stress	Experimental study	Nature exposure reduces anxiety and improves mood	Supports green space therapy interventions
Van den Bosch & Meyer-Lindholm	2020	Analyze long-term well-being from green space access	Longitudinal study	Increased access improves mental health over time	Promotes city-wide accessibility to parks
White et al.	2013	Quantify mental distress based on green exposure	Fixed-effects analysis on a large panel dataset	Greener areas are linked with less distress and better well-being	Large-scale evidence for mental health benefits
<b>Theme 3: Social Interactions &amp; Community Engagement</b>					
Benedict & McMahon	2006	Study community involvement in park care	Participatory research	Park stewardship increases pride and civic engagement	Encourages co-management of green spaces
Chovy	2023	Examine social functions of green spaces	Case study	Multipurpose parks facilitate diverse and inclusive interactions	Promotes multifunctional green infrastructure
Kaźmierczak	2007	Analyze green spaces in	Urban review	Green areas are	Promotes socially

Author(s)	Year of Publication	Objectives	Methodology	Key Findings	Relevance
		social inclusion		accessible, reduce aggression, and encourage voluntary work	inclusive green planning
Kuo	2003	Explore Park proximity and community participation	Empirical survey	Nearby parks increase the likelihood of social engagement	Highlights the value of green space accessibility
Lindsey et al.	2001	Promote green space equity in urban design	Policy-oriented study	Equitable access improves inclusivity and well-being	Urges fair distribution of green assets
Putnam	2000	Investigate the role of social capital and community bonds	Sociological framework	Green space-based activities foster social networks	Reinforces community-centered design of green spaces
Wolch et al.	2014	Evaluate green space disparities among social groups	Equity analysis	Marginalized communities have less access, limiting benefits	Directs focus on environmental justice in planning

Source: Authors' Construct

areas, where airflow is normally hindered by concentrated building layouts, integrating vegetation in urban design would promote airflow and minimize heat accumulation and pollutant levels. They illustrate the environmental relevance of urban greening as an organic method for climate adaptation in rapidly expanding towns such as in Ghana, where there may not be adequate official infrastructure for coolness and for pollution abatement.

## **4.2 Green Spaces and Quality of Life**

### **4.2.1 Environmental health benefits**

Green infrastructure in urban areas plays a key role in enhancing public health. Numerous studies (Tzoulas et al., 2007; Nowak et al., 2014) explain how greenery enhances air quality and mitigates exposure to environmental stressors such as pollution and heat. In Ghana, where there is a growing trend of hospitalizations as a result of heat stress and air pollution (Száráz, 2014), incorporating green infrastructure into urban planning can help alleviate the pressure on public health systems.

### **4.2.2 Mental Health and psychological well-being**

The mental health gains of proximity to open areas are well established. Kaplan and Kaplan's (1989) Attention Restoration Theory is the theory behind how natural areas assist in stress reduction and the restoration of mental function. Empirical research by Librett et al. (2003), White et al. (2013), and Van den Bosch and Meyer-Lindholm (2020) all associate residential proximity to green areas with reduced stress levels and increased life satisfaction. Within Ghana's rapidly developing regions, where the population is dense and has limited access to recreational amenities, accessible park and green corridor development may have significant mental health gains, particularly for low-income communities.

### **4.2.3 Social cohesion and civic engagement**

Beyond their health benefits, green parks are also social areas that enable community cohesion, collective identity, and civic engagement. Research by Kuo (2003), Chovy (2023), and Benedict & McMahon (2006) demonstrates how well-managed parks provide opportunities for interaction, diversity, and stewardship of the neighborhood. The literature

also highlights the unequal access challenge, especially among disadvantaged groups (Wolch et al., 2014). This is evident in Ghana, where green amenities are often concentrated in upscale areas, thus excluding poor communities. It is critical to eliminate this spatial inequality to support environmental justice and social inclusion.

## **4.3 Synthesis and Contextual Reflection**

Across all themes, the reviewed literature confirms that green spaces are not merely ornamental but constitute critical infrastructure for climate resilience, public health, and social well-being. While global evidence is strong, there is limited empirical research focused specifically on Ghanaian cities. Most studies addressing Accra and Kumasi remain descriptive or policy-oriented, lacking longitudinal or community-based data. This gap signals a need for more localized research and urban experimentation to guide planning decisions that prioritize equitable and climate-responsive green infrastructure.

## **5. SUMMARY OF FINDINGS**

The systematic review identified that urban green spaces are important determinants of environmental condition and social well-being in urban places, particularly under Ghana's fast rate of urbanization. Regarding temperature regulation, it was established that vegetation has the potential to lower ambient and surface temperatures by as much as 2 to 5 degrees Celsius through natural mechanisms such as evapotranspiration and shading. This function is of particular significance to urban centers such as Kumasi and Accra, which are increasingly vulnerable to extreme heat from urban heat island impacts.

Green spaces play an excellent role in humidity and moisture regulation since canopies of tree and vegetation increase the local humidity, hence enhancing thermal comfort during dry seasons, such as the Harmattan season in Ghana. These effects operate to minimize discomfort and physiological stress for the urban populace. The literature also highlights the importance of green spaces in enhancing air quality. Plant cover plays a crucial role in eliminating contaminants, including nitrogen dioxide, sulfur dioxide, and particulate matter, from the air and thereby decreasing the rate of respiratory illnesses. This is particularly applicable to Ghanaian cities, where open burning and traffic are major causes of city air pollution.

In terms of wind flow and ventilation, strategically located green spaces significantly impact airflow, assisting either in protecting communities from harsh winds or facilitating the supply of heat and pollutants. It is particularly valuable in dense urban environments where poor ventilation increases heat discomfort and pollutant exposure. The advantages of green infrastructure to environmental health extend beyond mere physical manipulation of the climate. By mitigating pollution and supporting biodiversity, green spaces lower the incidence of heat-related illness and enhance ecological resilience. They are a boon to Ghana's overwhelmed public health systems.

Socially, green areas were viewed to foster mental health and psychological wellness. Numerous studies attest that exposure to green areas alleviates stress, enhances mood, and restores cognitive function. For urban residents of dense and stressful cities, access to green areas is a determinant for better quality of life and emotional resilience. Social cohesion and civic engagement are enhanced by urban green areas. Parks and gardens are supposed to be inclusive areas to facilitate community interaction, leisure, and the manifestation of culture. Yet, literature indicates notable disparities with regard to access, with low-income and marginalized communities frequently being excluded from the gains of green infrastructure. In Ghana, this demands concerted planning interventions that will stimulate environmental justice and support equitable urban development.

## 6. CONCLUSION

This study has conducted a systematic review of the environmental and social functions of urban green spaces, stressing their paramount importance in regulating urban microclimates and enhancing the lives of urban dwellers. The findings confirm that green infrastructure, when properly designed and fairly distributed, can effectively decrease ambient temperatures, regulate humidity, enhance air quality, and facilitate natural ventilation in the urban setting. Such positions are especially important amid increasing climate change impacts in rapidly urbanizing areas such as Ghana.

Aside from the environmental gains, green areas are shown to enhance physical and mental well-being, facilitate social interaction, and bolster community involvement. Green areas are not just natural buffers to climatic risks but also areas for civic interaction, therapeutic

intervention, and social equality enhancement. Nonetheless, the review also determines existing inequalities in access, with marginalized and low-income communities tend to be excluded from quality green infrastructure, a situation that is increasingly causing concern in the development of Ghanaian cities.

Based on these insights, several policy implications arise. Firstly, city planning departments in Ghana need to incorporate green infrastructure into master plans as essential public infrastructure and not as an aesthetic amenity. Medium-sized parks with trees in highly populated areas can serve both social cohesion and climate adaptation functions. Secondly, investing in indigenous and biodiverse vegetation is essential to maximize ecosystem services and environmental resilience in the long term.

Third, it is essential that prioritizing equitable access to green areas in policy agendas is done. In order to reverse spatial inequalities and shape inclusive urban development, specific planning, participatory design processes, and land-use zoning reforms are essential. Fourth, it is essential that green infrastructure is embedded within wider national policies concerning climate adaptation, public health, and urban governance. Monitoring and evaluation systems should be set up to evaluate the long-term impacts of green space investments on urban livability and well-being. In the long run, green spaces in cities should not be viewed as a luxury but as a necessity. They are core to environmental sustainability, public health, and social inclusion. For Ghana to develop climate-resilient and just cities, green infrastructure must be at the center of urban development agendas.

## DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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