GREEN SPACE DEPLETION IN GHANA'S URBAN SETTLEMENTS: A CASE OF KUMASI

By

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DECLARATION

I hereby declare that this submission is my own work towards the MSc. Development Planning and Management (SPRING) and, to the best of my knowledge; it contains no material previously published by any other person or material which has been accepted for the award of any degree of the university, except where acknowledgement has been made in the text.

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ABSTRACT

Green spaces constitute an integral part of an urban environment. Unfortunately, Kumasi, Ghana's second largest and fastest growing city and the "Garden City of West Africa" has lost much of its green spaces over time. Various human activities created in the city in an attempt to attain a higher level of development have led to the depletion of its green spaces. Green spaces are constantly being lost to other land uses such as residential, educational and circulatory and little is being done to remedy the situation.

The study sought to give a broad discussion on the causes of green space depletion in Ghanaian urban settlements with particular reference to Kumasi and propose pragmatic measures to ameliorate the situation. The study adapted the case study approach and utilized publications that related to urban green spaces in Ghana and Africa. The study also made use of the consultative approach in order to have diverse views on the research topic. The data gathered were edited and coded. They were then analysed using statistical software known as Statistical Package for Social Scientist (SPSS) version 16.

Some of the major findings of the study were that, green space depletion in Kumasi is caused by factors such as: high land rent for other land uses, laxity in the enforcement of development controls and low priority to green spaces by city authorities. The study also proposed among other measures that there should be an intensive public education on the benefits of urban green spaces in the City.

The general public and all stakeholders of urban green space should put in a concerted effort towards the preservation of the green spaces in the City to restore its "Garden City" image.

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LIST OF ACRONYMS

CBD	-	Central Business District
DPG	-	Department of Parks and Gardens
EPA	-	Environmental Protection Agency
EU	-	European Union
FC	-	Forestry Commission
HFZ	-	High Forest Zone
KMA	-	Kumasi Metropolitan Assembly
NDPC	-	National Development Planning Commission
PU	-	Planning Unit
RCEP	-	Royal Commission on Environmental Pollution
TCPA	-	Town and Country Planning Agency
TCPD	-	Town and Country Planning Department
TEP	-	The Environment Partnership
UGS	-	Urban Green Space
UHI	-	Urban Heat Island
UK	-	United Kingdom
UN	-	United Nations
UNDP	-	United Nations Development Programme
VOCs	-	Volatile Organic Compounds

CHAPTER ONE

URBANIZATION: KEY ISSUES AND CHALLENGES

1.1 Background to the Study

Urbanization is an on-going process all over the globe. People moving from rural to urban areas are the primary cause of urbanization, and according to history this movement of people is very difficult to control. The inflow of new residents to urban areas necessitates more buildings, new institutions and often, new ways of life. The concentration of people and production in cities can offer opportunities for environmental gains at the same time as meeting human needs. Among the benefits are the economy of scale in the provision of jobs, housing and services such as health care, water supply, public transport systems and other infrastructure (Weingaertner, 2005). Over the last decade, the global proportion of urban population has been rising rapidly (United Nations, 2014) and this growth has resulted from large movement of people to cities to take advantage of increased opportunities and improve their standard of living (Asamoah, 2010). The world is turning into a giant urban area (Safavi, 2012). In 2007, the world crossed the 50 percent urban threshold (Zitkovic, 2008; Safavi, 2012), underscoring the significance of cities and their impact on the planet (Zitkovic, 2008). Although, cities cover less than 5 percent of land space worldwide, they consume about 75 percent of the world's resources (Zitkovic, 2008).

Urbanization is increasing in both developed and developing countries. Cities are growing faster all over the world. There will be nearly 2 billion new city residents accounting for around 60 percent of the world's population by 2030 leading to a severe damage of natural resources and ecosystems (Kharel, 2012). When cities grow, they require more land and resources to support the growth. This leads to change in land use causing environmental problems such as air and water pollution, loss of green spaces and biodiversity, heat island effects, and so on (Kharel, 2012).

Naab et al. (2013, p.257), argue that "a major problem of rapid urban growth is changing land use patterns". According to them, the general characteristics of rapid urbanization experienced by most sub-Saharan African countries, such as Ghana are rampant changes in land and building uses. Kharel (2010), also states that in the last few decades, land use practices such as agriculture, mining, logging, housing and

recreation have become so intensive and predominant that their impacts can be witnessed in forms of uncontrolled development (urbanization and sprawl), deteriorating environmental quality, loss of prime agricultural lands, depletion of green spaces, and loss of fish and wildlife habitats everywhere on the earth.

Adjei Mensah (2014) states that green spaces constitute a major environmental resource of urban landscape. He also states that, in Africa, statistics show that urban green spaces are depleting at an alarming rate with green spaces now occupying small fraction of the landmass of several urban areas.

Quagraine (2011, p.212) notes that, "urban landscape, especially, urban greenery is crucially important since it is integrally linked with the general health and comfort of urban dwellers, energy consumption levels and the general image of the City". Nowak (2002) also asserts that urban vegetation can directly and indirectly affect local and regional air quality by changing the urban atmospheric environment. He notes that the four main ways that urban landscapes affect air quality are:

- Temperature Reduction: Tree transpiration and tree canopies affect air temperature, radiation absorption and heat storage, wind speed, relative humidity, turbulence, surface albedo, surface roughness and consequently the evolution of the mixing-layer height. These changes in local meteorology can alter pollution concentrations in urban areas.

- Removal of Air Pollutants: Trees remove gaseous air pollution primarily by uptake via leaf stomata, though some gases are removed by the plant surface. Once inside the leaf, gases diffuse into intercellular spaces and may be absorbed by water films to form acids or react with inner-leaf surfaces. Trees also remove pollution by intercepting airborne particles. Some particles can be absorbed into the tree, though most particles that are intercepted are retained on the plant surface. The intercepted particle often is re-suspended to the atmosphere, washed off by rain, or dropped to the ground with leaf and twig fall. Consequently, vegetation is only a temporary retention site for many atmospheric particles.

- Emission of Volatile Organic Compounds (VOCs): Emissions of volatile organic compounds by trees can contribute to the formation of ozone and

carbon monoxide. However, in atmospheres with low nitrogen oxide concentrations (e.g., some rural environments), VOCs may actually remove ozone. Because VOC emissions are temperature dependent and trees generally lower air temperatures, increased tree cover can lower overall VOC emissions and, consequently, ozone levels in urban areas.

- Energy Effects on Buildings: Trees reduce building energy use by lowering temperatures and shading buildings during the summer, and blocking winds in winter. However, they also can increase energy use by shading buildings in winter, and may increase or decrease energy use by blocking summer breezes. Thus, proper tree placement near buildings is critical to achieve maximum building energy conservation benefits.

The increasing urbanization and human population growth during recent decades have resulted in significant loss of habitats in the urban landscape, accompanied by many environmental problems, such as a reduction of green spaces and ecosystem deterioration (Gairola and Noresah, 2010). Adjei Mensah (2014) notes that urbanization remains a single prime factor that is always associated with the destruction of urban green spaces. In many cities around the world, random urban growth leads to the change of land use and land cover (Amin, 2007) and the city of Kumasi is no exception. The high rate of population growth coupled with the unplanned developmental activities in Kumasi has led into the deterioration of urban green spaces.

1.2 Research Problem

The city of Kumasi is suffering from a rapid decline in its green spaces (Adjei Mensah, 2014) due to uncontrolled urbanization. Manlun (2003), states that green space system is the foundation of the natural system and plays the cardinal role of the natural productivity in the urban structure. He further notes that a sustainable green space system can play an effective part in cleaning air, adjusting climate, eliminating noise, beautifying surroundings among other things. It is therefore indispensable for constructing a high quality human settlement and high standard ecocity.

According to the Ministry of Lands and Natural Resources (2012), the Republic of Ghana has a land area of 238,500 sq km, made up of two broad ecological zones - a high forest zone (HFZ) covering much of the southern 30% of the country, and a

savanna zone over the considerably drier northern 70%. Kumasi, the capital of Ashanti and the second largest city in Ghana is within the HFZ of the country. The city therefore was endowed with all the benefits provided by natural landscape, especially urban trees, to become an excellent example of an ecological city in Africa (Quagraine, 2011). Sadly, like a typical Ghanaian city, the green spaces of the Kumasi Metropolis are being depleted at an alarming rate.

Urbanization requires the provision of various facilities such as residential, industrial, circulatory and commercial for its sustenance. The provision of these facilities in the Kumasi Metropolis not only threatens the maintenance of the dense surrounding tropical rainforest, but also the green spaces within it. Literature has proved that more and more soft green spaces in Kumasi are being converted into impermeable hard concrete surfaces. Rapid urbanization thus, has been identified as a major cause of the depletion of the green spaces in the city of Kumasi (Afrane and Amoako, 2011). Statistics show that several of the green spaces in Kumasi, once the Garden City of West Africa, have been depleted remaining only a small fraction which together with other open spaces constitute about 10.7 percent of the total land area of Kumasi (Amoako and Korboe, 2011).

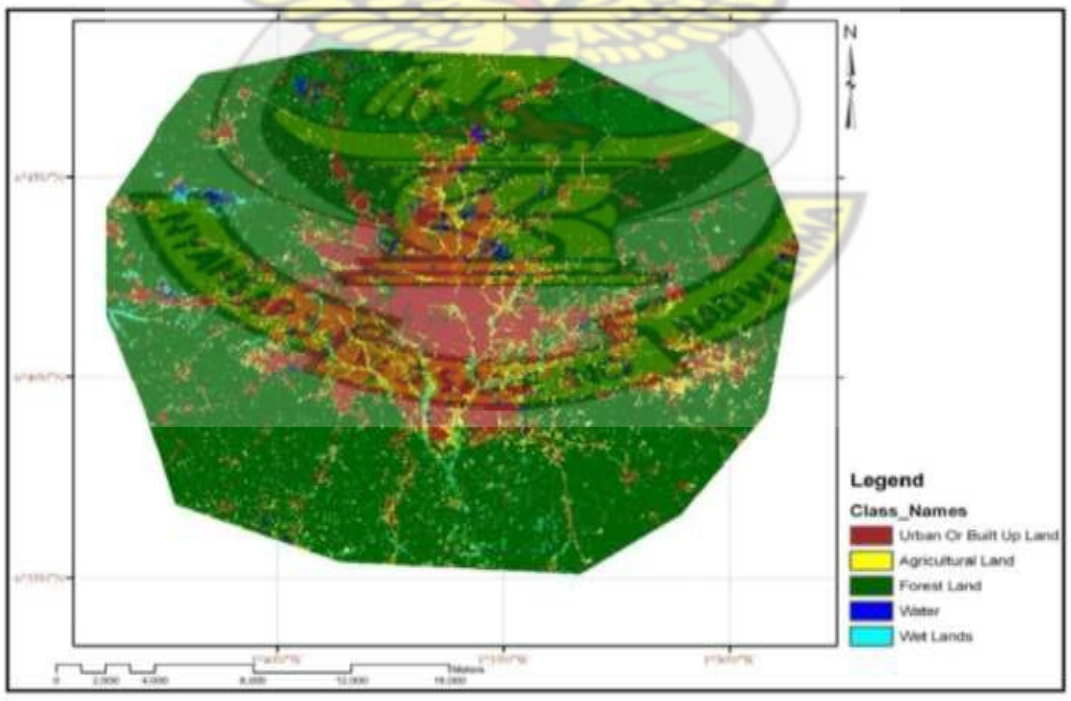


Figure 1.1: Landsat Satellite Image showing Land Cover change of Kumasi in 1986
Source: Tontoh (2011)

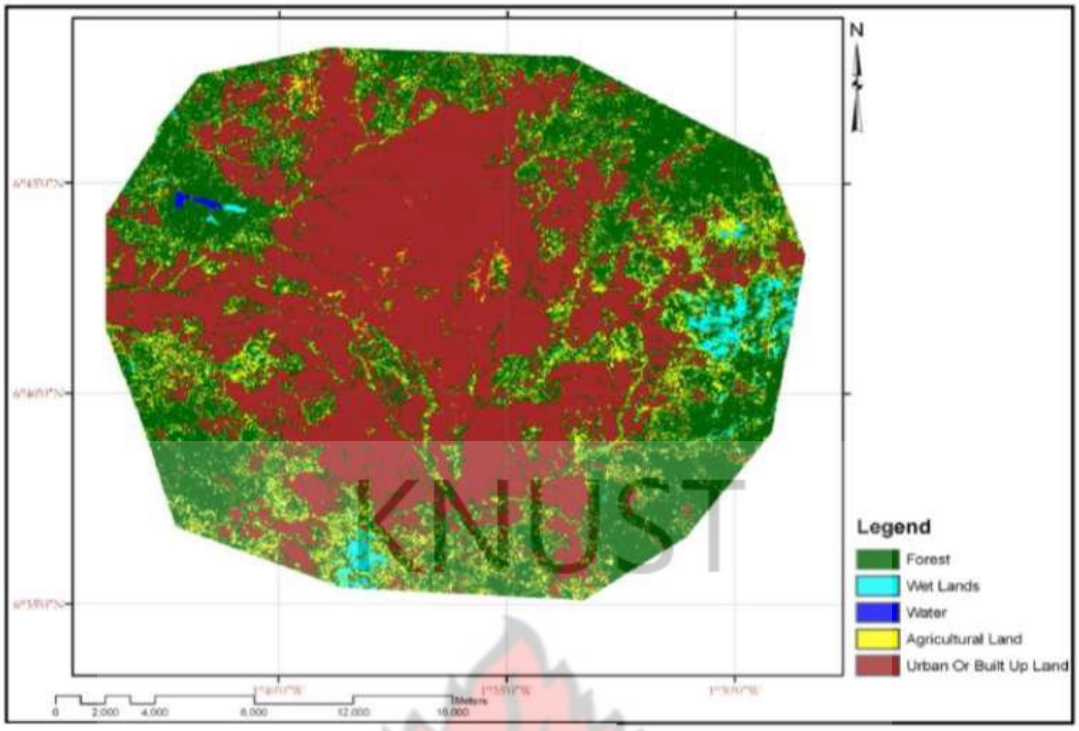


Figure 1.2: Landsat Satellite Image showing Land Cover change of Kumasi in 2007
Source: Tontoh (2011)

As can be seen from the Land Satellite images of Kumasi in Figures 1.1 and 1.2 above, green spaces in Kumasi have depleting as built up land increases .

Pragmatic measures therefore have to be taken to address the depletion of green spaces in the Metropolis lest the Metropolis becomes ecologically dysfunctional as it happened to some cities like the Easter Island and Norse Greenland in the past (Quagraine, 2011).

1.3 Research Questions

The study sets out to find answers to the following relevant question:

What is the extent of green space depletion in Kumasi?

The specific questions the study seeks to find answers to are as follows:

- What is the nature and state of green spaces in Kumasi?
- What factors account for the depletion of green spaces in Kumasi?
- How are green spaces in Kumasi promoted by the development plans of the city?

- What measures can be adopted to promote green spaces in Kumasi?

1.4 Research Objectives

The main objective of the research is to investigate green space depletion in Ghanaian urban settlements with particular reference to Kumasi. Specifically, the study seeks to achieve the following objectives.

- To identify the nature and state of green spaces in Kumasi
- To identify the causes of green space depletion in Kumasi
- To analyse some development plans of Kumasi in relation to green spaces
- To make recommendations that will promote green spaces in Kumasi

1.5 Scope of the Study

The spatial scope of the study was limited to the city of Kumasi, the capital of the Ashanti Region of Ghana. The specific areas within the Metropolis where the study was conducted were Kotei, Atonsu and Fanti New Town. These suburbs were chosen as study areas using the simple random sampling method. In context the study looked at green space depletion in Ghanaian urban settlements with particular reference to Kumasi.

1.6 Justification of the Study

In recent years human society has become increasingly aware of the need to protect the environment in the face of rapid urbanization and has therefore put in place stringent environmental laws to ensure environmental sustainability. In spite of this, there is a wanton disregard for the protection and preservation of the environment in the Kumasi Metropolis.

The findings and recommendations from the study will be very instructive and serve as a reference material for all stakeholders of environmental preservation in the Kumasi Metropolis. It will offer a detailed assessment of the causes of green space depletion in urban settlements in Ghana and the best practices that can be adopted by city authorities to curtail the phenomenon. The adoption of these recommendations by policy makers will go a long way to promote green spaces in our urban settlements. The study also assessed the varying degrees of compliance of zoning regulations by

physical developers in the Metropolis and what actually brought about those observed differences. Finally, the study will provide information which will serve as a basis for further research into issues relating to urban green space depletion.

1.7 Limitations of the Study

Admittedly, a host of difficulties were encountered in the course of undertaking this research work especially with data collection. In spite of the fact that the objectives of the study were vividly explained to the respondents, some of them were reluctant in responding to questions such as those relating to ownership and means of acquisition of land and their compliance with zoning regulations and in some instances refused to provide answers to those questions. Apparently, they feared that by disclosing such information, the KMA might know about their non-compliance and implicate them. The researcher allayed the fears of the respondents by convincing them that the answers they would provide were for pure academic work and also their identities would not be disclosed.

Also, access to information from relevant institutions which were of importance to the research was difficult as some of the respondents from the institutions failed to cooperate with the researcher. The researcher convinced these respondents by clearly explaining to them the purpose of the study. Nonetheless, the findings from this study were sufficiently accurate and reliable to make informed generalization about green space depletion in Ghanaian urban settlements.

1.8 Organization of the Study

The study is divided into five chapters. Chapter one was the introductory chapter and comprised a discussion of the background to the study, the problem statement, objectives, the scope and justification of the study. It also presented the limitations encountered during the study.

Chapter two conceptualized the framework of the study. Concepts used in the study were vividly defined in this chapter to distinguish their meanings from different meanings of similar concepts used elsewhere. The chapter also presented a literature review of concepts related to the topic under study.

Chapter three was devoted to the research methodology. It involved the study design, data requirement and sources, sampling techniques and data collection and analysis on the various concerns relating to urbanization and green space depletion.

Chapter four focused on presentation and discussion of findings using tables, pictures and charts where necessary. Chapter five provided the summary of findings, recommendations and conclusion.

CHAPTER TWO

URBAN AREAS AND URBAN GREEN SPACE

2.1 Introduction

This chapter sought to review relevant literature on urban areas and urban green space. The chapter focused on theories and models of urban growth, urbanization trends across the globe, green space and green infrastructure. The literature review sought to give an in-depth knowledge into issues arising from urbanization on urban green space.

2.2 Urban Areas

The word "urban" was derived from the Latin word urbanus meaning characteristic of, or pertaining to, the city (Macionis and Parrillo, 2007). The interpretation of urban statistics should always be done with caution because measurement of urban growth rests on a definition of 'urban area', which is not standard throughout the world and differs even within the same country depending upon the nature of local jurisdictions and how they might have changed over time (Brockerhoff, 2000; Ioannides and Rossi-Hansberg, 2005). There is no universally accepted definition for an urban population.

About half of the 228 countries for which the United Nations (UN) compiles data, use administrative considerations, such as residing in the capital of the country or of a province, to describe people as urban dwellers. Out of the remainder, 51 distinguish urban and rural populations based on the size or density of locales, 39 depend on functional characteristics such as the main economic activity of an area, 22 have no definition of "urban", and eight countries define all or none of their populations as living in urban areas. Each country's definition is accepted by the UN when it calculates urban estimates and projections. This practice appreciates that various governments know best what features differentiate urban from rural places in their respective countries. However, this approach undermines comparison of urban population data across countries because no standard definition exists (Brockerhoff, 2000).

Although, there is no categorical definition of what comprises "urbanity" there are nonetheless some basic characteristics that are agreed. Basically, an urban setting is defined in relation to, or as forming a core characteristic of, a city or town. Again, urban areas include demarcated geographic zones of dense human habitation and a degree of physical separation from rural areas. Notwithstanding these features: administrative demarcation, dense populations, separation from rural areas – definitions of what comprises urban vary significantly from country to country and city to city. Indeed, most states apply a core set of variables in their definition which often includes a demographic threshold and an index of urban functions which are typically linked to the absence of agricultural land and rural employment (Muggah, 2012). For instance in Ghana, the minimum population for an urban area is five thousand. However in the United States of America and Kenya, settlements with population of two thousand five hundred and above are considered urban (Tamakloe, 1997 in Asamoah, 2010). Depending on all of these criteria, then, countries can be described as either majority urban or rural (Muggah, 2012).

According to Yeboah et al. (2013, p.1), the current definition of urban in Ghana is problematic for two reasons. First, the minimum threshold of 5000 inhabitants is unrealistic because it dates back to the 1960 census when the country had a population of 6,726,815. Today, the country's population of 24,658,606 is almost four times as large and many localities with about 5,000 inhabitants still exhibit agricultural functions. They further argue that, "Ghana Statistical Service should reconsider raising the threshold for defining an urban locality". Second, there is the need to qualify the kinds of urban places in the country if the current threshold of 5000 is maintained to compare trends from year to year.

"Urban" is a place–based characteristic that incorporates elements of population density, social and economic organization, and the transformation of the natural environment into a built environment. Thus, an urban place is a spatial concentration of people whose lives are organized around non-agricultural activities. The crucial feature here is that urban means non-agricultural; whereas rural means any place that is not urban. Admittedly, "urban" is a fairly complex concept. It is a function of sheer population size, space (land area), the ratio of population to space (density or concentration) and economic and social organization. The transformations occurring throughout the world might well call into question this definition, because urban

characteristics of place, especially those related to infrastructure are increasingly and deliberately showing up in places that used to be strictly agricultural in nature (Rashed and Jurgens, 2010).

The terms "urban" and "rural" are still often used colloquially, as if they were clearly different and even mutually exclusive, and most people have clear mental conceptions of some ideal landscape corresponding to each. However, this simple dichotomy has long ceased to have much meaning, either in practice or for policy-making purposes in many parts of the South, not least sub-Saharan Africa. This is because rapid urban population growth and an expansion of the built-up area, technological change, global economic restructuring and the impact of externally-driven macro-economic adjustment policies have combined to alter the interface between "urban" and "rural" quite profoundly in many places. Nowhere is there a neat dividing line where the city meets the savannah, bushveld, forest or desert (Simon et al., 2004). Thus, the urban-rural divide is becoming very subtle as the world population grows, as the fraction of humans living in cities increases, and as technology continues to transform human society (Rashed and Jurgens, 2010).

Urban places are now home to virtually one of every two human beings and, by the middle of the twenty-first century, nearly two out of every three people will be urban dwellers (Rashed and Jurgens, 2010). This is a truly remarkable transformation considering the fact that in 1850 only 2 percent of the entire population of the world lived in cities of 100,000 or more people. By 1900 that figure had edged up to 6 percent and it had risen to 16 percent by 1950 (Davis, 1972 in Rashed and Jurgens, 2010). Today the world is dotted by places with 100,000 or more people, and it is so commonplace that a city of that size is considered to be very small (Rashed and Jurgens, 2010).

A dominant feature of the demographic transition of most countries is a shift in the distribution of the population from rural to urban places. The world's urban population in 1970 was 37 percent of the total. The population rose to 47 percent in 2000 and it was estimated that by the year 2010 the urban population would have surpassed the rural population and urban residents would comprise 56 percent of the total by 2020 (United Nations, 2000). Also, in the year 2000 the United Nations projected that whiles the world's rural population would increase by about 4 percent

over the next two decades the urban population would grow by as much as 47 percent rising from 2.8 to 4.2 billion people.

Urban growth is concentrated in certain areas of the world and has significant impacts in those areas. High rates of urbanization typically results from rapid urban growth (United Nations, 2001). The urbanization process is normally characterized by an attenuated S-shaped curve, which has increases in levels of urbanization most rapid during the middle stages of economic development (Davis, 1968 in United Nations, 2001). The experience of present developed countries tends to corroborate the above hypothesis, with slowing levels of urbanization occurring for these countries in the last quarter of this century. On the contrary however, growth in urbanization has increased in developing countries over the same period (United Nations, 2000).

Most urban growth is now occurring in developing countries. The levels of urbanization in developed countries remain much higher than those of developing countries, but the gap is rapidly closing up. There was a 43 percentage point difference in levels of urbanization between developed and developing regions in 1975. This had been reduced to a 37 point difference in 1995. The difference is projected to decline even further to 32 percentage points by 2015 (United Nations, 2000).

2.3 Urbanization

According to Glenn (1984), the term urbanization as traditionally measured by demographers is urban population divided by total population of a region. It can also be defined as the annual rate of change of the percentage of people living in urban areas, or the difference between the growth rate of urban population and that of total population (Hope et al., 1999).

Urbanization, as defined by Nsiah-Gyabaah (2003) is the "shift from a rural to an urban society, and involves an increase in the number of people in urban areas during a particular year". He further argues that urbanization is the outcome of the social, economic and political developments that lead to urban concentration and growth of large cities, changes in land use and transformation from rural to metropolitan pattern of organization and government. In effect, urbanization affects all spheres of human life both in the rural and urban setting.

Asamoah (2010) also argues that urbanization is the process and the rate at which human activities and population are attracted to a locality or point in space within relatively short period of time. According to her, the term urbanization can be defined as "the rapid development and transformation of a region including increases in the size, population and human activities at a given period of time".

The work of Naab et al. (2013) reveals that urbanization affects all sectors of the economy. At the heart of urbanization are cities (Drescher and Iaquinta, 2002). Cities are considered as the cause of environmental degradation and resource depletion, casting an ecological footprint across the globe, far beyond their immediate regions (Girardet, 1996 in Jenks and Burgess, 2004).

More often than not, cities are seen as congested, polluting, with poor housing, collapsing infrastructure, crime and poverty. In spite of these, it is cities that drive economies and it is within them that innovation occurs and an increasing part of global output is produced (Jenks and Burgess, 2004). Cities are seen as indicators of humankind's "progress" into the 21st century, but it remains to determine the ways in which this progress is beneficial and those in which it is detrimental. Concentration of the economic, social, political and administrative organs of a nation or region in cities has made them magnets for rich as well as poor households. Yet cities are only one part of urbanization; urbanization is also the transformation of rural consciousness and the summation of many individual decisions although they are not the whole picture (Drescher and Iaquinta, 2002).

Cities may have problems, but they are not necessarily a problem in themselves (Jenks and Burgess, 2004). In particular, Mitlin and Satterthwaite (1996) have noted that the poor environmental performance of many cities rather than inherent characteristics of cities in general can be attributed to failure of effective governance.

Urban growth as an economic phenomenon is inextricably linked with the process of urbanization. Urbanization itself has punctuated economic development. The spatial distribution of economic activity, measured in terms of population, output and income, is concentrated. The patterns of such concentrations and their relationship to measured economic and demographic variables constitute some of the most intriguing phenomena in urban economics. They have significant implications for the economic role and size distribution of cities, the efficiency of production in an economy, and

overall economic growth. As economies move from those of traditional societies to their modern stage, the role of the urban sector changes from merely providing services to leading in innovation and serving as engines of growth (Ioannides and Rossi-Hansberg, 2005).

Urbanization strongly influences the growth process influencing both the efficiency of growth and the extent of income inequality within an economy. In turn, growth influences the urbanization process, driving the spatial evolution of production and population agglomeration (Black and Henderson, 1999).

Urbanization occurs as countries shift sectorial composition away from agriculture into industry and as technological advances in domestic agriculture release labour from agriculture to migrate to cities. Urbanization, the shift of population from rural to urban environments, is typically a transitory process, albeit one that is socially and culturally traumatic. As a country develops, it moves from labour-intensive agricultural production to labour being increasingly employed in industry and services. The latter are not land-intensive and are situated in cities because of agglomeration economies. Thus urbanization moves populations from traditional rural environments with informal political and economic institutions to the relative anonymity and more formal institutions of urban settings. That in itself requires institutional development within a country. Spatially, it separates families, particularly by generation, as the young migrate to cities and the old stay behind. Urbanization is a spatial evolution process. By upper middle income ranges, countries become "fully" urbanized, in the sense that the percent urbanized levels out at 60-90% of the national population living in cities. The actual percent urbanized with full urbanization varies with geography, the role of modern agriculture in the economy, and national definitions of urban (Henderson, 2004).

2.4 Trends of Urbanization

According to the UN-Habitat (2006), large cities sprung up in Europe and the United States after the Industrial Revolution and many of the largest and fast-growing cities are found in developing countries of Africa, Asia, Central and South America. Cities however, first arose some ten thousand years ago, and were found mainly in Southeast Asia and the Mediterranean region (UN-Habitat, 2006). The report further states that currently, close to half of the world's population is urbanized and this is expected to

increase to 80-90 per cent in forty years' time. It also states that in regard to future trends, it is projected that 93 percent of urban growth would take place in Asia and Africa and to a lesser extent in Latin America and the Caribbean. The report again indicates that, over six billion people, representing two thirds of humanity, would be residing in towns and cities by 2050. This clearly shows that urbanization is occurring at a very rapid and alarming rate. Accordingly, rapid urbanization needs much attention by policy makers in countries all over the world.

2.4.1 Trends of Urbanization in Africa and the World

The population of the world reached 6.1 billion in 2000 and is now growing at an annual rate of 1.2 percent. By 2030, the figure is projected to reach 8 billion. However, from a population of 221 million in 1950, Africa witnessed a dramatic increase to 785 million in 2000. Notwithstanding decline in population growth rates since the mid 1980s, Africa remains the fastest growing region in the world at an estimated rate of 2.4 percent per annum. Africa will attain an estimated population of 1.4 billion by the year 2030, even though future growth rates are anticipated to be lower (UNDP, 1999). Hope and Lekorwe (1999) assert that even in Africa, there are differences among sub-regions. For instance, in 1990, approximately 22 percent of East African population resided in urban areas compared to 33 percent, 38 percent, 45 percent and 55 percent for West Africa, Middle Africa, North Africa and Southern Africa respectively. This is projected to be maintained through 2025, although at a higher level (Hope and Lekorwe, 1999). The percentage of urban dwellers is projected to vary from about 47 percent in Eastern Africa to about 74 percent in Southern Africa. As depicted in Table 2.1 current urban growth rates are high for every region in Africa but much lower in East Africa and this trend is expected to persist to the decade.

Table 2.1 Percentage of African Population Residing in Urban Areas by Region

Region	1990	1995	2000	2005	2010*	2015*	2020*	2025*
Africa	33.9	37.3	40.7	44.0	47.4	50.7	53.9	57.1
Eastern	21.8	25.4	29.0	32.5	36.0	39.6	43.2	46.8
Middle	37.8	41.6	45.6	49.5	53.5	57.0	60.4	63.6
Northern	44.6	47.9	51.2	54.5	57.7	60.7	63.6	66.3
Southern	54.9	58.2	61.3	64.2	66.8	69.3	71.6	73.8
Western	32.5	36.1	39.8	43.6	47.3	51.0	54.6	58.0

Source: United Nations World Urbanization Prospects, 2006.

* These are projected figures based on 2005 figures.

Over the last few decades, cities in both developing and developed countries have emerged as the major form of human settlement. Today more people live in and around cities than in rural areas. In 1800, only 50 million people lived in towns and cities worldwide. By 1975 there were 1.5 billion, and in 2000, there were three billion—more than the entire population on Earth in 1960 (Drescher and Iaquinta, 2002). Also, according to the UNFPA (2000), in 1999, 47%, or 2.8 billion, of the world's population lived in cities, and this is set to increase by around 60 million people each year. It also projected that by 2030 'nearly 5 billion (61 percent) of the world's 8.1 billion people will live in cities' (UNFPA, 2000).

Of the urban population, for every one person now living in cities in developed countries, there are two in the cities of the developing world. Within 30 years this proportion is predicted to rise to 1:4, indicating that 90% of the growth in urbanization will be in developing countries (Jenks and Burgess, 2004). In these countries the expansion of urbanization is occurring on an unimaginable scale. Very large cities, the megacities with populations of over 10 million people are becoming commonplace. In 1960, New York and Tokyo were the only megacities in the world, but by 1999 there were 17. In another 15 years projections suggest there will be at least 26 such cities, 22 of which will be in developing countries, and 18 of these in Asia (UNFPA, 1999).

Table 2.2: Ranking of World Ten Largest Metropolitan Areas, 1950 – 2015.

	1950		1995		2015*	
Rank	Cities	Inhabitant (millions)	Cities	Inhabitant (millions)	Cities	Inhabitant (millions)
1	New York	12.3	Tokyo	27.0	Tokyo	28.9
2	London	8.7	Mexico City	16.6	Bombay	26.2
3	Tokyo	6.9	Sao Paulo	16.5	Lagos	24.6
4	Paris	6.4	New York	16.3	Sao Paulo	20.3
5	Moscow	6.4	Shangai	15.1	Dhaka	19.5
6	Shangai	5.3	Bombay	13.6	Karachi	19.4
7	Essen	5.3	Los Angeles	12.4	Mexico City	19.2
8	Buenos Aires	5.0	Calcutta	11.9	Shangai	18.0
9	Chicago	4.9	Buenos Aires	11.8	New York	17.6
10	Calcutta	4.4	Seoul	11.6	Calcutta	17.3

Source: United Nations World Urbanization Prospects, 2006.

* These are projected figures based on 2005 figures.

Table 2.2 above shows the ten largest metropolitan areas in the world for the period between 1950 and 1995 together with 2015 projections. It indicates high urbanization rates. With the exception of New York, the population of the other largest metropolitan areas did not exceed ten million in 1950. However, within a period of four to five decades, the least of the ten cities in population had over eleven million inhabitants. The population of all ten cities had doubled by 1995. According to the 2015 projections, the population of all cities will continue to increase. The population of Tokyo will however increase by four times its population in 1950. The table also depicts that by 2015 the population of only one West African city, Lagos will be on the ranking list. Its population will be about 25 million.

2.4.2 Trends of Urbanization in Ghana

With an annual growth rate of about 2.5%, the population of Ghana is constantly on the increase. This eventually increases the trends of urbanization in the country as shown in the Table 2.3 below.

Table 2.3: Total Population and Percentage Urbanized, 1921-2010

Year	Total Population	Percentage Urbanized	Urban Population	No. of Urban Settlements
1921	2,298,000	7.8	179,244	-
1931	3,163,000	9.4	297,322	-
1948	4,118,000	12.9	570,597	41
1960	6,727,000	23.1	1,551,174	98
1970	8,559,000	28.9	2,472,456	135
1984	12,296,000	32.0	3,938,614	203
2000	18,912,000	43.8	8,278,636	364
2007	23,000,000	49.0	11,270,000	492
2010	24,658,823	51.0	12,545,229	636

Source: Ghana Statistical Service, 2010.

From Table 2.3, less than 10% of the total population lived in towns and cities by 1921 and this value increased drastically to more than 51% barely in 2010. However, this concentration is dominated by few centres, mainly Accra in the coastal belt, Kumasi in the middle belt, Tamale in Northern and Sekondi-Takoradi in the Western region of Ghana. Consistent with observed trends in other parts of Africa, Ghana's population is becoming increasingly urbanized. In recent times, more than forty percent of Ghanaians live in the city or town with more than 5000 people. More than half of Ghanaians would live in urban settlements by the year 2020 if these current trends should continue (Naab et al., 2013).

2.5 Urban Theory and Modelling

In their work *Models in Geography*, Chorley and Haggett (1967), described a model as a theory, a law, a hypothesis, a structured idea, a role, a relation, an equation or a series of equations, a synthesis of data, a word, a map, a graph, or some type of computer or laboratory hardware arranged for experimental purposes (Lui, 2009).

Different models are used to generally describe urban growth and land use change. Many of these models were developed to generalize the patterns of urban land use found in early industrial cities of the developed countries. New models of urban land use patterns were developed to describe urban landscape that was becoming increasingly complex and differentiated due to changes in the shape and form of cities over time (Asamoah, 2010).

According to Liu (2009), the use of models in urban research has its origins in von Thünen's classical model of agricultural location (von Thünen, 1826). Lui (2009) further states that in von Thunen's famous book, *Der IsolierteStaat*, published in 1826, he considered the relationship of three factors: the distance of the farmers from the market, the prices received by the farmers for their goods, and the land rent. Von Thunen hypothesized based on an econometric analysis of the estates in Mecklenburg in north Germany, where he farmed for 40 years that the intensity of land use was inversely proportional to the transportation cost or distance from the market. Henshall (1967) as cited by Liu (2009) also argues that in an "isolated state" with only one central city as the sole market and a uniform plain surrounding the city, this generates a concentric land-use pattern with the least intensive land use located the farthest away from the city centre.

Many models of urban development are related to von Thünen's model. For instance, Weber's (1909) *Industrial Location* could be regarded as the first model of urban growth. Later on, Christaller (1933) developed his *Central Place Theory* to model urban growth patterns in a regional context. With regard to the internal urban structure, the three classical models of urban growth and urban land-use are Burgess' (1925) *Concentric Zone Model*, Hoyt's (1939) *Sector Model*, and Harris and Ullmans' (1945) *Multiple Nuclei Model* patterns. The basis of these models is the understanding of urban development from the central business district (CBD) outwards (Lui, 2009). Again, it must be stated that these are general models devised to understand the overall pattern of land use. Therefore, none of them can accurately describe patterns of urban land use in all cities (Asamoah, 2010).

Critics argue that, most of these models are more applicable to cities in the United States of America than to cities of other nations (Graham, 1993 in Asamoah, 2010). The static nature of the models has also been widely criticized. Criticism again focuses on the fact that the models describe patterns of urban land use in a generic city, but do not describe the process by which land use patterns change. Nonetheless models continue to be useful generalizations of the way in which land is devoted to different uses within the city (Asamoah, 2010).

Lui (2009) also states that many of the models are static, with little or no regard for the dynamic nature of urban development. He further argues that, many models were

based on assumptions that were far from practical; they were by no means operational.

2.5.1 The von Thunen Model

Early in the 19th Century von Thunen developed a model of land use that showed how market processes could determine how land uses were spatially distributed over a theoretical geographic area (Figure 2.1). It is easiest to explain this model in the context of agricultural land use. The model is based on the following limiting assumptions:

- The city is located centrally within an "Isolated State" which is self- sufficient and has no external influences.
- The Isolated State is surrounded by an unoccupied wilderness.
- The land of the State is completely flat and has no rivers or mountains to interrupt the terrain.
- The soil quality and climate are consistent throughout the State.
- Farmers in the Isolated State transport their own goods to market via oxcart, across land, directly to the central city. Therefore, there are no roads.
- Farmers act to maximize profits.

If the above statements were true in an Isolated State, von Thunen hypothesized that the agricultural land uses would segregate into a spatially hierarchic structure.

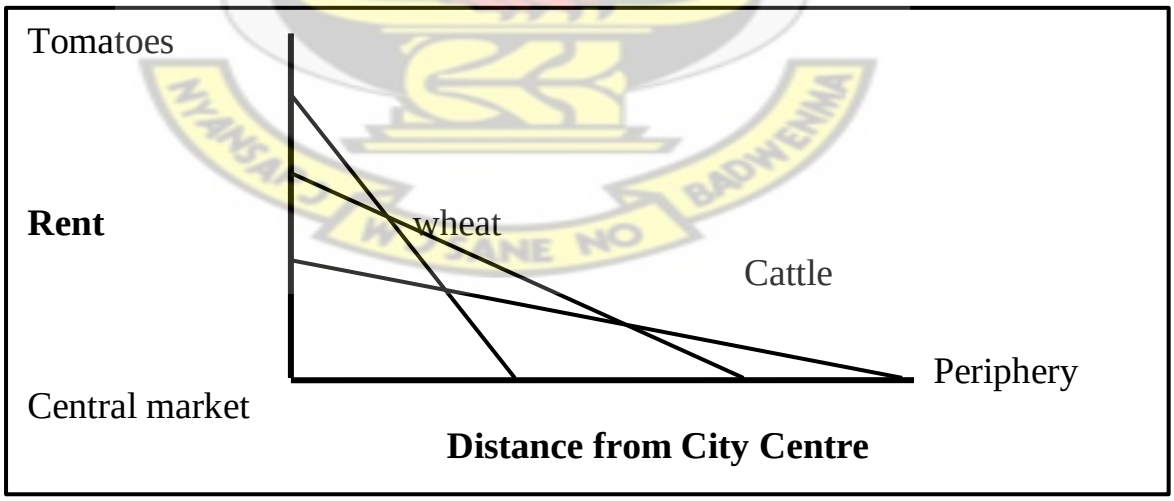


Figure 2.1: The von Thunen Spatial Organization of Agricultural Land Uses

Source: Candau, 2002.

Occurring closest to the city are dairying and intensive farming. Vegetables, fruit, milk and other dairy products would be produced close to the city because they must get to the market quickly. Since grains last longer than dairy products and fresh produce they can be located further from the city centre. Ranching is located in the most peripheral areas surrounding the central city. Animals are self-transporting and so they can be raised far from the city. Animals can walk to the central city for sale or for butchering. Beyond the ranch land lies the unoccupied wilderness, which is too great a distance from the central city for any type of agricultural product. Even though the von Thunen model is simplistic and created in a time before factories, highways, and even railroads, it is still an important model in geography. The von Thunen model is an excellent illustration of the balance between land cost and transportation costs. As one gets closer to a city the price of land increases. The farmers of the Isolated State balance the cost of transportation, land, and profit and produce the most cost-effective product for market (Candau, 2002).

2.5.2 Concentric Zone Theory

The Concentric Zone Model is one of the early descriptions of urban form (Asamoah, 2010). This theory views the functional zonation of land use in the city as a series of concentric land use rings centred on the Central Business District (CBD). The Concentric Zone Theory evolved as an explanation of historical urban land use development in Chicago. Unlike the von Thunen approach, Burgess offers a descriptive rather than analytical account of these urban dynamics. It is proposed that a city's land use may be classified as a series of concentric zones and that the city grows by expanding these zones outward (Amin, 2007). Thus, as the city grows, each ring places pressure on the ring surrounding it to expand (Carter and Polevychok, 2006).

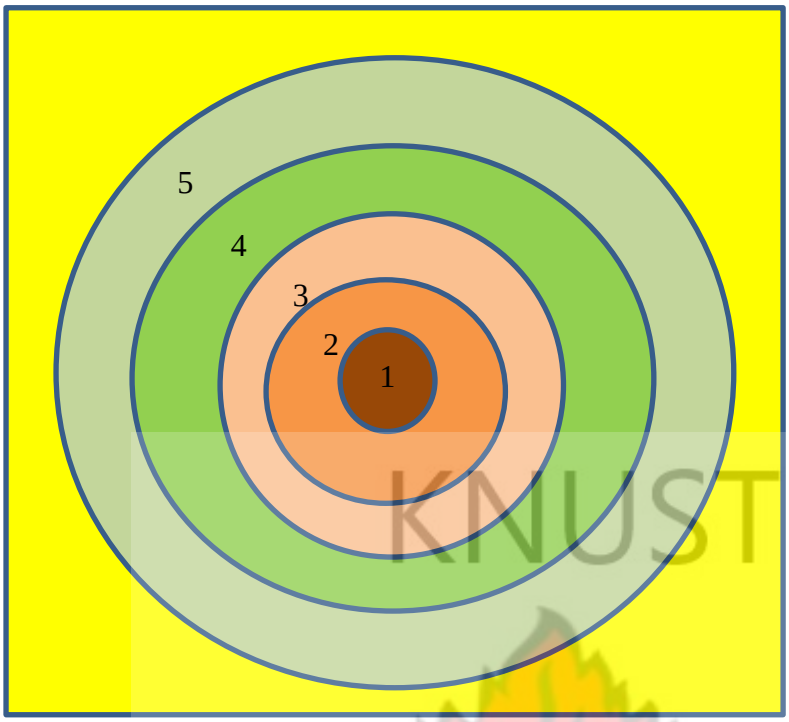
Zone I is the Central Business District (CBD) and lies at the centre of the city. Most economic activities take place at the CBD because it is the focus of an intra-city transport (Chauncy and Ullman, 1945 in Asamoah, 2010). This gives the CBD a locational advantage in terms of greatest accessibility to the whole of the urban area. Such distinctions however, do not occur in rural areas. The demand for site in the CBD is very great because of the advantage of accessibility. In addition, there is high land value in this area and this results from the restricted supply of land. The centrally placed characteristics of the CBD make it a focal point of commercial, social and

civic life of the urban centre. Land in this area takes the form of shops, offices and hotels. Also, this core area is normally the original settlement which explains the centrality of the place (Asamoah, 2010).

Next is the multi-use transitioning Zone II with some migrant ghetto residences mixed with manufacturing. Zone III is characterized as a working class neighbourhood. Amongst the factories are second-generation immigrants living in older homes with few amenities. Zone IV is occupied by middle class commuters. The homes are newer and more spacious than those of Zone III. Zone V is for the upper class and is dominated by better quality housing and extensive amenities (Amin, 2007).

The concentric theory therefore asserts that functionally related activities with similar characteristics will cluster at the same location at a certain distance from the centre of an urban area. This essential feature of the model suggests a positive correlation between socio-economic status of households and distance from the CBD. It is observed that more affluent households live at greater distances from the city centre. The CBD would exert pressure on the zone immediately surrounding it as the city grows and develops over time. Outward expansion of the CBD would invade nearby residential neighbourhoods causing them to expand outwards. The process is thought to continue with each successive neighbourhood moving further away from the CBD (Asamoah, 2010).

It is argued that where variations occur in such factors as topography of the physical landscape, the ideal symmetry would be disturbed. Also, the model can be affected by the fact that there may be sub-divisions in residential areas by race. Critics again argue that the theory failed to critically look at the development of complementary clusters and the possibilities which give rise to focal points other than the CBD. Also, the theory is criticized for assuming that the higher the income the further away a household is likely to locate from the centre. From an economic perspective, this connotes that accessibility or access considerations are more than offset by preferences for space. Hence, the specialized pattern of land use produced by the theory points only to the relevance of accessibility to the CBD. Notwithstanding these criticisms against the theory, it is of great importance in explaining how land use in an urban area is structured (Asamoah, 2010).



1. Central Business District
2. Transition Zone
3. Working Class Residential
4. Middle Class Residential
5. Upper Class Residential

Figure 2.2: Concentric Zone Model

Source: Amin, 2007.

Like von Thunen, Burgess assumes a generalized geographic space and strict action space. Additionally, the important influence of topography and transportation are ignored, and the monocentric city is unreasonable for representing real land use patterns (Amin, 2007).

This theory was more applicable to the pre-World War II city which was monocentric in nature (one central commercial/retail district), developed at higher densities, more reliant on public transportation, and less dominated by the automobile (Carter and Polevychok, 2006).

2.5.3 The Sector Model

The Sector model of urban land use was developed by Homer Hoyt in 1939 and was an improvement upon Burgess' Concentric Zone Model (Candau, 2002). This model is concerned with Residential Land Use, which suggests that functional land use zones will be wedge-shaped sectors radiating outward from the Central Business District. The sector model derives from the notion that high rent areas are found in wedge shapes and extend out in sectors along radial lines from the central business district to the urban periphery (Amin, 2007).

Hoyt observed some consistent patterns in many American cities. For example, it was common for low-income households to be found in close proximity to railroad lines.

Also, commercial establishments have been found along business thoroughfares. Therefore, Hoyt modified the concentric zone model to account for major transportation routes (Asamoah, 2010). Based on residential land patterns in the United States, the location of business is referred to indirectly (Amin, 2007).

According to Torrens (2000), "the model seeks to explain the tendency for various socio-economic groups to segregate in terms of their residential location decision. The model again suggests that, over time, high quality housing tends to expand outward from an urban centre along the fastest travel routes". The sector model considers direction in addition to distance as factors shaping residential allocation. Kivell (1993) argues that, the model recognizes that the CBD is not the only focal point of urban activity (Amin, 2007). In many respects, Hoyt's sector model is simply a concentric zone model modified to account for the impact of transportation systems on accessibility and land values (Asamoah, 2010). Refer to Figure 2.3.

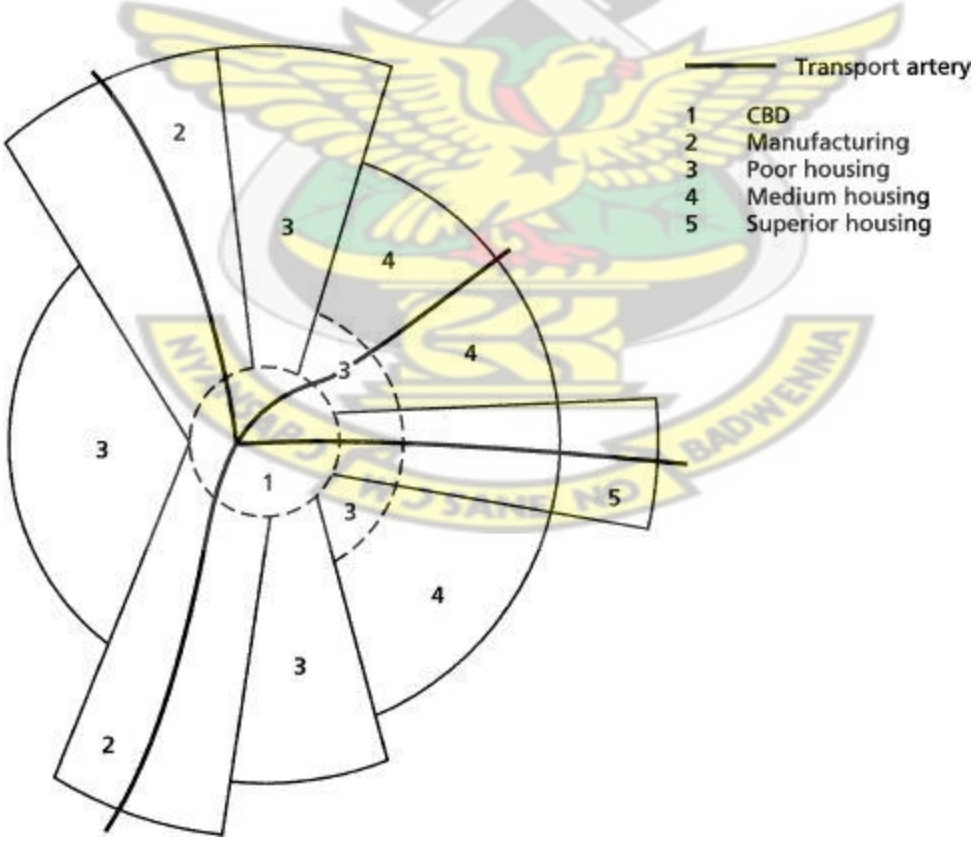


Figure 2.3: The Sector Model.

Source: Adapted from Candau, 2002.

2.5.4 The Multiple Nuclei Model

This model, which is closer to reality views a city as growing and assumes that urban growth takes place around several distinct nuclei. These nuclei could include a market, a nearby village, a factory, a mine or a railway terminal. Ultimately, all the nuclei would be combined into one urban area largely agglomerated by residential use and intra-city transportation. At the centre of the model is the CBD with light manufacturing and wholesaling located along transport routes (Chauncy and Ullman, 1945).

The model argues that cities of greater size develop into substantial suburban areas. Subsequently, some suburbs which reach significant size function like smaller business districts. These smaller business districts act as satellite nodes or nuclei of activity around which land use patterns form. Under this theory, the CBD is still seen as a major centre of commerce. This suggests that specialized cells of activity would develop according to specific requirements of certain activities and different rent-paying abilities. It is also suggested that there is a high tendency for some kinds of economic activity to cluster together. Heavy industry is thought to locate near the outer edge of the city, perhaps surrounded by low-income households. Suburbs of commuters and smaller service centres occupy the urban periphery.

The model has nine zones. Zone 1 is represented by Central Business District, Zone 2 is a Zone of Wholesale Light Manufacturing and Zone 3 is a Low Class Residential Zone. Zone 4 is occupied by Medium Class Residential Zone whilst Zone 5 is a High Class Residential Zone. Others are Zone 6 represented by Heavy Manufacturing, Zone 7 by Outlying Business District, Zone 8 by Residential suburb, and Zone 9 made up of Industrial Suburb Zone (Candau, 2002). Refer to Figure 2.4.

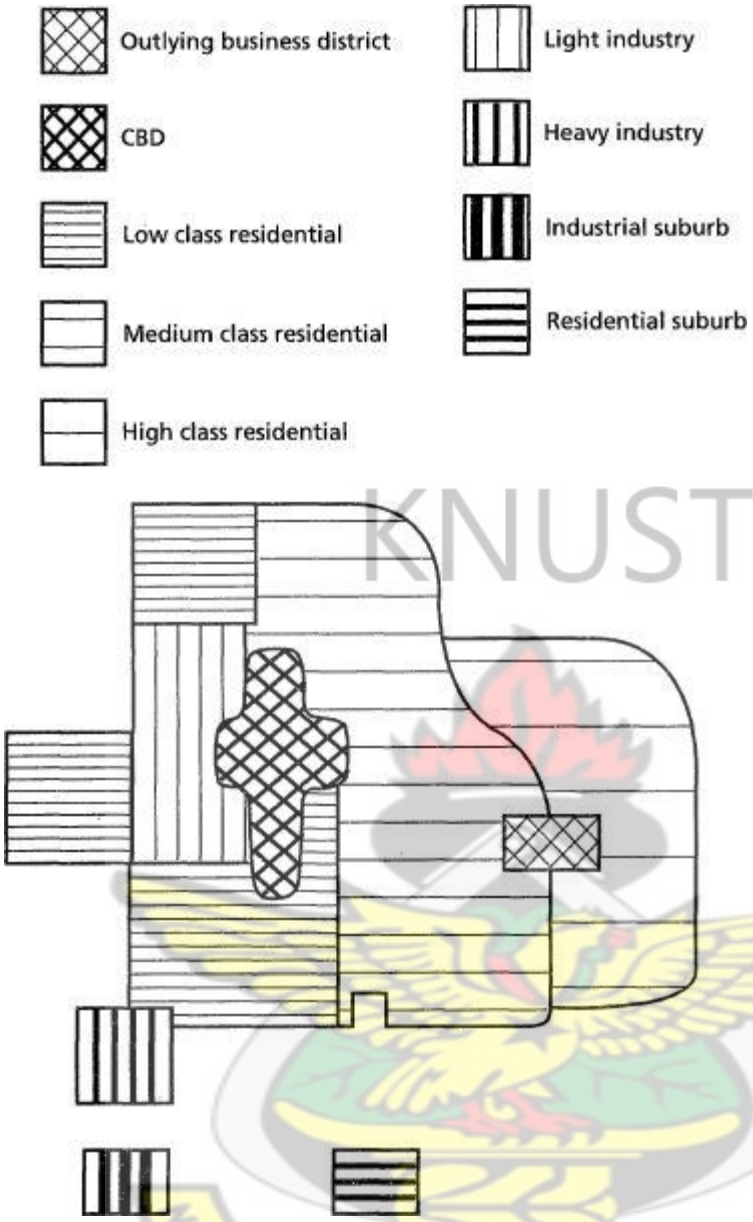


Figure 2.4: The Multiple Nuclei Model

Source: Adapted from Candau, 2002

2.6 Concepts and Terminologies Associated with Green Areas

A large number of concepts and terms have emerged in academics and policies to describe and define green areas as a result of increasing recognition of and emphasis on the importance of urban "nature". These concepts and terms are presented as general umbrella concepts or indicate specific types of green areas. Related to the umbrella ones are natural green space, green space (system/network) or green open space, urban greening, (public) open space, and green (infra) structure, etc. For the specific types, the examples may include urban forest or forestry, urban woodland,

community forest or forestry, and urban wilderness in addition to traditional parks and gardens (Shan, 2009).

The emergence of these (new) concepts and terms has reflected the development in relation to increasing understanding and recognition of the role of green areas in cities. Associated to urban development, understandings of nature in cities have shifted from an originally romantic and aesthetic attitude, through a functional view related to health and recreation, to an ecological emphasis beginning from the late 20th Century. One fact however remains; these views of nature in cities co-exist nowadays, with the functional (health) and ecological considerations dominating. This in turn generates that these concepts and terms are frequently used loosely and interchangeably in the literature (Shan, 2009). It is therefore imperative for a systematic review to be made on the terms and concepts.

2.6.1 Natural Green Space

The term natural green space as defined in *English Nature* (2000) is "land, water and geological features which have been naturally colonised by plants and animals and which are accessible on foot to large numbers of residents". According to Harrison et al., (1995 pp.1-2), its surface is "predominantly natural: earth, water and living things".

According to Shan (2009) the definition specifically covered the following:

Sites awaiting redevelopment which have been colonised by spontaneous assemblages of plants and animals;

Land alongside water-ways, transport and service corridors which although perhaps once deliberately landscaped or planted are now mixtures of planted and spontaneous assemblages;

Tracts of 'encapsulated countryside' such as woodlands, scrub, heathlands, meadows, and marshes which through appropriate management continue to support essentially wild plant and animal assemblages. Often these natural areas exist within the framework of formally designated public open space; ponds, ditches, rivers, lakes and reservoirs;

The less intensively managed parts of parks, school grounds, sports pitches, golf courses, churchyards and cemeteries; Incidental pocket-sized plots along residential

and commercial roads, pathways, car-parks and property boundaries, including walls and built structures which are often spontaneously colonised by plants and animals; Allotments, orchards and gardens.

He also explains that the term refers to areas colonized naturally by plants and animals and are under little human influence. Clearly, naturalness was given high priority and the term represents the view of ecologist and conservationist. However, in theory, the strictly "natural" definition is not applicable in cities because it underscores nature's own independent process and being unchanged by human activity and may thus exclude all artificial or modified types of vegetation, or nature of the third kind (Shan, 2009). Fact is that, these vegetated areas, whether man-made or modified, predominate in urban green landscapes and can also have high value of biodiversity, particularly many large parks for example. Also, using the definition strictly necessitates complete knowledge of the site history so that one can decide whether a site has been naturally colonized or is the product of planting and extensive management (Shan, 2009).

2.6.2 Green Space

Concepts that support the incorporation of green spaces into the physical landscape of urban areas to enhance the living condition in these areas have been propounded by various scholars. Emphasis on the preservation of urban natural environment (green spaces) was made by some of the earliest urban utopian concepts like Charles Fourier's fantasy villages called "phalansteries", Ernest Callebach's novel "Ecotopia," and the most famous Ebenezer Howard's "Garden City," (Roelofs, 1999) and George Cadbury's "Bournville Village" (Adjei Mensah, 2014) which are all significant landmarks in green city movements. Dunett et al (2002) and Swanwick et al. (2003) suggest that the term "green space" is a more recent term and its origin can be traced from the urban nature conservation movement and the European thinking about green space planning which started in UK. Green space is a vital part of the public realm. Attractive, safe and accessible parks and green spaces contribute positive social, economic and environmental benefits, improving public health, well-being and quality of life (CABE, 2004). Adjei Mensah (2014) states that the meaning of green space is often confused with other terminologies in urban planning particularly open space and public open spaces and in most cases these terms are used loosely or interchangeably. He also states that to clarify the meaning of green space and

differentiate it from other concepts in the urban landscape, some authors came up with the following definitions.

Shan (2009) asserts that green space is a recent term which originated from the urban nature conservation movement and the European thinking about green space planning. According to the Greenspace Scotland (2008), green space refers to any vegetated land or water within or adjoining an urban area and includes: 'natural' green space, green corridors and amenity grassland, parks and gardens. It also includes outdoor sports facilities, playing fields, cemeteries and allotments and derelict, vacant and contaminated land. It is also defined as those spaces made up of soil surface area capable of supporting vegetation growth (Greenspace Scotland, 2008).

Forsyth (2003) states that a green space consists of several outdoor places with substantial amounts of vegetation which is often recruited to reflect the human dimensions. Kit Campbell Associates (2001) also describes a green space as any vegetated land or structure, water or geological feature within urban areas. These spaces according to Forsyth (2003) include urban parks and other green areas that may have some "natural" looking constituents but be actually designed, planted, and conserved by people.

According to the European Union (EU), urban green space is defined as "public green space located in urban areas, mainly covered by vegetation which are directly used for active or passive recreation, or indirectly used by virtue of their positive influence on the urban environment, accessible to citizens, serving the diverse needs of citizens and thus enhancing the quality of life in cities or urban regions" (URGE- Team, 2004, p. 13 in Booklet 2).

In Ghana, urban green space refers to "unused landscapes in cities or towns such as parks which have sufficient greenery on them to make them ameliorate the harsh conditions engendered by concrete buildings/structures in such areas" (Barnes, 2014).

In China, the term urban green space refers to "all the green land/area covered by vegetation city-wide" (Ministry of Housing and Urban-Rural Development, 2002). Thus, urban green space includes everything in cities that has vegetation (Gairola and Noresah, 2010).

Urban green space (UGS) can also be defined as "all publicly owned and publicly accessible open space with a high degree of cover by vegetation, e.g. parks, woodlands, nature areas and other green space. It can have a designed or cultural character as well as a more natural character" (Schipperijn, 2010).

Bonsignore (2003) also defines urban green space as "outdoor settings that contain significant amounts of vegetation". Swanwick et al. (2003, pp.97-98) define urban green space as "land that consists predominantly of unsealed, permeable, 'soft' surfaces such as soil, grass, shrubs and trees … whether or not they are publicly accessible or publicly managed". Jim and Chen (2003, p.95) assert that "green spaces in cities exist mainly as semi-natural areas, managed parks and gardens, supplemented by scattered vegetated pockets associated with roads and incidental locations."

According to Iuculano and Ubaldo (1992) in Fratini and Marone (2011), the term "urban green-space" is used to describe those portions of a territory not constructed on, of private character (green-space intended to increase the enjoyment of the owner, a private subject) or of a public nature (green-space intended to increase public use through discharge of functions in favour of average citizens), that coexist with the structures and the manmade features and are intended for enjoyment and health of the citizens on the whole.

Chen (2013) notes that while there are differences between definitions of UGS in various countries two striking features are common as regards the use of the concept. The features are:

1. Dominance of vegetation;

2. An entire geographical area influenced by urbanization (the entire territorial area, not only built-up areas);

It has also been identified that the concept "urban green space" is an oxymoron embracing incompatible features. Juxtaposed with a built-up concrete area representing "extreme" intervention in the natural process, green space in cities does not completely change the inherent "naturalness" of the land (such as still providing ecosystem services and supporting natural processes). In this regard, urban green space is very essential in the protection of some land from extreme human activities

and interventions, and balancing conflict between sealed concrete areas and unsealed natural areas (Uggla, 2012).

Notwithstanding the subtle differences in the definitions above, a conclusion can be made that a green space in cities or urban green space refers to urban spaces primarily covered by vegetation, whether natural or artificial. It is not only limited to urban parks and gardens but rather covers land that is made up predominantly of unsealed, permeable, "soft" surfaces such as soil, grass, shrubs and trees which are privately or publicly accessible or managed (Dunnett et al., 2002). The character of "predominant" is accentuated because green spaces may include buildings and other forms of hard surfaces. Swanwick et al (2003) came up with the following explanations to give much understanding about the description of green spaces in urban landscapes. They explain that, urban areas are made up of the built environment and the external environment between buildings. As shown in Figure 2.5 below, the external environment is made up of two main entities, "green space" and "grey space". The green space may either be linear (occurred along transport routes such as roads, railways), semi-natural (wetlands, woodland), functional (allotments, churchyards, school grounds) and amenity (parks and gardens) (Dunnett et al., 2002; Swanwick et al., 2003).

The second component of the external environment which is 'grey space' covers land that to a greater extent is sealed, impermeable and has 'hard' surfaces such as concrete, paving or tarmac. The grey space is of two types, functional grey space (which provides a specific purpose such as roads, pavements, car parks and other hard surfaced areas related to different types of built development) and civic grey space (publicly accessible areas planned basically for public enjoyment such as town squares, plazas and esplanades) (Swanwick et al., 2003).

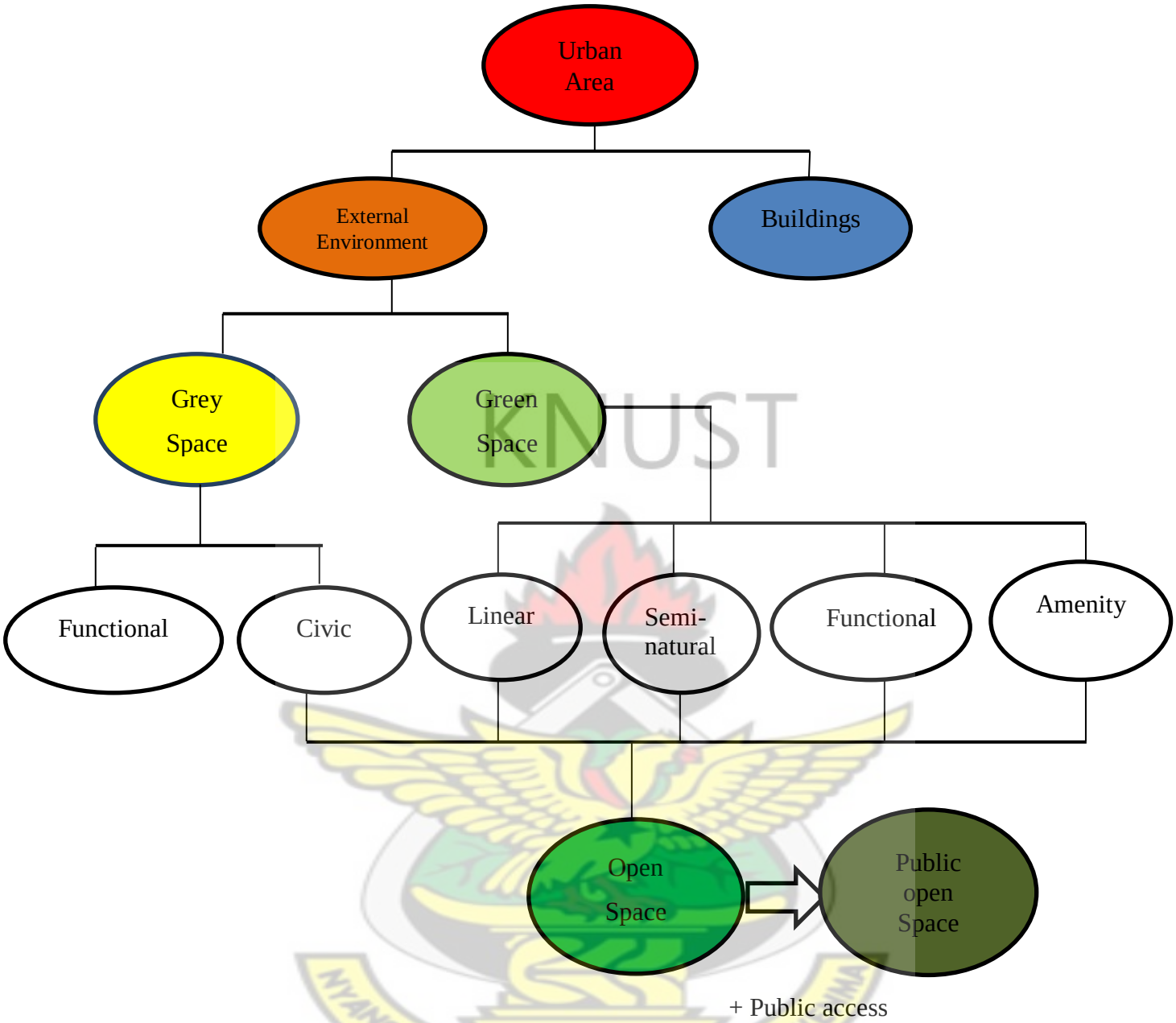


Figure 2.5: Description of Green Spaces in Urban Landscape

Source: Adjei Mensah, 2014.

2.6.3 Green Infrastructure

Green infrastructure is a widely used term to refer to green space and often focuses upon connectivity (Saraev, 2012). It has been suggested that fundamental to the development of green infrastructure thinking were the paradigm designs of Frederick Law Olmsted and Ebenezer Howard. The ideas of relating the ecological capacity and social opportunities of an area have now been taken as a given in landscape planning but the works of Olmsted and Howard were some of the first to explore this

relationship. Olmsted's work in New York and Boston is still discussed by many green infrastructure researchers as early examples that promoted the integration of form and function that leads to landscape multi-functionality. These are themes that are now considered fundamental in green infrastructure thinking. Howard's work in the UK promoted similar values to Olmsted's. Howard suggested through his designs that placing green spaces in close proximity to residential zones would improve both the psychological and physical health of local population. The relevance of Olmsted and Howard cannot be underestimated when discussing green infrastructure. The rise in green infrastructure research has coincided with a reassessment of what landscapes should be in terms of form and function. Green infrastructure as a term relates to the connective matrices of green spaces that can be found in and around urban and urban-fringe landscapes. They provide a number of complimentary benefits for ecological, economic and social spheres and have been increasingly viewed as concept that both planners and practitioners can draw on (Mell, 2008).

Currently, there are as many definitions of green infrastructure as there are authors working on the concept and as in most academic and practitioner research, the definitions used by an organization or an author directly relate to the focus of their own green infrastructure research. For example, conservationist authors strongly emphasize the ecological and biodiversity components, planners may review the concept in terms of policy implementation, while recreational greenways and green infrastructure specialists may focus on the benefits gained through development (Mell, 2010). It must also be underscored that explosion of interest about green infrastructure doesn't necessarily equate to increased understanding of the concept and that the term green infrastructure can mean different things to different people. In spite of the fact that there is diversity in the definitions developed for green infrastructure, there are common themes which underlie each of them (Mell, 2010).

"Green infrastructure in an urban environment refers to all non-hard and non- built areas, including surface water areas as well as a zone of 1-2 km between town and countryside that are more or less connected to each other. The structure should be organized with an overruling strategy, thus, it must be possible to recognize a system in the structure. Accordingly a green infrastructure is a network of patches of natural character including surface water and greenways, penetrating an urban built-up area.

The concept should not be limited by administrative considerations; thus, both public and private lands are included in a green infrastructure" (Sandström, 2002).

Countryside Agency (2006) describes green infrastructure to comprise the provision of planned networks of linked multifunctional green spaces that contribute to protecting natural habitats and biodiversity, enable response to climate change and other biosphere changes, enable more sustainable and healthy lifestyles, enhance urban liveability and wellbeing, improve the accessibility of key recreational and green assets, support the urban and rural economy and assist in the better long-term planning and management of green spaces and corridors.

Green infrastructure is the network of natural and semi-natural areas, features and green spaces in rural and urban, and terrestrial, freshwater, coastal and marine areas, which together enhance ecosystem health and resilience, contribute to biodiversity conservation and benefit human populations through the maintenance and enhancement of ecosystem services (Naumann et al., 2011).

Green Infrastructure refers to the "combined structure, position, connectivity and types of green spaces which together enable delivery of multiple benefits as goods and services" (Forest Research, 2010).

Green Infrastructure is also explained by TEP (2005 p.1) as the physical environment within and between cities, towns and villages. The network of open spaces, waterways, gardens, woodlands, green corridors, street trees and open countryside that brings many social, economic and environmental benefits to local people and communities.

Green Infrastructure is a sub-regional network of protected sites, nature reserves, green spaces and greenway linkages. Green Infrastructure should provide for multi-functional use…it should operate at all spatial scales from urban centres through to open countryside (TCPA, 2004 p.6).

Green Infrastructure is an interconnected network of green spaces that conserves natural ecosystems values and functions and provides associated benefits to human populations. Green Infrastructure is the ecological framework needed for environmental, social and economic sustainability (Benedict and McMahon, 2002 p.12).

Our nation's natural life support system - an interconnected network of protected land and water that supports native species, maintains natural ecological processes, sustains sir and water resources and contributes to the health and quality of life for America's communities and people (Williamson, 2003 p.4).

Although, there are differences in the above definitions of green infrastructure, the following features are common to what constitute green infrastructure: access, spatial variance, multi-functionality, natural and human benefits, biodiversity, sustainability and connectivity. Again each of the definitions identifies that green infrastructure is, or should be, part of a wider ecological network linking different ecological features (Mell, 2010).

2.6.3.1 Typologies of Green Infrastructure

Using stakeholder participation, Davies et al. (2006) came out with a typology that they felt could constitute green infrastructure. The typology showed that green infrastructure is made up from a number of diverse landscape features and components and presented a number of classifications proposed to hold a 'green' value. The typology system developed by Davies et al. emulates work by Ahern in his classifications of Greenways. Rather than on elements or issues earlier discussed in reference to the development of the green infrastructure concept Ahern (1995) based his typology classifications on issues of scale, goals, landscape context and planning strategy.

Mell (2010) argues that Ahern's typology of assessing green infrastructure offers an opportunity to explore the difficulties in categorizing green spaces. He further explains that various landscape elements, for example a cemetery, may be managed to provide a site for reflection and spiritual respite but could be located in an ecologically important landscape. It may, therefore, be imperative in the development of green infrastructure to acknowledge the variance in land use and actual land classifications.

Mell (2010) again notes the attempt by the RCEP (2007) to develop a typology for green infrastructure. As their broad classifications of what constitutes green infrastructure, the RCEP outlined the categories formal, informal, green space corridors, strategic green spaces, sports grounds and public private spaces (See Figure

2.4). Juxtaposed with the stakeholder analysis of Davies et al., this system compares favourably.

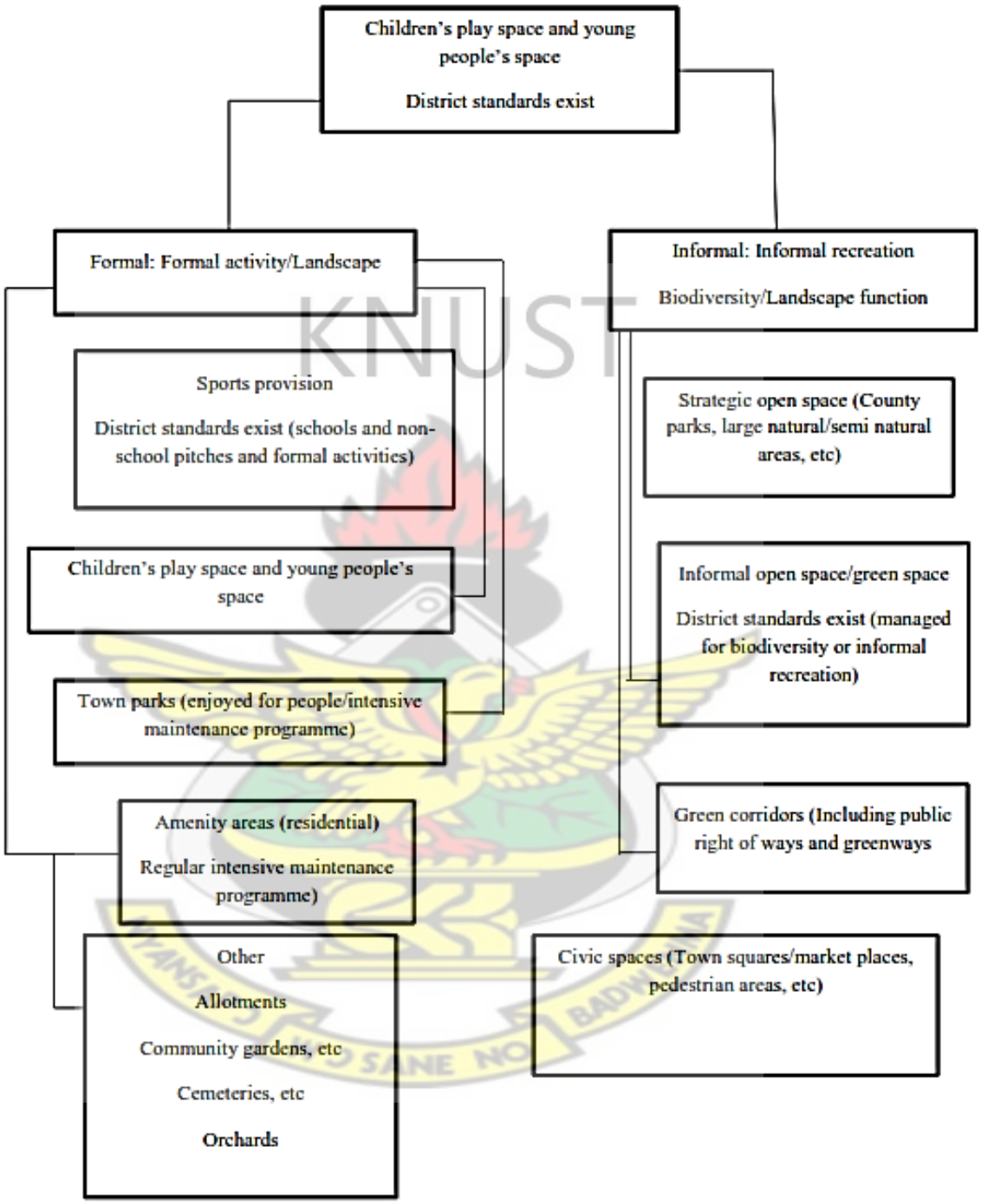


Figure 2.6: Land Use and Green Space Classifications
Source: Mell, 2010.

It is worth noting that, without a vivid idea of what green infrastructure consists of, it is difficult to argue the different semantic and disciplinary values of the concept.

Discussion about green infrastructure typology needs to be done in conjunction with the literature, assessing both its conceptual basis and its value to landscape management practices. An assessment of this nature makes it possible for an examination of the fundamental principles (e.g connectivity, multi-functionality, and access) to be reviewed (Mell, 2010).

Mell (2010) also proposed a typology that fits green infrastructure with the following areas: form, function and context, and can be broken down into ecological, economic and social criteria reviewing the value of specific landscape or green infrastructure elements (Refer to Table 2.6 below).

Table 2.4: Mell's Typology Classification

Typology classification	Element or Function
Form	Ecological (physical space, connectivity, elements) Economic (costs of a space, design) Social and cultural norms (users of a space, aesthetics of a space, motivations)
Function	Ecological (biodiversity, conservation) Economic (industry, business, regeneration) Social (education, recreation, health)
Context	Ecological (biodiversity, supporting networks, ecological mobility) Economic (costs of a space, economic development, sustainability) Social and cultural norms (location, facilitations, motivations, perceptions)

Source: Mell, 2010.

2.7 Functions of Green Spaces

So many works have been carried out on the functions of green spaces. These functions are usually categorised into Ecological functions, Socio-cultural values, Economic benefits and Structural functions (see Figure 2.7). In most cities today, the ecological function has been given top priority at least in government political agendas (Chen 2013).

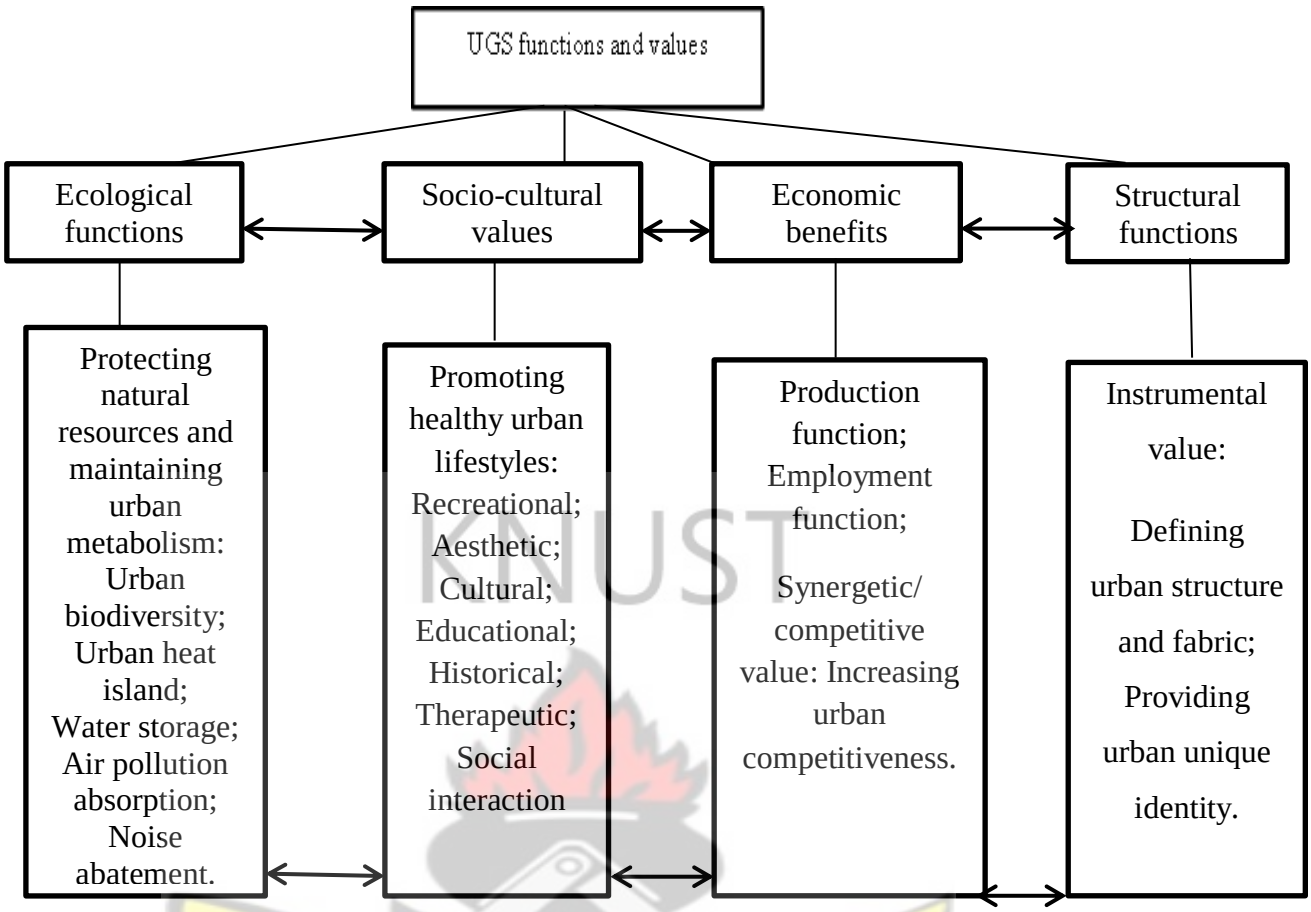


Figure 2.7: Taxonomy of Functions and Values of Urban Green Space.

Source: Chen, 2013.

2.7.1 Ecological Functions

Urban green space has many direct ecological functions. For example, urban trees help improve the air quality by capturing air pollution (Nowak et al., 2006). Urban vegetation also contributes to the reduction of atmospheric CO_2 by direct sequestration (McPherson, 1998; Nowak and Crane, 2002).

Caspersen et al., (2006) note that forests, parks and other open spaces in and around cities provide attractive settings for outdoor recreation, both for daily (short-term) and longer-term use. They also state that living in a 'green' environment and/or close to accessible green spaces is essential for residents' satisfaction with their living environment.

Urban green space, such as forests or parks, can ameliorate UHI effect by preventing incoming solar radiation from heating the surrounding buildings and surfaces, cooling the air by evapotranspiration, and reducing wind speed (Akbari et al., 2001).

Also the presence of UGS, and especially urban woodland, can reduce surface runoff (by intercepting precipitation), absorb pollutants, and emit hydrocarbons as well as modify solar radiation, air temperature, wind speed, and relative humidity (Pauleit and Duhme, 2000; Choi et al., 2012). Increased vegetative cover and higher-albedo surface materials have been identified as approaches that can help achieve cooling effects in urban areas (Jonsson, 2004). Again, urban parks are now a vital urban infrastructure for mitigating UHIs in this era of global warming (Lee et al., 2009).

According to Deng et al. (2008), there are four main aspects of ecological contributions of urban green space to cities and their inhabitants: maintaining urban biodiversity; improving the microclimate and alleviating urban heat island effects; reducing air pollution and purifying air; urban natural disaster prevention and refuge provision.

2.7.2 Socio-Cultural Values

Sullivan et al. (2004) note that green space can provide places where people can meet and develop social ties. Coley et al. (1997, p.487) found that 'the presence of trees consistently predicted greater use of outdoor spaces by all people, young and older, as well as groupings of people consisting of both youth and adults together'.

Parks provide urban residents relief from their stressful lives, accelerate recovery from disease, and can foster active living, fighting sedentary lifestyles associated with obesity, cardiac diseases and various types of cancer. Community gardens, a recent feature of many inner city parks, can provide residents space for social interaction and enable people to supplement their diets with fresh fruits and vegetables. Parks have the tendency to foster closer community ties. Parks can also moderate vulgarity and nurture child development. Most children would opt to play in outdoor spaces that provide them with a range of sensory experiences and which help them to refine their motor skills (Byrne and Sipe, 2010).

Combined, dense population, traffic noise and pollution generate an environment in which inhabitants are severely exposed to stress inducing factors. Hence the need for accessibility to green areas is enlarged in an urban environment characterized by an intense lifestyle and high exposure to environmental pollution and other stress inducers (Caspersen et al., 2006).

Yu (2002) cited by Chen (2013) also indicates that urban green space provides an opportunity for communication and connection for local residents and improves neighbourhood relationships and enhances internal cohesion within the community. "Working class" people enjoy some health benefits according to the amount of green space existing in their neighbourhood and this reduces "health inequalities" (Hartig, 2008). Groenewegen et al. (2006) even describe green space as "Vitamin G" for human well-being.

Van der Ryn and Cowan (2007) note the attention given to the educational function and value of urban green space from the likelihood of using nature for the lessons for sustainability. Chen (2013) also argues that people who reside in cities full of cemented floors, relentless buildings and concrete have very little chance to come close to remote nature. Green space in the city provides such a place for people particularly children to discover nature and acquire a brilliant environmental education (URGE-Team, 2004).

2.7.3 Economic Aspect

The economic values of urban green space arise from its production and employment opportunities. Products (such as fuel wood, fibre, fruits and compost), and employment opportunities (such as new planting projects, maintenance and management of certain areas) are examples of tangible economic values of green space. Urban agriculture, for example has increasingly gained attention. Different vegetable gardens, food gardens, herb gardens and fruit gardens have become very popular in western countries where city dwellers own their home gardens and community gardens. Backyard gardens to a very large extent help to alleviate shortages of food and save on household expenses especially in urban areas (Chen, 2013).

Derkzen (2012) asserts that the ecological, or production and employment functions of urban green space are better quantifiable and may lead to economic gains, for example on the community level where temperature moderation, run-off retention and dust filtration can lower the costs for households and the municipal government.

A difference in temperature of about five degrees celsius can substantially lower the costs for air-conditioning and the permeable soils of green space reduces flood risk and the costs of repairing, rebuilding and insurance claims (Baycan-Levent et al.,

2010). Derkzen (2012) again notes that there is a market value in the natural produce of urban green areas such as wood, young trees and compost and the capacity for energy production.

Furthermore, management and maintenance of green space create local employment and a work load for planners and policy makers, plus for related facilities such as bicycle hire and catering services (Rodenburg et al., 2001). Green space itself can also be studied for research purposes, in research areas such as geology, environmental economics, human geography, urban forestry, environmental and landscape planning or genetics (Derkzen, 2012).

Anwar and Breuste (2008) have also indicated that another direct economic benefit that can be gained from urban green space are the revenues derived from tourism, as it is proved that the presence of green space is closely related to the attractiveness of a city for locals as well as outsiders, and urban green spaces also have the influence to attract businesses and institutions that wish to be associated with a natural environment.

Chen (2012) argues that there is another intangible form of economic value associated with green space: well-planned and managed urban green space can considerably improve a city's competitiveness and productivity and help to increase the value of land and further attract more investment. Green space like public parks, natural areas and golf courses can have a statistically substantial effect on the sale prices of houses in close proximity to those resources (Bolitzer and Netusil, 2000).

2.7.4 Structural Functions

Just like buildings and infrastructure, vegetation, urban green spaces and natural landscape are architectural structures for urban space. The structural functions of urban green space are often used in urban planning and design by defining urban structure and urban form, regulating urban development, buffering between city zones, organizing traffic and the architectural use for planning and design (Lui, 2008).

Parks and urban green spaces are often used in urban planning practice to separate urban zones at a smaller scale. Green spaces are especially valued in a compact city form and they offer a natural balance to build form and can be developed as a green network to ensure contact with the natural world (URGE, 2004).

Urban green spaces and vegetation play very crucial roles in organizing traffic. For a considerable period of time, planning and design of urban green space have been related to traffic network. It is of immense relevance that the design and management of public space reconcile the needs of these often conflicting modes of transport. Vegetation and green space add to high quality streetscapes and public space. Well-designed streets and public spaces boost walking and cycling, and foster a safer environment by reducing vehicle speeds and use (CABE Space, 2004).

The architectural values for planning and design associated with urban green spaces, vegetation and natural landscapes cannot be overemphasized. "Vegetation is used in defining open space and integrating the buildings to the surrounding environment. Plants form walls, canopies or floors of varying heights and densities; these are architectural characteristics. Landscape variation is created through different colours, textures, forms and densities of plants. Urban trees can direct vision, break up large spaces, and define space. They can be used to frame scenes and to provide foreground and backgrounds for landscape features" (Tyrväinen et al., 2005, p.89).

Urban green spaces, vegetation and natural landscapes "give local character and identity, provide distinctive landscape and give legibility and structure to the urban fabric" (URGE, 2004, p.14).

Chen (2013) has also indicated that urban green space not only constitute the physical structural framework of urban development, but also improves the overall image of a city and creates a unique branding and sense of identity. Studies have revealed that natural areas in a city are one of the key qualities that make the city visually appealing (Swanwick, 2004).

Today, cities compete intensely with one another, nationally and internationally, to attract more intelligence and investment (Chen, 2013). A positive city image created by urban green space can greatly promote its amenities and liveability, and thus attract people to live, stay or visit in a city, and further encourage investment and create more employment (Chiesura, 2004).

2.8 Drawbacks of Urban Green Space

Green space does not always offer benefits to the society. Jorgensen et al., (2007) have underscored that urban green spaces are seen as dangerous places especially if

they are not well kept and protected. UGS can be used as hideouts for criminals and according to Jorgensen and Anthopoulou (2007), people might fear using those places. Ribeiro et al., (2009) also note that a good number of people have to deal with pollen allergies and urban vegetation is an important source of allergenic pollen in cities.

2.9 Urban Green Space and Planning

Competition between land uses is not uncommon these days and is very intensive in the process of urban development and regeneration. Relationships between existing and potential urban green space and other land uses such as housing and infrastructure are usually trade-off relationships. In addition, there is even prioritization when it comes to land use of urban green space. For instance, developing an intensively used amusement park with large paved areas can conflict with the goal of preserving plant biodiversity. Planners and policy or decision-makers need to evaluate and consider carefully what the advantages and disadvantages of alternative options are in order to make these trade-off decisions.

Conventionally, urban green space development has often been considered only on a local project level, e.g. at the level of an individual park. In urban areas, when there is pressure on land use, green space considerations are always weak in comparison with more commercially oriented development (Liu, 2008).

2.10 Conceptualizing the Causes of Urban Green Space Depletion

The literature that has so far been reviewed throws light on the concept and trends of urbanization across the globe. The concept of urban green space has also been discussed. A review of some theories and models of urban growth has also been made. From Figure 2.6 the interplay of rural-urban migration, natural increase and factors such as social, political and economic development gives rise to urban growth which in turn results in urbanization. Failure on the part of institutions and agencies such as the Environmental Protection Agency, Town and Country Planning Department and Department of Parks and Gardens to discharge their duties effectively may result in uncontrolled urbanization.

Also, urbanization coupled with institutional failure results in the depletion of urban green spaces. Loss of urban biodiversity, reduction of carbon sink, high exposure of urban dwellers to environmental pollution and loss of income are some of the effects

of loss of urban green space. Fig. 2.6 further depicts some of the theories and models of urban growth which include the von Thunen Model, Concentric Zone Theory, Sector Model and Multiple Nuclei Model.

The bulk of the urban population in Ghana consists of migrants from rural areas and other small towns in the countryside. The deleterious consequences of rural-urban migration at the points of destination have been noted. With the demand for urban socioeconomic amenities exceeding their supply, the urban areas often become spectacles of multifarious problems such as overcrowding, congestion, pollution and green space depletion (Twumasi-Ankrah, 1995).

Natural increase describes the excess of births over deaths in an area and it's impact on urbanization comes chiefly through rural-urban differences in these two vital forces. With improvements in sanitation, communication and transportation, death rates in cities are now lower than in rural areas. Thus, for the past several decades throughout most of the world death rates in cities have been lower than in rural areas (Drescher and Iaquinta, 2002). Natural increase and high rates of rural to urban migration are major root factors of the rapid urban population growth in all the towns in Africa (Drescher and Iaquinta, 2002; Lawi, 2013). Much of urban growth in sub-Saharan Africa is now due to natural population increase (RurbanAfrica, 2013). According to Owusu (2010), the contribution of natural increase and migration to urbanization in Ghana from 1984 to 2000 was 62.6% and 37.4% respectively and this underscores the crucial role these factors play in urbanization.

Economic and social development whose results manifest through modernization usually bring about urban growth (Rostow, 1960). According to Hope and Lekorwe (1999), most industries in Africa are located in urban centres, resulting in rapid rural-urban migration by rural dwellers. The location of industries in urban centres tends to concentrate economic activities in urban areas and so promotes urban bias development policies (Asamoah, 2010). The policies of central governments in most developing countries focus on the development of urban centres at the expense of rural areas and this leads to the 'urban bias' hypothesis (Lipton, 1977). The hypothesis states that most resources in most poor countries are systematically allocated to urban areas rather than rural areas where most people live. This usually results in the concentration of more investments in urban areas than in rural areas. The

main point is that this disparity is created and maintained by central governments' policies designed to assist metropolitan centres at the expense of rural areas (Lipton, 1977).

Cities are not simply random collections of buildings and people. They exhibit functional structure. Thus, they are spatially organized to perform their functions as places of commerce, production, education, and much more. These spatial organizations are usually represented by models. The models of urban growth that were reviewed in relation to the study were the von Thunen Model, Concentric Zone Model, Sector Model and Multiple Nuclei Model.

Several problems and challenges undermine the effective operations of the institutions responsible for managing and maintaining the green spaces in the Metropolis. The institutions which were considered in the study were the Environmental Protection Agency, Town and Country Planning Department of the KMA, Planning Unit of the KMA, Forestry Commission and Department of Parks and Gardens. Some of the problems which usually hinder the smooth discharge of their operations with regard to the maintenance and protection of green spaces in Kumasi are inadequate logistics, political interference, nepotism, financial constraints and inadequate staff. All these problems and challenges usually result in the failure of the institutions to protect and maintain the green spaces in the Metropolis and subsequently lead to the depletion of the urban green spaces. The depletion of urban green spaces has brought untold effects on the residents and the environment of the Metropolis. Mention can be made of the ecological, socio-cultural, economic and structural effects. Under the ecological effects, mention can be made of urban biodiversity loss, creation of an Urban Heat Island and atmospheric pollution. Examples of the socio-cultural effects are the depletion of open spaces for social interaction and high exposure of urban dwellers to environmental pollution. Reduction of urban agriculture and loss of revenue from tourism are examples of the economic effects of urban green space depletion. A typical example of the structural effects of urban green space depletion is the reduction in legibility and structure of the urban fabric (Refer to Figure 2.8).

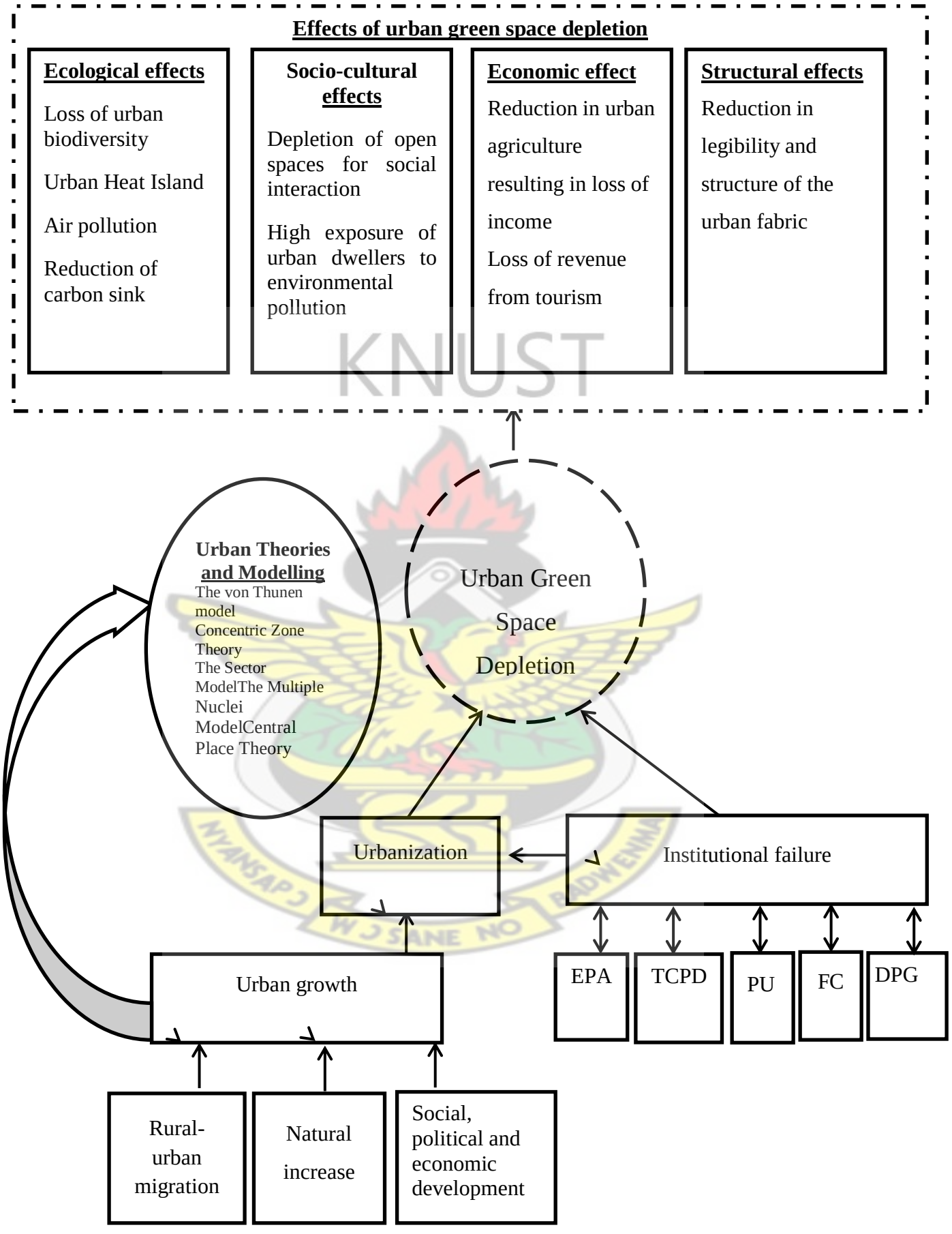


Figure 2.8: Conceptual Framework for Urbanization and Green Space Depletion

Source: Author's Construct, 2014

CHAPTER THREE
PROFILE AND RESEARCH METHODOLOGY

3.1 Introduction

The chapter comprises the profile of the Kumasi Metropolis as well as an analysis of the current situation of the Metropolis in line with the study objectives. Since it is of great relevance to outline the methods that will guide the conduct of work, prior to undertaking any research, this chapter accordingly presents the study design, research tools and methods used for the collection of data.

3.2 Kumasi Metropolitan Area in Context

This section discusses the location and physical characteristics, vegetation and infrastructure of the Kumasi Metropolis. The aesthetic features and demographic characteristics of the Metropolis are also discussed under this section.

3.2.1 Location and Physical Characteristics

Kumasi, the traditional and administrative capital of Ashanti, lies 270 km north west of Accra, the national capital; 397 km south of Tamale, the Northern Regional capital and 120 km south east of Sunyani, the Brong-Ahafo Regional capital (see Figure 3.1 below). Located in the transitional forest zone, Kumasi covers a total land area of 254 square kilometres (25,415 hectares). It is located between Latitudes $6^{o}35$"N and $6^{o}40$"N and Longitudes $1^{o}30$"W and $1^{o}35$"W.

The topography of Kumasi ranges from 250 to 300 metres above sea level and it is, therefore, undulating. The Metropolis has an average minimum temperature of about 21.5^{o}C and an average maximum temperature of 30.7^{o}C. Kumasi experiences a double maxima rainfall regime (214.3mm in June and 165.2mm in September).

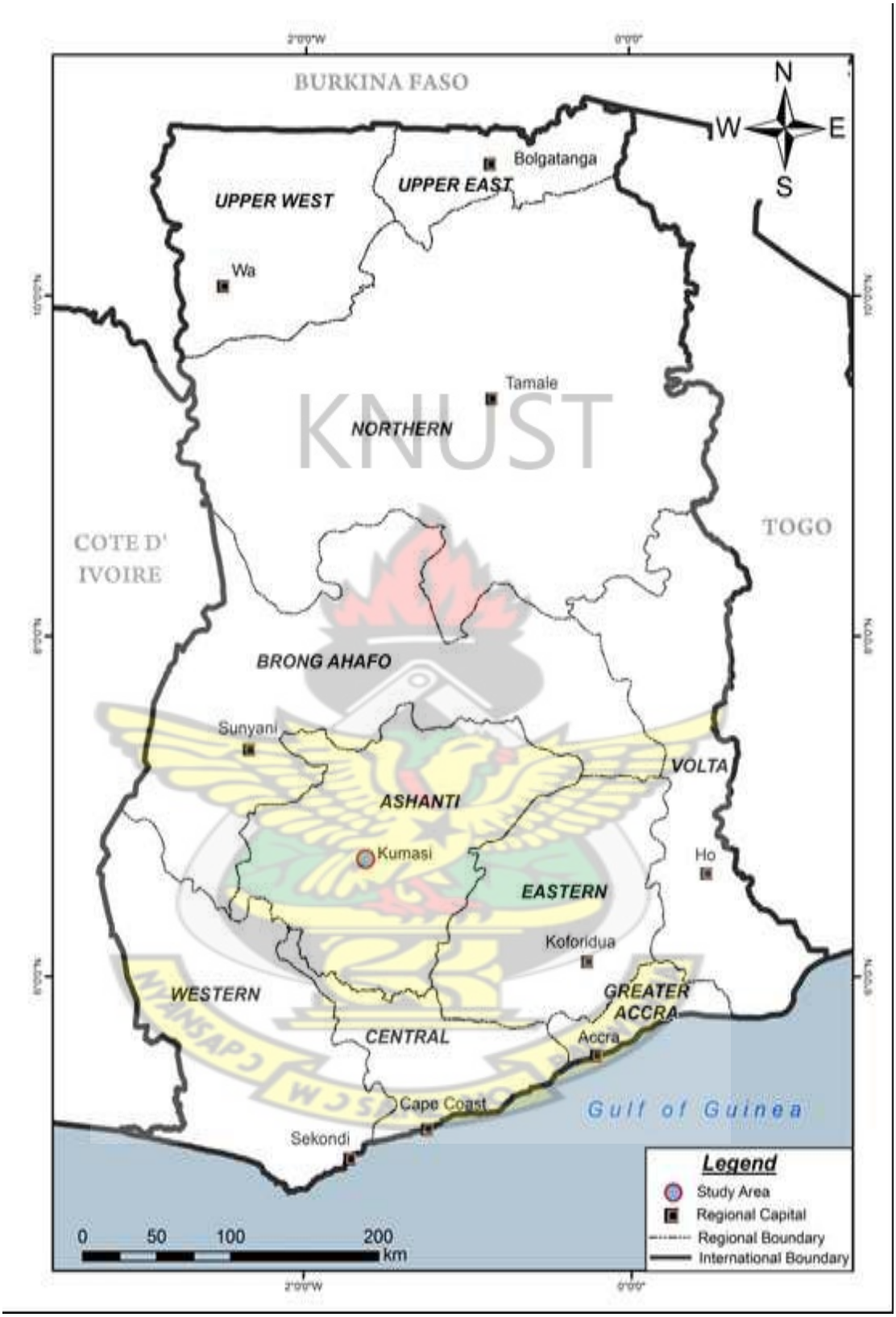


Figure 3.1: Administrative Map of Ghana Showing Kumasi Metropolitan Area

Source: KMA, 2010

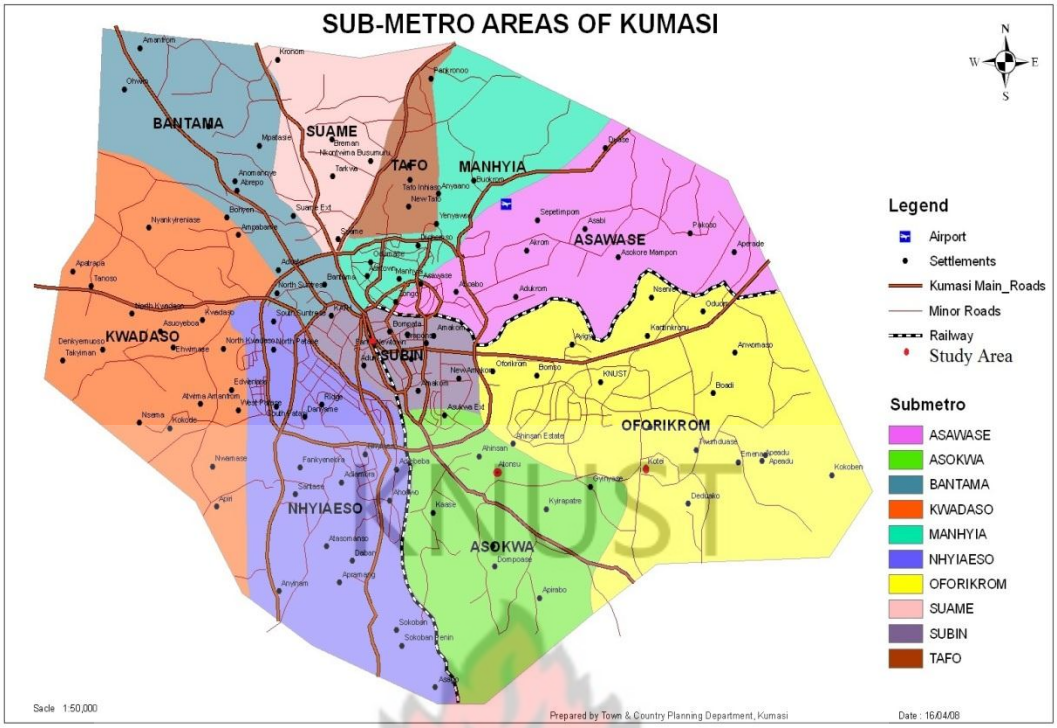


Figure 3.2: Sub Metro Map of Kumasi showing the Study Areas

Source: KMA, 2010

3.2.2 Vegetation

The Metropolis is found within the moist semi-deciduous South-East Ecological Zone. Predominant species of trees found are Ceiba, Triplochlon, and Celtis with Exotic Species. A patch of vegetation reserve within the city has led to the development of Kumasi Zoological Gardens, adjacent Ghana National Cultural Centre and opposite Kejetia Lorry Terminal and the KNUST Botanical Gardens. These forest conservations serve as tourist attraction centres. In addition to their scenic beauty as tourist centres, they also serve other objectives such as educational, preservation of wildlife, leisure and amusement. Apart from the zoological gardens, there are other patches of vegetative cover scattered at the peri-urban areas of the Metropolis. However, the rapid spate of urbanization has caused the depletion of most of these nature reserves (KMA, 2010).

3.2.3 Physical Infrastructure

The Town and Country Planning Ordinance, Cap 84, promulgated in 1945 set aside Kumasi as the "Garden City of West Africa" and declared the city among other regional capitals as a statutory planning area. It is estimated that 48 percent, 46 percent and 6 percent of the Metropolis are urban, peri-urban and rural respectively,

confirming the fast rate of urbanization. The high rate of population growth coupled with the high migrant numbers has outstripped the rate of infrastructure development and service provision. Most of the facilities have exceeded their carrying capacities (KMA, 2010).

3.2.4 Aesthetic Features

The landscape of Kumasi has a number of statues especially of past kings who have ruled the Asante Kingdom. These statues serve two-fold purposes which are to honour their kings and decorate the landscape of the Metropolis. Nevertheless, due to the rapid rate of urbanization and deforestation, the Metropolis is deprived of the greenery that earned her the accolade "the Garden City of West Africa" (KMA, 2010).

3.2.5 Demographic Characteristics

As at 2010, the population of Kumasi was estimated to be over 2 million people reflecting an intercensal growth of 5.4 percent between 2000 and 2010. This population accounts for about 43 and 8.3 percent of the region and nation's population respectively. Compared to the national and regional growth rate of 3.4 percent and 2.7 percent respectively, the Metropolis is growing at a faster rate indicating the attractiveness of Kumasi in the Region. Kumasi is the most populous district in the Ashanti Region in that it accounts for more than a third of the Region's population. The economically active population is about 55.6 percent which indicates that the population mainly falls between the ages of 15-64 years. This shows that the population of Kumasi is an economically active one (KMA, 2010).

3.2.5.1. Trend of Population Growth in Kumasi

From a population of 81,870 in 1948, Kumasi has witnessed a dramatic increase to over two million (2,035,064) in 2010. The Metropolis recorded its highest population growth rate of 7.9 percent in the 1948-1960 intercensal period and at the same period the Ashanti Region recorded its lowest population growth rate of 2.0 percent The lowest population growth rate of Kumasi (2.5 percent) was recorded in the 1970-1984 intercensal period whilst at the same period the Ashanti Region and the nation recorded 3.8 percent and 2.6 percent growth rates respectively. In the 1984-2000 and 200-2010 intercensal periods, the population growth rate of Kumasi was twice as much as that of the entire nation, 5.4 percent and 2.7 percent respectively. As at 2010,

the population of Kumasi represented 42.6 percent of the Ashanti regional population and 8.3 percent of the national population. In 2014, Kumasi's population was projected to be 2,443,737 (refer to Tables 4.1 and 4.2 below) (KMA, 2010).

Table 3.1: Population of Kumasi (1948 – 2014)

Area/year	1948	1960	1970	1984	2000	2010	*2014
Kumasi	81,870	218,172	346,336	487,504	1,170,270	2,035,064	2,443,737
Ashanti	1,109,130	1,481,698	2,090,100	2,948,161	3,612,950	4,780,380	5,769,650
Nation	-	9,726,320	9,632,000	12,296,081	18,912,079	24,658,823	27,461,578

Source: KMA, 2010. *Projected

Table 3.2: Population Growth Rate (1948 – 2010)

Area/year	1948 – 1960	1960 – 1970	1970 – 1984	1984 – 2000	*2000 – 2010
Kumasi	7.9	4.5	2.5	5.4	5.4
Ashanti	2.0	3.8	3.8	3.4	3.4
Nation	-	2.4	2.6	2.7	2.7

Source: KMA, 2010. *Projected

3.2.5.2. Migration

Migration is one of the three factors that influence population increase. Birth and death are the other factors. Migration is determined by identifying the place of person's birth, place of his/her enumeration and the population born elsewhere (in or out of Ghana). Appreciable size (65.7 percent), of the residents in Ashanti Region was born at the place of their enumeration. This partly explains the homogeneity of the region and their strong traditional affiliation. Another reason has been the ease of accessibility to the Metropolis for businesses transaction. It is worth noting that over a third (34.3 percent) of the population in the Metropolis is migrants. The Metropolis has attracted a number of migrants from several parts of Ghana and neighbouring African countries such as Togo, Burkina Faso, Mali, Nigeria, Ivory Coast and abroad especially, Europe. This has contributed significantly to the phenomenal growth of the population in the city (KMA, 2010).

3.3 Research Methodology

The methodology used in carrying out the research is discussed under this section. The research design, sampling techniques, sampling size determination among others are discussed.

3.3.1 Research Design

The research work seeks to investigate green space depletion in Ghanaian cities with particular reference to Kumasi. Due to time and resource constraints on the part of the researcher, three suburbs were selected as study areas. At most one of the three suburbs was to be selected from one of the ten sub-metropolitan areas. The sub-metropolitan areas were therefore listed from the numbers 1 to 10 on a sheet of paper. Using the simple random sampling method, three sub-metros were chosen for the study by the table of random numbers. The sub-metros chosen were Oforikrom, Asokwa and Subin. A suburb was to be selected at random from each of the selected sub-metros. The lists of the various suburbs were made for each of the selected sub-metros and the suburbs numbered. Simple random sampling was again used to select one suburb as a study area from each of the selected sub-metros using table of random numbers. Kotei was selected from the Oforikrom sub-metro, Atonsu was selected from the Asokwa sub-metro and Fanti New Town was selected from the Subin sub-metro.

The Central Business District (CBD) and other parks and gardens were also areas of interest for the study. Problems posed by population growth to green spaces, particularly how it contributes to green space depletion in the Metropolis were revealed.

From the variety of research approaches explained in literature, the case study approach was selected for this research work considering the nature of the topic. Shields (2009), defines a case study as "a research approach which allows for an in-depth examination of events, phenomena, or other observations within a real-life context for purposes of investigation, theory development and testing or simply as a tool for learning". He further adds that it often employs documents, artefacts, interviews, and observations during the course of research. The case study design gives the researcher an opportunity to have an understanding of how urbanization contributes to green space depletion.

Angers (2004) asserts that a characteristic of the case study design, the intensive probing, leads to the discovery of previously unsuspecting relationships. He also states that the case study design allows for an in-depth examination of phenomena such as urbanization and green space depletion in Kumasi.

This study employed the qualitative research approach mainly but integrated the quantitative research approach in some aspects. Patton and Cochran (2002), argue that qualitative research is characterised by its aims, which relate to understanding some aspect of social life, and its methods which (in general) generate words, rather than numbers, as data for analysis. Quantitative research on the other hand is described by Aliaga and Gunderson (2000), as explaining phenomena by collecting numerical data that are analysed using mathematically based methods (in particular statistics). Much emphasis was placed on triangulation: the use of more than one approach to the investigation of a research question in order to enhance confidence in the ensuing findings.

3.3.2 Data Requirements and Sources

The study used both primary and secondary data in the analysis. Primary data were collected using questionnaires, visual observations, interview guides and key informant interviews. The questionnaires and interview guides were administered to respondents who own residential facilities in the study areas and some key institutions concerned with planning of the city and protection of urban green spaces. The data were collected in accordance with variables and issues concerning urbanization and green space depletion. The variables include major land uses in Kumasi and the role of institutions in the planning and management of green spaces in Kumasi. The institutional surveys covered the Town and Country Planning Department, Environmental Protection Agency, Department of Parks and Gardens, Forestry Commission and Planning Unit of the KMA. Traditional Authorities and Assemblymen in the study areas were also interviewed.

The Town and Country Planning Department was selected because it plays a coordinating role to ensure that all stakeholders play their roles in the land use planning process. The Metropolitan Director of Town Planning was interviewed because he is directly in charge of the preparation of land use plans for the Metropolis. The Environmental Protection Agency is a decentralised government

agency that works together with the KMA to manage and protect green spaces and the environment at large. There was therefore the need for the Environmental Protection Agency to be interviewed. The Assistant Programmes Officer was interviewed. The Department of Parks and Gardens was selected for interview because it is responsible for environmental landscape development and management of urban green and open spaces. The Regional Director was interviewed because he directly supervises all the activities of the Department in the Metropolis. The Forestry Commission also creates, protects and manages the forests and protected areas in the city. They are also mandated to prepare and implement integrated forest and wildlife management plans. Their views on urban green space depletion were also sought. The human resource director was interviewed. The Planning Unit of the KMA prepares and implements a set of decisions and actions for the development of the citizens. In the process it is supposed to design a management plan for green spaces in the Metropolis. The Deputy Planning Metro Officer was interviewed. Secondary data were collected through the review of relevant literature, which includes documents from the Kumasi Metropolitan Assembly (KMA), the Ghana Statistical Service (GSS) and the internet.

The questionnaires and interview guides seek to identify the types and nature of land use in Kumasi, their implications on green space conservation and the way forward for protecting green spaces from further encroachment by urban land uses.

3.3.3 Sample Sizes Determination

A mathematical formula, $n = \frac{N}{1+N(\alpha)^2}$ was employed in determining the sample size of landlords/ladies (refer to Appendix B), where *n* is the sample size, *N* is the sample frame, α is the margin of error and 1, a constant. This resulted in 150 samples selected from the study areas. The findings of the research are sufficiently valid to make informed generalizations.

3.3.4 Sample size distribution

The sample size of each study area was determined using the proportional method of sample size distribution.

Kotei = (150) (404÷3656) = 17

Atonsu = (150) (2740÷3656) =112

Fanti New Town = (150) (512÷3656) =21

Table 3.3 shows how the sample size is distributed

Table 3.3: Sample Size Distribution

Study Area	Number of houses (2014)	Sample size
Kotei	404	17
Atonsu	2740	112
Fanti New Town	512	21
Total	**3656**	**150**

Source: KMA, 2010 and Author's Construct for Sample Size.

3.3.5 Sampling Techniques

Probability sampling was used in selecting the respondents from the study areas. The population for the research is made up of all landlords/ladies in study areas. The total population of landlords/ladies in the study areas was taken for the total number of residential facilities in the study areas, which was 3656. This was a projected figure for the year 2014 based on the figures for the year 2010 as provided by the 2010-2013 Medium Term Development Plan of the KMA. This is shown in Appendix A. In choosing the samples for the research, the probability sampling, specifically the simple random sampling (SRS) method was used. Under this method, a sample was drawn according to random selection procedures in which every member of the target population had a known, non-zero chance of being included in the sample (Henry, 1990). A type of SRS called the SRS with replacement was used to select individual respondents from the various study areas. Under this method, one unit of element was randomly selected from the population and it was the first sampled unit. Then the sampled unit was replaced in the population. The second sample was drawn with equal probability. The procedure was repeated until the requisite sample units *n* were drawn. The probability of selection of an element remained unchanged after each draw. It is worth noting that the lists of individual houses in the various study areas were obtained using the numbers of various houses in the study areas before the method was employed.

Upon locating the house, the landlord was interviewed. In his absence, any representative who could give the required information was interviewed. Samples were "representative" and permitted valid generalization for the overall population.

The study adopted both probability and non-probability sampling techniques as and when necessary. For the non-probability sampling the purposive sampling was used. Purposive sampling was employed during the selection of the decentarlized institutions, Assembly members and Traditional Authorities. The purposive sampling technique, also called judgment sampling, is a calculated choice of an informant owing to the qualities the informant possesses. It is a non-random technique that does not require underlying theories or a set number of informants. Thus, the researcher decides what needs to be known and sets out to find people who can and are willing to provide the information by virtue of knowledge or experience (Bernard, 2002). Thus, specific units were selected for study due to their unique characteristics. Purposive sampling was used to gather data from respondents from some relevant decentralized institutions. The institutions are the Town and Country Planning Department, Environmental Protection Agency, Department of Parks and Gardens, Forestry Commission and Planning Department of KMA. The heads of these institutions or departments were chosen as the respondents. The information from these institutions corroborated or rejected the claims put forward by the landlords/ladies in the study areas. The institutions were also selected because they were directly related to the study topic.

3.3.6 Units of Analysis

The units of analysis for the research were landlords/ladies in the three study areas and the five (5) decentralised departments and agencies namely the Town and Country Planning Department, Planning Unit of KMA, Environmental Protection Agency, Forestry Commission and Department of Parks and Gardens.

3.3.7 Data Sources and Collection Tools

Primary data sources included responses from institutional heads, traditional authorities, assemblymen and landlords through interview guides and questionnaires. Secondary data sources include development plans, the internet, journals, books, magazines were reviewed.

Table 3.4: Data Sources and Collection Tools

Objectives	Data Required	Source	Data Collection Tool
To identify the nature and state of green spaces in Kumasi	Nature of green spaces State of green spaces	Forestry Commission, DPG	Interview Guide
To identify the causes of green space depletion in Kumasi	Causes of green space depletion	Department of Parks and Gardens, KMA Development Planning Department, TCPD, EPA, Forestry Commission, Traditional Authorities, Assemblymen, Landlords	Interview Guide, Questionnaire
To analyse the green space plans of Kumasi from the pre-colonial era to the post-independence era	Green space management plans	TCPD, Planning Unit of KMA, DPG, Journals, Books.	Interview Guide
To make recommendations that will promote green spaces in Kumasi.	Promotion of green spaces in Kumasi	Department of Parks and Gardens, KMA Development Planning Department, TCPD, EPA, Forestry Commission, Traditional Authorities, Assemblymen, Landlords	Interview Guide, Questionnaire

Source: Author's Construct, 2014.

3.3.8 Methods of Data Collection

Bernard (2000) asserts that data collection is crucial in research, because the data are expected to contribute to a better understanding of a theoretical framework. It then becomes relevant that choosing the method of obtaining data and from whom the data will be obtained be done with sound judgment, especially since no amount of analysis can make up for improperly collected data (Bernard, 2000).

Questionnaires were used to collect data from landlords whilst interview guides were used to collect data from some decentralised departments of the KMA and other agencies. The items in the questionnaires and interview guides consist of a combination of close-ended and open-ended questions. The close-ended questions involved a list of items with alternative answers for respondents to choose from. With the open-ended questions, respondents were required to provide answers on their own.

Different sets of questionnaires and interview guides were developed for landlords and the various agencies and departments. The questionnaire for landlords tried to ascertain whether they obtained permit from the appropriate authority before putting up their buildings and also whether their buildings conform to the metropolitan layout plan. The availability of green spaces on their premises was also studied by means of the questionnaires.

The institutional survey sought to find out among other things the problems the institutions encountered in discharging their duties to manage and protect urban green spaces.

3.3.9 Rationalization and Analysis of Data

Data gathered from all the various sources were thoroughly edited, coded and analysed. Depending on the answers provided by the respondents, the various questions were assigned numerical values. In this way, the data were simplified into meaningful information for analysis. After coding the response, it was then input into the computer data analysis using statistical software known as Statistical Package for Social Scientists (SPSS) version 16.

Descriptive Statistics were used to summarize quantitative data. The use of maps, tables, graphs, charts and diagrams were employed to present the gathered data. Analytical tools such as measures of central tendencies were used to determine trends and averages. Qualitative data were analysed by interpretation, inferences and cross referencing with secondary data and information from other institutions. This helped to validate and check information provided by various institutions (Refer to Figure 3.3).

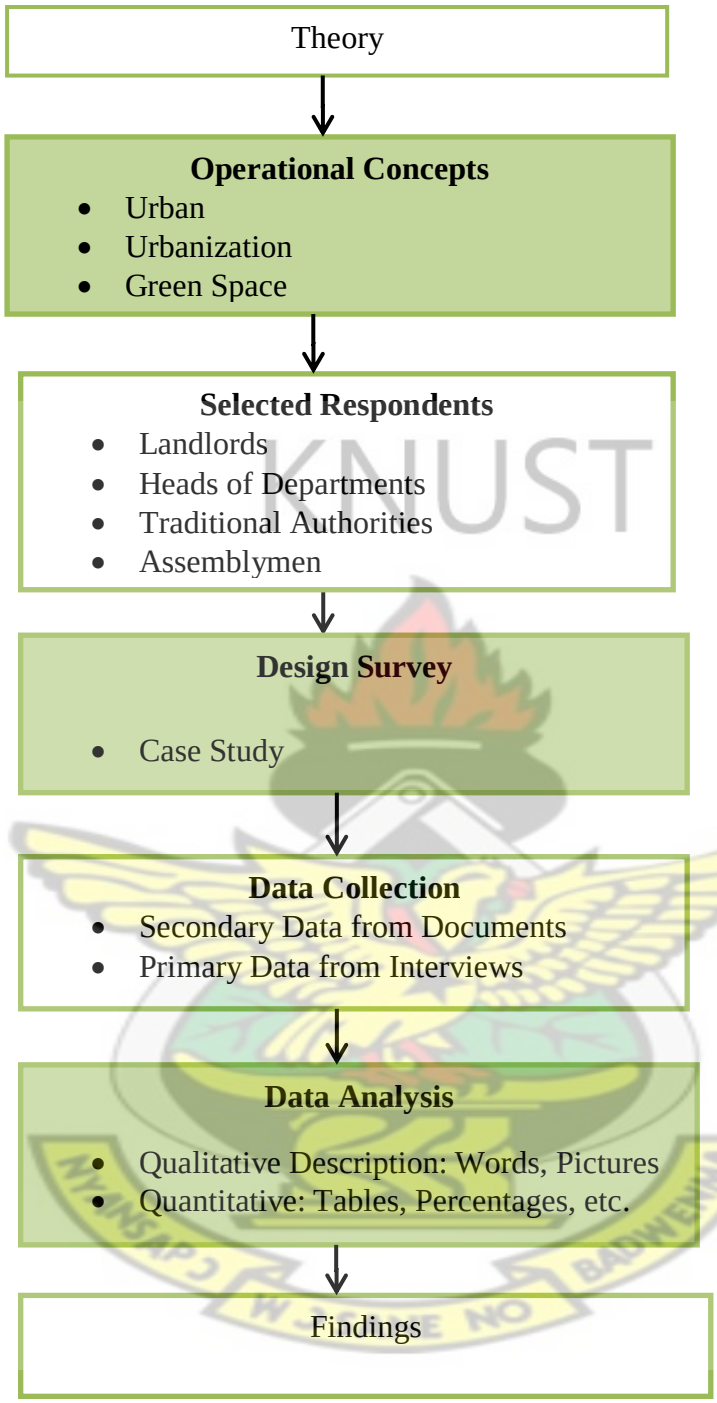


Figure 3.3 Diagrammatic Representation of the Research Methodology

Source: Author's Construct, 2014

CHAPTER FOUR

URBAN LAND USE CHANGE AND URBAN GREEN SPACE DEPLETION

4.1 Introduction

The chapter consists of the discussions as well as detailed analyses of land use changes and green space depletion in the Kumasi Metropolis as revealed by the study.

4.2 Mode of Land Acquisition and Acquisition of Permit by Respondents

This section discusses among others the mode of land acquisition and acquisition of building permit by respondents.

4.2.1 Mode of Land of Acquisition by Respondents

From Table 4.1 below, 78.7 percent of the respondents acquired their lands from the chiefs of their respective communities, 14.0 percent of the respondents built on family lands. 7.3 percent of the respondents also acquired their lands from other sources such as acquiring from other people other than the chiefs. There was high percentage of respondents (78.7%) who acquired their lands from chiefs because majority of lands in the study areas were owned and controlled by the chiefs and this was confirmed by the survey of Traditional Authorities.

Table 4.1: Mode of Land Acquisition

Mode of Land Aquisition	Kotei	Atonsu	Fanti New Town	Frequency of Respondents	Percentage of Respondents
Family Land	4	14	3	21	14.0
Acquired from a chief	11	92	15	118	78.7
Others	2	6	3	11	7.3
Total	**17**	**112**	**21**	**150**	**100.0**

Source: Field Survey, April, 2014.

4.2.2 Acquisition of Building Permit by Respondents

The study indicated that 70.0 percent of the respondents acquired permit from the appropriate institutions before putting up their structures whilst 16. 7 percent of the respondents did not acquire permit before putting up their structures. 13.3 percent of the respondents were also not sure whether permits were obtained before their structures were built since they inherited their property from deceased relatives (refer

to Table 4.2) It was quite surprising that 70.0 percent of the respondents had obtained building permits because of the haphazard nature of buildings in some areas within the study areas, especially Kotei and Atonsu.

Table 4.2: Acquisition of Building Permit

Permit Acquired	Kotei	Atonsu	Fanti New Town	Frequency of Respondents	Percentage of Respondents
Yes	12	78	15	105	70.0
No	3	20	2	25	16.7
Not Applicable	2	14	4	20	13.3
Total	**17**	**112**	**21**	**150**	**100.0**

Source: Field Survey, April, 2014.

4.2.3 Respondents' Awareness of Community Layout Plans

The study indicated that 77.3 percent of the respondents were not aware of the layout plans of their communities. Only 22.7 percent of the respondents were aware of their community layout plans. This accounted for the haphazard nature of buildings in some parts of the study areas. Wetlands and other nature reserves in the study areas have been encroached upon giving a clear picture of non-conformity to community layout plans (refer to Table 4.3). Even though the Town and Country Planning Department has inscribed on building that do not conform to layout plans for work to stop, owners usually disregard the inscriptions.

Table 4.3: Awareness of Community Layout Plan

Awareness	Kotei	Atonsu	Fanti New Town	Frequency of Respondents	Percentage of Respondents
Aware	6	21	7	34	22.7
Not aware	11	91	14	116	77.3
Total	**17**	**112**	**21**	**150**	**100.0**

Source: Field Survey, April, 2014.

4.2.4 Respondent's Perception of Benefits of Green Spaces

The study indicated that 50.7 percent of the respondents thought that green spaces were beneficial whilst 49.3 percent thought green spaces were of no benefit (refer to Table 4.4). The respondents who thought green space were of no benefits also wanted the green spaces in their communities to be converted into other more profitable land uses such as residential and commercial. This partly explains why encroachment on wetlands and nature reserves is on the rise in the study areas.

Table 4.4: Perception of Benefits of Green Spaces

Are Green Spaces of Benefits	Kotei	Atonsu	Fanti New Town	Frequency of Respondents	Percentage of Respondents
Yes	9	60	7	76	50.7
No	8	52	14	74	49.3
Total	**17**	**112**	**21**	**150**	**100.0**

Source: Field Survey, April, 2014.

4.3 Nature and State of Green Spaces in Kumasi

This section considers the nature of green spaces found in the Metropolis and also the current state of these green spaces.

4.3.1 Nature of Green Spaces in Kumasi

A variety of green spaces are found in Kumasi which play several functions to the residents of the Metropolis. Some of the forms of green spaces found in the Metropolis are outlined below.

- Wetlands (Marshy and waterways)
- Public parks
- Greens in private residences
- Greens in educational areas
- Cemeteries
- Trees/shrubs along main roads and streets
- Greens in public offices and working areas
- Farmlands
- Forests

Public parks, wetlands and forests help to protect biodiversity of local plants and animals and also preserve essential ecological functions in the Metropolis. Also greens in private residences and educational areas together with trees along main roads and streets help shape urban form and buffer incompatible uses in the Metropolis. Thus, they improve the quality of life in the City and also enhance city aesthetics.

Although different forms of green spaces exist in Kumasi, it came to the fore that among the various forms of urban green spaces much emphasis is given to urban trees. Some Non-Governmental Organizations like the Friends of Rivers and Water Bodies in collaboration with the Environmental Protection Agency and the Forestry Commissions often embark on tree planting exercises in Kumasi to enhance the greenery and air quality in the Metropolis. According to the Forestry Commission, Royal palm tree, Acacia auriculiformis, Polyathialongifolia (Weeping Willow), Cassia siamea (Siamese Cassia) and Mangiferaindica (Mango tree) are among the dominant tree species found in the Metropolis.

Climate plays a very crucial role in the growth of green spaces in Kumasi. The Metropolis experiences two major climate seasons: rainy and dry seasons. The dry season is characterized by very high temperatures and hot weather conditions. This season does not favour the development of urban green spaces because during the season trees and grasses on many urban green spaces wither due to intense hot conditions. Poor irrigation mechanisms to water green spaces especially shrubs and lawns in the Metropolis compound the problem causing excessive dryness of such green spaces.

4.3.2 State of Green Spaces in Kumasi

The provision of social infrastructure in the Kumasi Metropolis to sustain urbanization has brought a drastic toll on the green spaces in the Metropolis. Currently, the green spaces in the city are facing rapid depletion. The green space plans which were designed by the colonial masters which intended to make Kumasi the "Garden City" of West Africa have long been abandoned. The green belts which were designed in the colonial city schemes to guard against sprawl have been altered after independence. Encroachment on wetlands is a practice which has gained currency in many parts of the city. There has been encroachment on the banks of the

Sisai River at various towns where it transects. For example at Atonsu, the trees along the Sisai River which among other functions prevented the drying up of the river have been cleared for anthropogenic activities. Prominent among the activities are housing, urban agriculture, carpentry works, car washing and repairing and dumping of waste. At Aboabo and Atonsu, the Subin River is being used as a dumping site for both domestic and industrial waste such as kitchen waste, spoilt refrigerators and saw dust. This causes the river to overflow its bank when there is a heavy downpour and results in perennial flooding in areas like Atonsu and Aboabo.

Again, a fuel filling station (Unity Oil) has been built in the vast wetland opposite the Atonsu Market (Sawmill Junction). At Kotei, some hostels are being constructed in wetlands with disregard for layout plans. The practice of building in wetlands does not only contribute to depletion of green spaces but it also brings about the occurrence of floods in the Metropolis.

The Jackson (Jubilee) Park at Fanti New Town is devoid of the needed urban trees and grasses and has been surfaced with hard and impervious materials. The poorly managed park is used as a resting place for hawkers and head porters. The Adehyeman Gardens at Mbrom, which had so many trees and was used for social gatherings, has been poorly managed. All the trees have been cut and stores have been built in their places for commercial purposes. Patches of urban trees are found at the Amakom Children's Park and the Fanti New Town Park. The Parks which served the purposes recreation and other social gatherings are now serving entirely different purposes. The pavilion at the Amakom Children's Park is now being used for church services and its library serves as a hiding place for social deviants and an abode for the homeless. The Fanti New Town Park has also been turned into a parking lot for cargo cars. The Ridge Park at Danyame and other smaller parks at Danyame developed for gentlemen's sports like cricket, horseback riding and bandstands have been depleted of grasses and are not been used for their purposes.

The beautiful green scenery of the Kumasi Metropolis is now being replaced with urban facilities and this has eroded the image of Kumasi as the "Garden City" of West Africa.

4.4 Development Plans of Kumasi in Relation to Green Space Development

This section analyzes the green space plans of Kumasi from the pre-colonial era through the colonial era to the post- independence era.

4.4.1 Development Plan of Kumasi in the Pre-Colonial Era

Pre-colonial Kumasi possessed excellent foundational elements that supported soft or green landscaping and it is believed that the location of the Ashanti Regional capital can partly be attributed to its fertile land (Quagraine, 2011). Kumasi is also believed to have been established on rocky laterite hill surrounded by natural landscape and the dense tropical rainforest (Tipple, 1987). Although pre-colonial Kumasi did not have any formal or documented planning scheme, it exhibited a kind of geographic specialization and diversification which was unprecedented in this part of Africa. This feature was called the system of "wards" akin to the pedestrianized Howard's Garden City concept (McCleod, 1991). In the wards system, business people with a common trade inhabited particular wards. For instance, goldsmiths, coffin makers, and umbrella makers all practiced and lived within a particular section of town. In all there were 77 wards throughout the city. The ward system promoted green transportation in the city such as walking. There was yet another striking feature of cleanliness of pre-colonial Kumasi which impressed the early 19th century European visitors. There were also urban open spaces that served multiple public functions at the time. Pre-colonial Kumasi with its green landscaping, land fertility, dense tropical rainforest, the "ward system", cleanliness and open spaces could be likened to the contemporary eco-city concept. The pristine green spaces of pre-colonial Kumasi offered so many benefits to the residents. Some of these benefits were the provision of spaces for social interaction and reduction of soil erosion.

4.4.2 Development Plan of Kumasi in the Colonial Era

Kumasi, a real hybridized African city experienced both Ashanti and colonial influence extensively including the concepts of western landscape. After the 1896 defeat of the Ashantis to the British, the landscape of Kumasi was to change radically to suit the British. Kumasi and its surrounding villages were razed down and rebuilt at the same location with more culturally familiar landscape to its new masters (Schmidt, 2005). The British needed urban planning concepts that would satisfy their intentions because they had decided to occupy Kumasi. As a result, some green spaces were converted to other land uses. For example, 1903, the wetlands adjacent to

the City's central park were converted into a railway station that connected the lines from Accra and Takoradi and some of the open spaces that served multiple functions were also converted into orderly designed squares (Schmidt, 2005). In 1945, Kumasi earned the accolade the "Garden City of West Africa" after the drawing of a more detailed conceptual landscape plan by Maxwell Fry and Jane Drew. The plan was to mimic Howard's (1902) garden city concept that had gained popularity in the Western World.

The creation of urban green belts and urban parks in the City were the main landscape elements of the Fry and Drew's 1945 city plan for Kumasi. The relevance of the green belts in the plan was to define a boundary against sprawling, to provide agricultural lands and also to serve as sponges of various air pollutants in the city. In the plan, a 330-yard wide of green belt was provided along stream channels within Kumasi. Due to the topography of Kumasi, the new green belts coincided with streams especially the Subin River and its tributaries that transect the city through communities like Aboabo, Atonsu, Bantama, Subin and Kaasi. Parks with well defined functions were provided in Kumasi including Cricket grounds, playing fields and bandstands. Marshy areas in the City were converted into parks. The plan also made provision for five urban parks which are the Kejetia (Adehyeman Gardens), Suntreso (Department of Parks and Gardens), Kumasi Zoo, Amakom (Children's Park) and the Fanti New Town Park. Most of these parks were located farther away from the residential areas and were all designed to include benches and paths (Schmidt, 2005).

4.4.3 Development Plan of Kumasi in the Post-Independence Era

Much development was not experienced in post-independence Kumasi with regard to the development of the designated green belt areas but experienced mostly spontaneous landscape development. Examples were the Jackson (Jubilee) Park at Fanti New Town and the Abbey Park at Ashanti New Town. These Parks unlike the colonial parks were open to all directions and situated on flat lands close to high density residential areas. These parks served different purposes such as soccer, funeral celebrations and other social events. These parks however, lack the shade vegetation like urban trees that were described by Olmstead as the "lungs of the City". These parks do not need any complex maintenance and neither do they contribute much to the health of the urban environment as purifiers of polluted air and reducers of heat

radiation. They appear miserable, uninviting and desolate when they are not in use. Numerous similar green spaces in smaller scale had sprung up in various places in Kumasi and this gave Kumasi rustic than an urban look (Quagraine, 2011).

The 1963-88 Kumasi Planning Scheme and 1996- 2000 Kumasi Development plan were plans which aimed to restore Kumasi's "Garden City of West Africa" image. In the 1963 88 Scheme, a ring-road was to be designed around the city perhaps to complement the radial development of Kumasi as a garden city similar to Howard's (1902) concept of radial rail transport. Another component of the 1963-88 Scheme that was favourable for landscape development was the allocation of 40 percent of the 20,000 hectares (from reserves) that was parcelled out for city expansion for open space and agricultural development. A major limitation of the 1996-2000 Kumasi Development Plan was that, the plan was not supplemented with spatial plan (Quagraine, 2011).

4.5 Land Use Change in Kumasi

Table 4.5 indicates the land use structure of the Kumasi Metropolis over the period spanning between 1995 and 2010. The total land coverage of the Metropolis is approximately 250 sq. km. The major land uses that make up the Metropolis are residential, commercial, industrial, educational, civic and culture, open (green) space and circulation.

As at 1995, residential land use comprised about 43.7% of the total land area of Kumasi. There was a steady increase in the percentage of residential land use to about 43.8% in 2000. In 2005, it further increased to 44.1% and again increased to 44.7% in 2010. The trend of change in residential land use from 1995 to 2010 showed a steady increase. From 2005 to 2010, there was a percentage change in residential land use of about 1.4%.

From 1995 to 2000, the percentage of industrial land use increased steadily from 4.1% to 4.2%. It decreased to 4.1% in 2005 and further decreased steadily to 4.0% in 2010. From 2005 to 2010, the percentage change in industrial land use was about -2.4%.
The percentage of commercial land use in Kumasi (2.4%) was constant from 1995 to 2010. In 1995, the percentage of educational land use in the Metropolis was 17.5%. The value was maintained in 2000 and 2005 and steadily decreased to 17.3% in 2010.

The percentage change in educational land use in the Metropolis from 2005 to 2010 was -1.1%.

Also the percentage of civic and cultural land use (7.5%) was constant from 1995 to 2000 and decreased steadily to 7.3% and 7.2% in 2005 and 2010 respectively. From 2005 to 2010, the percentage change in civic and cultural land use in the Metropolis was -1.4%.

Open (green) space occupied 11.5% of the total land area of the Metropolis in 1995 and decreased to 11.2% in 2000. The value was maintained in 2005 and decreased to 10.7% in 2010. The percentage change in open (green) space from 2005 to 2010 was -4.5%. The value represented a drastic decline in open (green) spaces in the Metropolis.

The percentage of circulation land use (13.3%) was constant from 1995 to 2000. In 2005, it increased steadily to 13.4% and further increased to 13.7% in 2010. The percentage change in circulation land use from 2005 to 2010 was 2.2%.

Table 4.5: Land Use Structure of Kumasi from 1995-2010

Land use	1995		2000		% change	2005		2010*		% change
	Area (km^2)	%	Area (km^2)	%		Area (km^2)	%	Area (km^2)	%	
Residential	109.3	43.7	109.6	43.8	0.5	110.3	44.1	111	44.7	1.4
Industrial	10.3	4.1	10.6	4.2	2.4	10.3	4.1	10.1	4.0	-2.4
Commercial	6	2.4	6	2.4	0	6	2.1	6	2.4	0
Education	43.8	17.5	43.8	17.5	0	43.8	17.5	43.3	17.3	-1.1
Civic and cultural	18.8	7.5	18.8	7.5	0	18.1	7.3	18	7.2	-1.4
Open (green) space	28.8	11.5	28.1	11.2	-2.6	28.1	11.2	27.5	10.7	-4.5
Circulation	33.1	13.3	33.1	13.3	0	33.4	13.4	34	13.7	2.2
Total	250	100	250	100	-	250	100	250	100	-

Source: TCPD of KMA, 2010.

*Projected

From the foregoing analyses, there has been an increase in the percentage of residential land use from 1995 to 2010. This can be attributed to the fact that the Kumasi Metropolis has been experiencing rapid urbanization over the years.

According to the Kumasi Metropolitan Assembly (2010), 48%, 46% and 6% of the Metropolis is urban, peri-urban and rural respectively, confirming the high rate of urbanization. This high rate of urbanization in the Metropolis necessitates the provision of infrastructural facilities to meet the needs of the teeming population. As indicated in Table 3.1, the population of Kumasi as at 2010 was 2,035,064. Accordingly, more houses were put up to accommodate the increasing population. The total housing stock in Kumasi as at 2010 was projected to be 85,725 (KMA, 2010). The high rate of sprawl in the Metropolis also demands an increase in the total length of road network to facilitate the commuting of people from the peri-urban areas to and from the city centre. The Metropolis has a total road network of 1117km (KMA, 2010). The provision of these residential facilities and construction of roads in the Metropolis have contributed significantly to the depletion of its green spaces. The provision of housing and other social infrastructure in Kumasi is more financially rewarding than maintaining green spaces. This partly accounts for why the percentage of the land area in the Metropolis used for residential facilities has been appreciating over the years whilst the percentage of land area for green/open space has been depreciating.

The proportion of land area of the Metropolis that has been developed also gives an indication of the extent of green space depletion. Figure 4.1 shows that a greater proportion (81.6%) of the land area of the Metropolis has been developed. This can be attributed to the massive urban sprawl which the Metropolis has been experiencing over the years. Sprawl is usually characterized by the destruction of the natural environment, agricultural lands and also encroachment on wetlands and nature reserves. Land development in the Metropolis brings about destruction to vegetation and ecosystems as vegetation is cleared for the building of infrastructure.

As at 1995, about 74.8% of the land area in the Metropolis was developed. The value increased to 76.5% in 2000 and further increased to 79% in 2005. In 2010, the percentage of developed lands in the Metropolis had shot to 81.6%. In 1995, about 25.2% of the land area of Kumasi was undeveloped. The value decreased to 23.5% and 21% in 2000 and 2005 respectively. As at 2010, the percentage of undeveloped lands in the Metropolis was just 18.4% and it is anticipated to decrease further in the years ahead due to the intense constructional activities taking place in the Metropolis. The undeveloped lands in the Metropolis are located mainly at the urban peripheries.

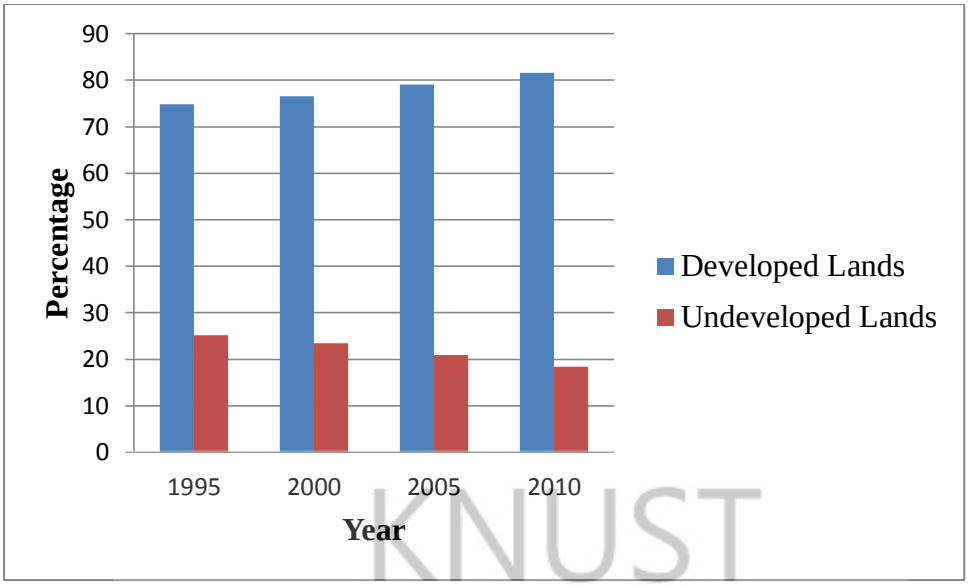


Figure 4.1: Proportion of Developed and Undeveloped Lands in Kumasi from 1995 to 2010.

Source: TCPD of KMA, 2010.

Using land cover change in the Metropolis as a proxy to assess the rate of green space depletion also clearly depicted that there had been a rapid conversion of much of the vegetated area to built up and bare areas. According to Campion (2012), in 1986 the land area under the jurisdiction of KMA was about 80% covered with vegetation with the remaining 20% being built up and bare lands. The built up lands covered areas within the central part of the City such as Adum, Asafo, Fanti New Town, Suame, Atonsu, Kwadaso and Santasi. The land surface of towns at the peripheries of the City was predominantly covered with vegetation and such towns included Emena, Asokore Mampong, Daban and Kotei (Schmidt, 2005). By 2007, there had been a significant reduction in the land area under the jurisdiction of KMA covered with vegetation. Towns like Kotei, Emena, Danyame and Dakwadwom which hitherto had their land surfaces predominantly covered with vegetation had seen a significant reduction in vegetation, perhaps due to intensive constructional activities. It is estimated that between 1986 and 2007, the vegetated areas in Kumasi had reduced from 80% to 50% with bare and built up areas growing at 1.9% per annum between that same period (Campion, 2012). This is depicted in Figures 4.2 and 4.3, which show the changes in land cover in Kumasi from the year 1986 to 2007.

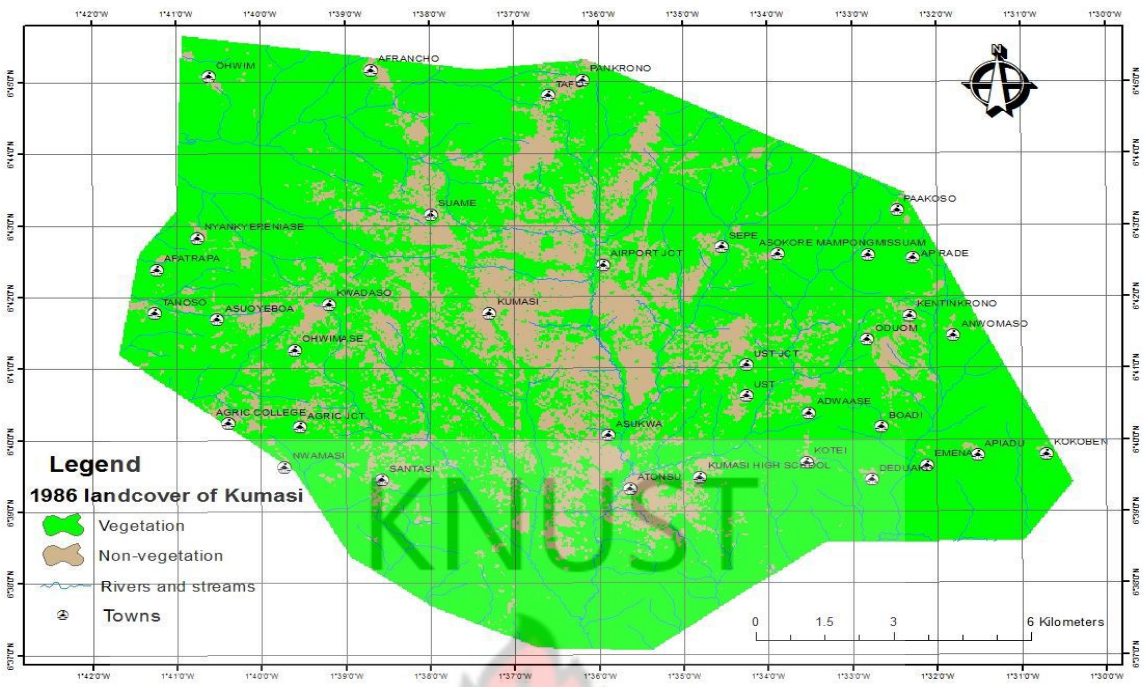


Figure 4.2: Land Cover of Kumasi in 1986

Source: Campion, 2012.

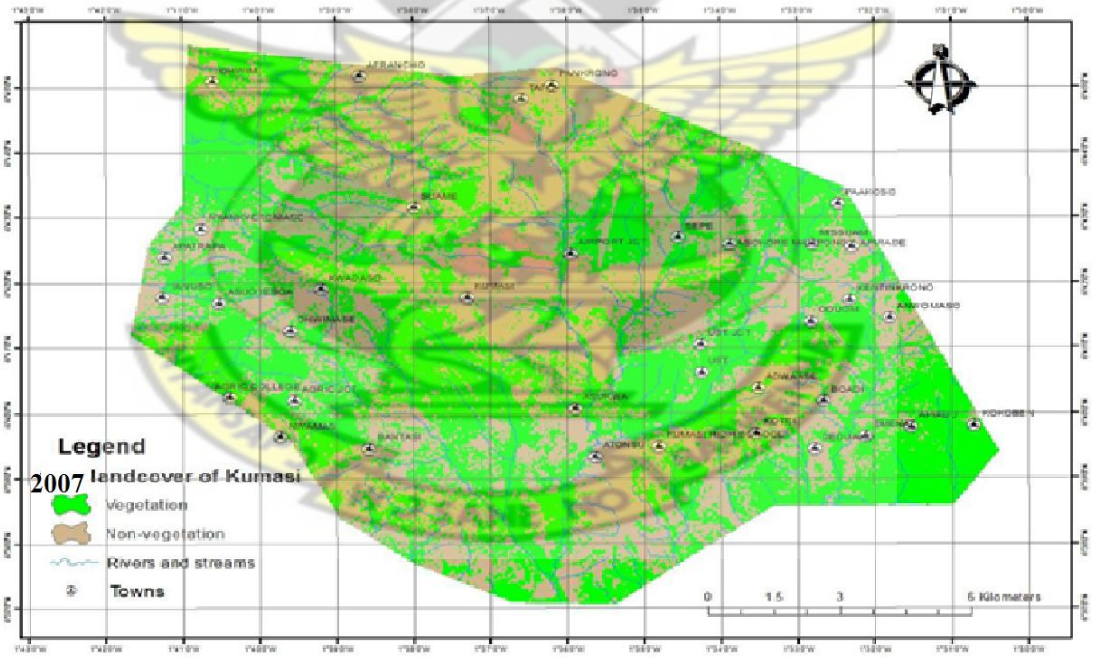


Figure 4.3: Land Cover of Kumasi in 2007

Source: Campion, 2012.

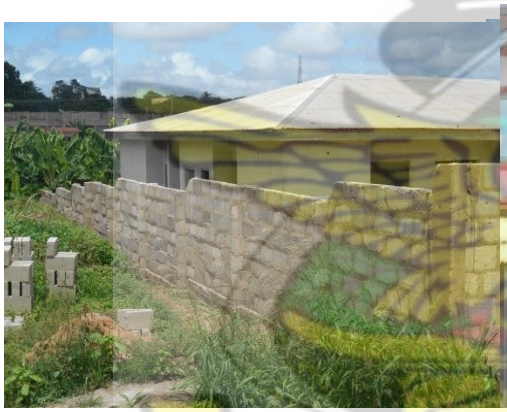
4.6 Causes of Green Space Depletion in Kumasi

This section is devoted to the factors that cause green space depletion in the Kumasi Metropolis. Some of the factors are outlined below.

4.6.1 High Land Rent for other Land Uses in the City

The study showed that in Kumasi, land uses such as residential and educational are more financially rewarding than green spaces and this was confirmed by the Town and Country Planning Department. People in the Metropolis are willing to pay high rents for houses, hostels and schools. This is a strong motivation factor for landlords/ladies to build more residential and educational facilities at the expense of green spaces. Thus, there is a lucrative business in these land uses. This has resulted in the encroachment on some green spaces in the study areas as revealed by a field visit to the study areas.

Plate 4.1: Encroachment on a Wetland at Kotei



Source: Author's Field Survey, 2014

Plate 4.2: A Residential Land Use at Atonsu

Source: Author's Field Survey, 2014

4.6.2 Laxity in the Enforcement of Development Controls

Development controls are tools or mechanisms used in town planning to guide the growth of cities and improve the quality of life of the residents (Philip, 2007). As urbanization occurs, more structures are being put up in the Metropolis for housing, businesses, schools and other purposes. In doing this, some developers do not conform to layout plans in their communities as was revealed in the study areas. As was earlier discussed, about 77.3 percent of the respondents were not aware of their community layout plans and so by extension did not conform to these plans. It is therefore imperative for development controls in the Metropolis to be enforced. However, the study revealed that there was so much laxity in the enforcement of

development control in the Metropolis. So many provisions on green spaces were contained in planning schemes/layouts and master plans which guided the control of physical development of Kumasi by the city authorities. However, many of these provisions on green spaces are virtually non-existent on the ground. This came to light after a thorough cross examination of the layout of the study areas and the actual physical development that had occurred in the areas in question. For example, the Ministry of Lands and Natural Resources demarcates a minimum of 100 m from the stream bank as no development area (Water Resources Commission, 2008). Contrary to this regulation some developers build houses within 100m from stream banks. For example the work of Campion (2012) reveals that about 34% of the wetlands at Atonsu Sawmill Junction has been used for housing facilities within 100m from the stream channel.

All these underscore the laxity in the enforcement of development controls in the city. Officials of the Town and Country Planning Department conceded enforcement of development controls by their outfits has been very weak due to challenges like political interferences and financial constraints.

4.6.3 Uncooperative Attitudes of the General Public towards the Preservation of Green Spaces

The study indicated that there were uncooperative attitudes of the general public in the study areas towards the preservation of green spaces. This was found to be the result of lack of involvement of the residents in the Metropolis in decision making on green spaces and poor awareness of the residents on the benefits of green spaces. In Kumasi, decisions on green spaces were found to be undertaken mostly by city planning authorities without active involvement of the residents. The poor involvement of the residents together with their little awareness on the benefits of green spaces has made them to perceive the protection of green spaces as the sole responsibility of planning authorities and therefore do not take good care of these spaces in their neighbourhoods. As indicated earlier, 49.3 percent of the respondents were not aware of the benefits of green space in their communities.

Personal observation on the physical environment of the study areas showed wide spread depletion of green spaces as result of the wanton disregard for the protection of green spaces by the general public. At Adum, it was observed that some of the lawns

which have been created to beautify the Central Business District (CBD) had been destroyed by the activities of hawkers and porters. At Atonsu, a wetland had being reclaimed by way of filling with sand for the construction of a fuel station. At Kotei, several trees and lawns had been destroyed by the general public for commercial activities. In some parts of the Metropolis such as Atonsu and Kotei, green spaces have been converted into refuse dump. This was confirmed by the Environmental Protection Agency and Forestry Commission and they expressed great worries about that unfortunate attitude.

4.6.4 Problem of Ownership of Green Space Lands

According to KMA (2010), three forms of land ownership exist in Kumasi. The first one deals with "vested lands" which are lands owned by the government of Ghana. All lands that fall within one mile radius from the Kumasi Fort come under this category. The remaining lands which cover greater part of Kumasi's land area are called "stool lands" and are held in trust by chiefs (traditional authorities) for the Ashanti King who is the custodian of the land. As was earlier revealed, majority (78.7%) of the respondents acquired their lands from their chiefs who are custodians of the lands in their communities.

There is yet a third category of land designated as "public lands" which are parcels of land allocated in the vested and stool lands that are acquired by the government of Ghana for public interests. Examples of such lands are public school lands, right of ways, sanitary sites, open spaces (grey and green spaces) and railway reservation.

The study indicated that who actually has ownership of green space lands in the Metropolis was a big issue. As has been indicated earlier, green spaces fall under public lands and so per the constitution of the country are to be managed by the Lands Commission. However, interviews with the traditional authorities in the study areas revealed otherwise. Green space lands were actually managed by the traditional authorities. Owing to this, some of the areas delineated as green spaces on the layouts of the study areas have been sold out to people for other more lucrative land uses.

Due to the urbanization taking place in the Metropolis, there is a very lucrative business in building houses and renting them out as hostels and sometimes shops. Because some of the private developers in the Metropolis are not aware of the layout plans of the communities in which they intend to build, they accept any plot of land

they are allocated by the chiefs regardless of its delineated use in the layout. This had resulted in a significant reduction of green spaces in the study areas.

4.6.5 Low Priority to Green Spaces by City Authorities

The study showed that, since the city of Kumasi is undergoing rapid urbanization, the attention of city authorities has been focused on providing roads, schools; housing and other social infrastructure to the public whilst issues about green space management have been neglected. The KMA does not strictly adhere to the green space plans of the Metropolis. A close examination of the 2010-2013 MTDP of KMA showed that very little priority had been given to the management of green spaces in the City. This has contributed to the rapid conversion of many green spaces into other land uses in Metropolis.

4.7 Effects of Green Space Depletion in Kumasi

The depletion of green spaces in the Kumasi Metropolis has presented a host of effects to the residents in the Metropolis and the environment. Notable among the effects are as follows:

4.7.1 Generation of Heat and Pollution of Urban Air.

It is a general knowledge that urban thermal environment has a higher air temperature than its surrounding area. Research has proved that the primary reason for the modification of an urban environment is the reduction of a substantial portion of its green space and the increase of impermeable paved surfaces in urban areas (Sarat and Eusuf, 1985). As cities urbanize, more social infrastructure especially circulatory facilities like roads, parking lots and car parks are provided to facilitate transportation. According to the World Forest Centre (1993), these facilities change the climate of urban areas by absorbing and radiating solar heat to make the surrounding area hot and dry. A research conducted in the Kumasi Metropolis between 1971 and 2000 confirmed a rise in day time temperature of about 1.2^0C.

Again, urban sprawl has caused an increase in the use of automobiles in the Kumasi Metropolis which has resulted in the excessive release of vehicular emissions like Carbon Dioxide and Carbon Monoxide into the atmosphere. Removal of vegetation reduces the net carbon sink therefore the emitted fumes from vehicles which are essential greenhouse gases become trapped in the atmosphere causing atmospheric pollution and a rise in the ambient air temperature. The rise in temperature in the city

exposes city dwellers to excessive heat radiation and increases the incidence of diseases like malaria and cholera.

4.7.2 High Incidence of Floods in the Metropolis

More green spaces in the Kumasi Metropolis are being converted into hard impervious concrete surfaces. The loss of pervious areas in the Metropolis coupled with an inadequate drainage system brings about flooding. The flooding in the Metropolis usually is a consequence of increased impermeable catchments resulting in higher catchment yield in a shorter duration. The frequency of floods in the city increases when green spaces are converted into concrete surfaces because the concrete surfaces do not have the ability to absorb rainfall.

Rapid conversion of wetlands to residential and commercial land uses in the city reduces the interconnectivities of water bodies in an undulating terrain. Encroachment on natural drains, removal of vegetation cover and reclamation of wetlands are the cardinal reasons for frequent flooding even during normal rainfall.

4.7.3 Decreased Biodiversity and Habitat Loss

The forests and wetlands in the Metropolis serve as a repository of biodiversity. Deforestation and destruction of wetlands destroys the biodiversity and habit for migratory species including endangered ones. Many of these endangered flora and fauna species are of great medicinal and economic value to the residents of the Metropolis.

4.7.4 Reduction in Spaces for Social Interaction and Leisure

Depletion of green spaces like parks and lawns in the Metropolis has caused a reduction of spaces for leisure and social interaction. Parks like the Amakom (Children's) Park and the Fanti New Town Park and the Adehyeman Gardens which served as places for leisure and relaxation have been depleted and are used for other purposes. Aside the Amakom Park, there is no other specially designed park which serves as playground and leisure park for children in the Metropolis.

The chapter has revealed that the high rate of open (green) space depletion in the Kumasi Metroplois could be linked to a number of factors. Chapter five presents a summary of the findings that have been made and the measures that can be adapted to promote green spaces in the Kumasi Metropolis.

CHAPTER FIVE

SUMMARY OF FINDINGS, RECOMMENDATIONS AND CONCLUSION

5.1 Summary of Findings

This chapter highlights the summary of findings revealed in the study, recommendations that will promote green spaces in the Kumasi Metropolis and conclusion to the study.

5.1.1 The Nature of Green Spaces in the Kumasi Metropolis

According to the study, different varieties of green spaces are found in the Kumasi Metropolis. The types of green spaces identified are: wetlands (marshy and waterways), public parks, greens in private residences and greens in educational areas. Others are cemeteries, trees/shrubs along main roads and streets, greens in public offices and working areas. The rest are farmlands and forests.

5.1.2 State of Green Spaces in Kumasi

The study revealed that from the year 2005 to 2010, the rate of depletion of open (green) space in the Kumasi Metropolis was 4.5%. This depletion of green spaces in the Metropolis was evident in the following:

There has been much encroachment on the banks of the Subin and Sisai Rivers at various towns where the rivers transect. For example, at Atonsu, trees along the Sisai River banks which protected the river from drying up have been cut down and replaced with houses and shops.

The Subin River and other wetlands in the Metropolis are being used as dumping sites for domestic and industrial waste. It was revealed that effluents and solid waste from factories such as the Coca-Cola Bottling Company and Guinness Ghana Limited are discharged into the Subin River.

Also, parks which served as places for social interactions and leisure have their vegetation cover been depleted or completely devoid of vegetation. For example, the Jackson (Jubilee) Park at Fanti New Town and Abbey Park at Ashanti New Town are devoid of the needed urban trees and grasses. The Jackson Park has been surfaced with hard and impervious concrete materials. The poorly managed Amakom

(Children's) Park which used to have several trees and grasses now has fragmented grasses and few patches of trees. The Adehyeman Gardens is now a hub of commercial activities as many of its trees have been cut and have been replaced with shops.

The Ridge Park and other smaller parks at Danyame developed for gentlemen's sports like cricket, horseback riding and bandstands have been depleted of grasses and are not been used for their purposes.

Wetlands are being filled up with sand to facilitate the construction of hostels, fuel filling stations and other infrastructure. For example at Kotei, wetlands are now being used for the construction of hostel facilities.

In effect, the once beautiful green scenery of the Kumasi Metropolis is now being replaced with urban facilities.

5.1.3 Factors leading to the Depletion of Green Spaces in Kumasi

The major factors identified to be the causes of green space depletion in the Kumasi Metropolis are as follows:

High land rent for land uses in Kumasi such as residential and commercial facilities. This leads to the conversion and encroachment on green spaces for these profitable land uses.

Laxity in the enforcement of development controls in the City. Once development controls are not enforced developers do not conform to layout plans in the City which leads to encroachment on nature reserves and green spaces.

Uncooperative attitudes of the general public towards the preservation of green spaces in the Metropolis. The public is not involved in the management of green spaces in the city and so considers the task of green space management as the sole responsibility of city authorities. This explains why some of the green spaces in the Metropolis have been turned into dumping sites by the public.

Problem of ownership of green space lands in the Metropolis. Green space lands in the Metropolis which should have been owned and controlled by the government are actually been owned and controlled by traditional authorities. Many of these green

spaces have been sold by traditional authorities to private developers for residential and commercial purposes.

Low priority to green spaces by city authorities. Promoting and preserving green spaces in the Metropolis has not been considered as an important priority by city authorities. They concentrate resources and efforts into the building of social infrastructure such as roads, schools and hospital which they consider can improve the livelihoods of the public at the expense of green spaces.

5.1.4 Green Space Development Plans of Kumasi

Pre-colonial Kumasi had a very fertile land and was surrounded by natural landscape and a dense tropical rainforest. Although, Kumasi at that time did not have any formal or documented planning scheme, it exhibited a kind of geographic specialization and diversification which was unprecedented in this part of Africa. This feature was called the system of "wards" and promoted green transportation to a very large extent. Kumasi at that time was also very clean and had urban open spaces that served multiple public functions. Pre-colonial Kumasi with its green landscaping, land fertility, dense tropical rainforest, the "ward system", cleanliness and open spaces could be parallel the contemporary eco-city concept. The pristine green spaces of pre-colonial Kumasi offered so many benefits to the residents.

During the colonial times, the British designed an urban landscape for Kumasi which satisfied their intentions because they intended to live in Kumasi. This resulted in the conversion of some green spaces into other land uses. In 1945, Kumasi earned the accolade the "Garden City of West Africa" after the drawing of a more detailed conceptual landscape plan by Maxwell Fry and Jane Drew. The main landscape elements of the 1945 Kumasi City Plan were the creation of urban green belts and urban parks in the City. According to the plan, parks with well defined functions were to be provided in Kumasi including Cricket grounds, playing fields and bandstands. Marshy areas in the City were also to be converted into parks. The plan also made provision for five urban parks which are the Kejetia (Adehyeman Gardens), Suntreso (Department of Parks and Gardens), Kumasi Zoo, Amakom (Children's Park) and the Fanti New Town Park.

Much development was not experienced in post-independence Kumasi with regard to the development of the designated green belt areas but experienced mostly

spontaneous landscape development. Examples were the Jackson (Jubilee) Park at Fanti New Town and the Abbey Park at Ashanti New Town. These parks however, lack the shade vegetation like urban trees. The 1963-88 Kumasi Planning Scheme and 1996- 2000 Kumasi Development Plan were plans which aimed to restore Kumasi's "Garden City of West Africa" image. A major component of the 1963- 88 Scheme was that, a ring-road was to be designed around the city perhaps to complement the radial development of Kumasi as a garden city akin to Howard's (1902) concept of radial rail transport. However, a major limitation of the 1996-2000 Kumasi Development Plan was that, the plan was not supplemented with a spatial plan.

5.1.5 Roles of Institutions in the Protection of Green Spaces in Kumasi

Various institutions such as the Town and Country Planning Department (TCPD), Environmental Protection Agency (EPA), Forestry Commission (FC) , etc. are involved in the planning and management of green spaces in the Kumasi. The TCPD plays a coordinating role to ensure that all stakeholders play their roles in the land use planning process. The EPA is a decentralised government agency that works together with the Kumasi Metropolitan Assembly (KMA) to manage and protect green spaces and the environment at large. The Department of Parks and Garden (DPG) is responsible for environmental landscape development and management of urban green and open spaces. The Forestry Commission (FC) also creates, protects and manages the forests and protected areas in the city. It is also mandated to prepare and implement integrated forest and wildlife management plans for the city. The Planning Unit (PU) of the KMA prepares and implements a set of decisions and actions for the development of the citizens. In the process it is supposed to design a management plan for green spaces in the Metropolis.

Some organizations also collaborated with the aforementioned institutions to protect the green spaces in the city. Some of them were the Community Water and Sanitation Agency (CWSA) and Non-Governmental Organizations (NGOs) concerned with the protection of green space. The study also revealed that even though there were some regulations and ordinances for the protection of green spaces in the city, they were not enforced. Some of these were the Forest Protection Law and Wetland Management Regulation.

The interview with the EPA also revealed that various stakeholders such as the general public, interest groups and businesses were to be involved in the planning and management of green spaces. However, majority of these stakeholders had no interest in issues concerned with green spaces in the city.

5.1.6 Constraints of Institutions in the Protection of Urban Green Space

As indicated in section 5.1.1 above, there are institutions committed to managing the effects of urbanization on green spaces in the city of Kumasi. Mention can be made of the Town and Country Planning Department, Environmental Protection Agency, Forestry Commission and Planning Unit of the KMA. Nonetheless, these institutions face numerous challenges which impede the smooth discharge of their duties. Some of the challenges noted were financial constraints, unwillingness of the public to cooperate with the institutions, inadequate staff and logistics and political interference. Nepotism was also a problem which hindered the operations of these aforementioned institutions. In spite of the aforementioned constraints the officials are working tirelessly to render the best of services. For the institutions to perform more efficiently and satisfactorily, they should be given the necessary support especially by the government and the general public.

5.2. Recommendations

The experiences gained from literature and field surveys throughout the research made it possible for the following recommendations to be made to promote green spaces in the Metropolis:

5.2.1 Private Investors should be encouraged to invest in Green Spaces

Private investors should be allowed to acquire green space lands and manage them on behalf of the state. Once they invest in green spaces, they will develop them into scenic and tourist sites. This will generate substantial revenue for themselves and the state and people will begin to perceive green spaces as equally profitable as other land uses. This practice to a very large extent will reduce the conversion of green spaces into other land uses.

5.2.2 Development Controls should be enforced

Laxity in the enforcement of development controls in the Metropolis can be addressed by enforcing laws which will deter people from encroaching on green spaces. Thus, a judicial support system is needed to restrain the general public from their disregard

for the protection of urban green space. Laws should not just be enacted but should also be enforced to ensure their full compliance.

5.2.3 Felling Trees without Permit should be avoided

Felling trees in communities without seeking for permit from the Environmental Protection Agency should be avoided. This will go a long way to reduce deforestation in the Metropolis by way of maintaining the forests in the Metropolis.

5.2.4 Constant Education of the General Public on the Benefits of Green Spaces

The public should be constantly educated on the benefits of urban green space by the City authorities through constant advertisement on green space protection on radios and by information vans. The general public should also be made an integral part of the management of community green spaces. The education should be aimed at inducing the interest and the participation of the public in green space management. This practice will improve the cooperation of the public in the preservation of green spaces.

5.2.5 Zoning Specific Areas within the City as Nature Reserves.

Specific areas within the city, especially environmentally sensitive areas should be zoned as green spaces and nature reserves. These zoned green space areas should be well protected and managed and should be prevented from being converted into other land uses. Also, no green space should be re-zoned for other land uses. The study identified some areas which hitherto were being used as green spaces but have now been re-zoned for other land uses. For example, part of the wall that fences the Kumasi Zoological Gardens has been converted into a restaurant. All such lands should be identified and reverted to its original land use as green spaces by the Assembly.

5.2.6 Creation of Lawns by the Public should be encouraged

City authorities should encourage private developers to create lawns and garden at the facade of their houses, schools, offices, etc. This can be done through an intensive education of the general public to sensitize it on the functions and benefits of green spaces to a community. The Forestry Commission and the TCPD should distribute free seedlings of ornamental plants to landlords to be planted in their houses.

5.2.7 Creation of Green Belts around the City

Urban sprawl was identified as a contributing factor to green space depletion in the Metropolis. Green belts should be created along the fringes of the City to reduce the incidence of sprawling occurring in the City.

5.2.8 City Authorities should rank Green Space among its Top Priorities

City authorities should demonstrate a strong political will to promote and maintain green spaces. Green spaces should be considered among the top priorities of government. A significant chunk of the metropolitan budget should be allocated to the protection and promotion of green spaces in the City. The institutions responsible for green space protection should be adequately resourced by government by way of providing them with the necessary resources needed to discharge their duties satisfactorily.

5.2.9 Improvement in the Collaboration among Allied Bodies

Collaboration between the allied bodies concerned with urban green space management and also among other stakeholders of urban green space should be improved. A comprehensive plan for the management of the city's green spaces should be prepared by the Assembly and be fully implemented. The plan should be communicated to all the stakeholders of urban green space.

5.3. Conclusion

Green space depletion has been identified as one of the means through which societies fail (Diamond, 2005). Green spaces in Kumasi should be saved from depletion because their effects could have far reaching consequences and be felt nationwide. After a thorough research into the effects of urbanization on green spaces in Kumasi, the implication of the findings is that city authorities and policy makers should demonstrate a strong will and commitment in managing the effects of land use change resulting from urbanization on green spaces in the city. Countries like Japan and the Highland New Guinea developed successful green space management systems when they were face with the problem of green space depletion and they continued to prosper. On the contrary, Easter Island and Norse Greenland failed to develop successful green space management system and they collapsed as a consequence (Quagraine, 2011). The general public and all stakeholders of green spaces should put

in a concerted effort in the preservation of our green spaces to save the once “garden city” from becoming a “concrete city”.

REFERENCES

Adjei Mensah, C. (2014). Destruction of Urban Green Spaces: A Problem Beyond Urbanization in Kumasi City (Ghana). *American Journal of Environmental Protection*. Vol. 3, No. 1, 2014, pp. 1-9.

Adjei Mensah, C. (2014). Urban Green Spaces in Africa: Nature and Challenges. *International Journal of Ecosystem* 2014, 4(1): 1-11.

Afrane, S. and Amoako, C. (2011).Peri-Urban Development in Kumasi. In: Adarkwa, A. A. (ed). Future of the tree: Towards growth and development of Kumasi (pg. 92-110). Kumasi: University Printing Press.

Ahern, J.(1995). Greenways as a planning strategy. Landscape Urban Planning. 33 (1–3), 131–156.

Akbari, H.,Pomerantz, M. and Taha, H. (2001). Cool surface and shades on residential heating and cooling energy use in four Canadian cities. *Energy 17(2)*, 141-149.

Aliaga, M. and Gunderson, B. (2000).Interactive Statistics. *Saddle River*, p3-15

Allen, A. (2003). Environmental planning and management of the peri-urban interface: perspectives on an emerging field. *Environment & Urbanization* .Vol. 15 No 1 April 2003, IIED, Sage Publications.

Amin, M. M. A. (2007). Modelling Urban Dynamics Using Geographic Information Systems, Remote Sensing and Urban Growth Models. PhD. thesis submitted to the Faculty of Engineering at Cairo University.

Amoako, C. and Korboe, D. (2011).Historical Development, Population Growth and Present Structure of Kumasi. In: Adarkwa, A. A. (ed), Future of the tree: Towards growth and development of Kumasi (pg. 35-54). Kumasi: University Printing Press.

Angers, J, D. (2004). Integrating a Technology-enriched Curriculum Ethno-Case Study. Ph.D. thesis submitted to the Graduate Faculty of the Louisiana State University and Agricultural and Mechanical College.

Anwar, M.M. and Breuste, J. H. (2008).Socioeconomic functionality of urban parks – investigations of two parks in the megacity of Karachi/Pakistan .*Salzburger Geographische Arbeiten* 42: 109-128.

Asamoah, B. (2010). Urbanisation and Changing Patterns of Urban Land Use in Ghana: Policy and Planning Implications for Residential Land Use in Kumasi. Unpublished MSc Dissertation, Department of Planning, KNUST.

Barnes, D. (12th June, 2014). Environmental Protection Agency, Ashanti, Assistant Programme Officer, Personal Interview.

Baycan-Levent T., Vreeker, R. and Nijkamp, P. (2010). A Multi-Criteria Evaluation of Green Spaces in European Cities. *European Urban and Regional Studies* 16(2): 193-213

Benedict, M. and McMahon, E. (2002). Green infrastructure: Smart conservation for the 21st century. *Renewable Resources Journal*, 20(3), 12-17.

Bernard, H.R. (2000). Research Methods in Anthropology: Qualitative and quantitative methods.3rd edition. Walnut Creek, California: Alta Mira Press.

Black, D. and Henderson, V. (1999).A theory of Urban Growth. *Journal of Political Economy*, vol. 107, no. 2.

Bolitzer, B. and Netusil, N. R. (2000). The impact of open spaces on property values in Portland, Oregon. *Journal of Environmental Management*, 59(3), 185-193.

Bonsignore, R. E. (2003). The diversity of green spaces. Minneapolis, USA: Design Centre for the American Urban Landscape, University of Minnesota. Available at /http://www.designcenter.umn.edu/reference_ctr/publications /pdfs/db2.pdfS Retrieved on 19/03/ 2014.

Brady, A. B., Brake, D. R. and Starks, C. W. (2001). The Green Infrastructure Guide: Planning for a Healthy Urban and Community Forest.

Brockerhoff, M. P. (2000). An Urbanizing World. *Population Bulletin*.Vol. 55, No. 3.

Byrne, J. and Sipe, N. (2010).Green and open space planning for urban consolidation – A review of the literature and best practice. Urban Research Program .Issues Paper 11.

CABE Space (2004).Green Space Strategies. A good practice guide. CABE Space, London.

Campion, B. B. (2012). Urban Wetland Ecology and Floods in Kumasi, Ghana.Phd Thesis, University of Bremen.

Candau, J. (2002). Temporal calibration sensitivity of the SLEUTH urban growth model, master's thesis, Department of Geography, University of California, Santa Barbara, CA.

Carter, T. and Polevychok, C. (2006).Understanding Disinvestment and Decline. Winnipeg: Department of Geography, University of Winnipeg.

Caspersen, O. H., Konijnendijk, C. C. and Olafsson, A, S. (2006). Green space planning and land use: An assessment of urban regional and green structure planning in Greater Copenhagen. *Danish Journal of Geography* 106(2): 7-20.

Chauncy, D. H. and Ullman, E. L. (1945).“The Nature of Cities” The Annals of the American Academy of Political and Social Science. Charlotte, University of North Carolina. In Asamoah, B. (ed) Urbanisation and Changing Patterns of Urban Land Use in Ghana: Policy and Planning Implications for Residential Land Use in Kumasi. Msc. Thesis, Department of Planning, KNUST, Kumasi.

Chen, C. (2013). Urban green space planning in post-1949 China: Beijing as a representative case study. PhD. Thesis submitted to Lincoln University, New Zealand.

Chiesura, A. (2004). The role of urban parks for the sustainable city.*Landscape and Urban Planning,* 68, 129-138.

Choi, H., Lee, W. and Byun, W. (2012).Determining the Effect of Green Spaces on Urban Heat Distribution Using Satellite Imagery.*Asian Journal of Atmospheric Environment* Vol. 6-2, pp.127-135.

Chorley, R. J. and Haggett, P. (1967).Models in geography. London: Methuen.

Christaller, W. (1933). (translation 1966). Central Places in Southern Germany. Englewood Cliffs, New Jersey: Prentice Hall.

Coley, R. L., Kuo, F. E. and Sullivan, W. C. (1997). Where does community grow? Environment and Behavior, 29, 468-494.

Commission for Architecture and the Built Environment (2004). Green Space Strategies: A Good Practice Guide.

Countryside Agency (2006). Countryside in and around Towns: The Green Infrastructure of Yorkshire and the Humber. Leeds: Countryside Agency.

Davies, C., McGloin, C., MacFarlane, R. and Roe, M. (2006). Green Infrastructure Planning Guide Project: Final Report. NECF, Annfield Plain.

Davis, K. (1968). The urbanization of the human population. In The Components of Urban Growth in Developing Countries.

Deng, H., Song, M., Chen, C. and Rong, B. (2008).Current situation and development of Chinese urban forestry. International Journal of Sustainable Development & World Ecology, 15(4), 371-377.

Derkzen, M, L. (2012). Experiencing the Urban Green Space: An exploratory study of visiting behaviour, perceptions and preferences in the urban green spaces of São Paulo, Brazil. Master's thesis submitted to the Faculty of Geosciences, Department of Innovation and Environmental Sciences Utrecht University.

Diamond, J. (2005).*Collapse: how societies choose to fail or succeed.* New York: Penguin Group.

Drescher, A. W. and Iaquinta, D. T. (2002)."Urbanization – Linking Development across the Changing Landscape". Final Draft. Rome. January 18, 2002.

Dunnett, N., Swanwick, C. and Wooley, H. (2002). Improving urban parks, play areas and green spaces. London: Department for Transport, Local Government and the Regions.

English Nature (2000). Revealing the value of nature. English Nature, Peterborough, England.

Forest Research (2010).Benefits of green infrastructure. Report toDefra and CLG. Forest Research: Farnham.

Forsyth, T. (2003). Critical Political Ecology: The Politics of Environmental Science. Routledge, London.

Fratini, R., and Marone, E., 2011, Green-space in urban area: Evaluation of the efficiency of public spending for management of green urban areas. IJED 1 (1), 9-14.

Gairola, S. and Noresah, M. S. (2010). Emerging trend of urban green space research and the implications for safeguarding biodiversity: a viewpoint. *Nature and Science:* 8(7).

Girardet, H. (1996).The Gaia Atlas of Cities: New Directions for Sustainable Urban Living, Gaia, Stroud. In Jenks, M and Burgess, R. (eds). Compact Cities: Sustainable Urban Forms for Developing Countries. London: Spon Press.

Glenn, A. (1984). "Urbanization of the Non-Farm Population. A Research Note on the Convergence of Rich and Poor Nations".Koninkhjke Brill Nv. Leiden.

Graham, H. (1993). Land and Houses policies in Europe and the USA: A Comparative Analysis . London, Routledge. In Asamoah, B. (2010). Urbanisation and Changing Patterns of Urban Land Use in Ghana: Policy and Planning Implications for Residential Land Use in Kumasi. Msc. Thesis, Department of Planning, KNUST, Kumasi.

Greenspace Scotland (2008).Health Impact Assessment of greenspace. A Guide. Stirling: Greenspace Scotland.

Groenewegen, P., van den Berg, A., De Vries, S. and Verheij, R. (2006). Vitamin G: Effects of green space on health, well-being, and social safety. *BMC Public Health*, 6(1), 149-159.

Harrison, C., Burgess, J., Millward, A. and Dawe, G. (1995). Accessible natural greenspace in towns and cities: A review of appropriate size and distance criteria. *Research Report* No. 153, English Nature, Peterborough, England.

Hartig, T. (2008).Green space, psychological restoration, and health inequality.*The Lancet*, 372(9650), 1614-1615.

Health Impact Assessment of greenspace- A Guide. (2008). Scotland: Greenspace Scotland.

Henderson, J, V. (2004). Draft chapter prepared for Handbook of Economic Growth, Volume 1, P. Aghion and S. Durlauf (eds.), North Holland.

Henry, G, T. (1990).Practical Sampling.Vol. 21. London: Sage Publications.

Henshall, J, D. (1967). Models of agricultural activity.In Models in geography, Eds. R. J. Chorley and P. Haggett, 425–58. London: Methuen.

Hope, Sr., K. Roland. and Lekorwe, H. M. (1999). "Urbanization and the Environment in Southern Africa: Towards a Managed Framework for the Sustainability of Cities". *Journal of Environmental Planning and Management*.42(6). London, Routledge.

Howard, E. (1902). *Garden cities of tomorrow*. London: S. Sonnenschein Ltd.

Hoyt, H. (1939). The structure and growth of residential neighborhoods in American cities. Washington, D.C.: U.S. Government Printing Office.

Ioannides, Y, M and Rossi-Hansberg, E. (2005).Urban Growth.Tufts University, Department of Economics. Working Paper.

Iuculano T. andUbaldo P. (1992), Inventarioegestioneinformatica del verdepubblico, Acer n. 7/8, Il Verde Editoriale, Milano In Fratini, R., and Marone, E. (eds). Green-space in urban area: Evaluation of the efficiency of public spending for management of green urban areas. IJED 1 (1), 9-14.

Jenks, M. and Burgess, R. (2004).Compact Cities: Sustainable Urban Forms for Developing Countries. London: Spon Press.

Jim, C.Y. and Chen, S.S. (2003). Comprehensive greenspace planning based on landscape ecology principles in compact Nanjing city, China, *Landscape and Urban Planning*, 65(3), 95-116.

Jonsson, P. (2004). Vegetation as an urban climate control in the subtropical city of Garborone, Botswana. *International Journal of Climatology* 24(10), 1307-1322.

Jorgensen, A. and Anthopoulou, A. (2007). Enjoyment and fear in urban woodlands – Does age make a difference? *Urban Forestry & Urban Greening* 6: 267–278.

Jorgensen, A., Hitchmough, J. and Dunnett, N. (2007).Woodland as a setting for housing – appreciation and fear and the contribution to residential satisfaction and place identity in Warrington new Town, UK. *Landscape and Urban Planning* 79, 273–287.

Kharel, G. (2010). Impacts of Urbanization on Environmental Resources: A Land Use Planning Perspective. MSc. Thesis, Faculty of the Graduate School, The University of Texas at Arlington.

Kit Campbell Associates (2001). Rethinking Open Space, Open Space Provision and Management: A Way Forward. Report to the Scottish Executive Central Research Unit, Edinburgh.

Kivell, P. (1993). Land and the City: Patterns and processes of urban change. London, Routledge.

Kumasi Metropolitan Assembly (2010). *Kumasi Development Plan* (2010-2013). Kumasi: Kumasi Metropolitan Assembly.

Lawi, J. (2013). The Rapid Growth of Towns and Migration in Tanzania: A Case Study of Babati Town. *International Journal of Business, Humanities and Technology,* Vol. 3 No. 7.

Lee, S.H., Lee, K.S., Jin, W.C. and Song, H.K. (2009).Effect of an urban park on air temperature differences in a central business district area. *Landscape and Ecological Engineering* 5(2), 183-191.

Lipton, M. (1977).*Why Poor People Stay Poor: A Study of Urban Bias in World Development.* Cambridge, Harvard University.

Liu, L. (2008).Status and prospects for urban green structure planning in China - Weihai city as a case study. Forest & Landscape Research No. 41-2008. Forest & Landscape Denmark, Frederiksberg.302 pp.

Lui, Y. (2009). Modelling Urban Development with Geographical Information Systems and Cellular Automata. New York: CRC Press.

Macionis J.J. and Parrillo, V.N. (2007).Cities and urban life. Upper Saddle River, New Jersey: Pearson.

Manlun, Y. (2003). Suitability Analysis of Urban Green Space System Based on GIS. MSc. thesis submitted to the International Institute for Geo-Information Science and Earth Observation, Enschede, the Netherlands.

Mcleod, M, D. (1991). *The Asante*. London: British Museum Publications.

McPherson, E.G. (1998).Atmospheric carbon dioxide reduction by Sacramento's urban forest. *Journal of Arboriculture* 24: 215–223.

Mell, I, C. (2009). Green Infrastructure: Concepts and Planning. Newcastle University.

Mell, I. C. (2008). Is the green light really on? Has Green Infrastructure Planning started to provide cross-cutting benefits for urban and urban-fringe areas. 2008 Association of American Geographers Conference, Boston, April 15th-19th 2008.

Mell, I. C. (2010). Green infrastructure planning: a contemporary approach for innovative interventions in urban landscape management. Accessed from <http://www.journalofbiourbanism.org/2012/mell/>. 9/05/2014.

Ministry of Housing and Urban-Rural Development of the People's Republic of China (2002).Guideline for Formulating Urban Green Space System Planning. Beijing: Author. (in Chinese). In Chen, C. Urban green space planning in post-1949 China: Beijing as a representative case study. PhD. Thesis submitted to Lincoln University, New Zealand.

Ministry of Lands and Natural Resources (2012), Ghana Forest Investment Program. Accra: MLNR.

Mitlin, D. and Satterthwaite, D. (1996).Sustainable development and cities.In C. Pugh (ed.), Sustainability, the environment and urbanization (pp. 23–62). London: Earthscan.

Muggah, R. (2012). Researching the Urban Dilemma: Urbanization, Poverty and Violence.

Naab, F. N., Dinye R. D. and Kasanga, R. K. (2013). Urbanisation and its Impact on Agricultural Lands in Growing Cities in Developing Countries: A Case Study of Tamale in Ghana. *Modern Social Science Journal*, 2 (2013), No. 2, 256-287.

Naumann, S., McKenna, D., Timo, K., Mav, P. and Matt, R. (2011). Design, implementation and cost elements of Green Infrastructure projects. Final Report to the European Commission, DG Environment, Contract no. 070307/2010/577182/ETU/F.1, Ecologic Institute and GHK Consulting.

Nowak D, J. (2002). The Effects of Urban Trees on Air Quality, USDA Forest Service, Syracuse, NY.

Nowak, D.J and Crane, D.E. (2002). Carbon storage and sequestration by urban trees in the USA. *Environmental Pollution*. 116: 381-389.

Nowak, D.J., Crane, D.E. and Stevens, J.C. (2006).Air pollution removal by urban trees and shrubs in the United States. *Urban Forestry and Urban Greening*. 4: 115-123.

Nsiah-Gyabaah, K. (2003). Urbanization Processes – Environmental and Health Effects in Africa. Panel Contribution to the PERN Cyber seminar on Urban Spatial Expansion.

Owusu, G. (2010). Urban Development Trends in Ghana and Accra. Presentation, Accra.

Patton, M. Q. and Cochran, M. (2002).A Guide to Using Qualitative Research Methodology.

Pauleit, S. and Duhme, F.(2000).Assessing the environmental performance of land cover types for urban planning. *Landscape and Urban Planning*. 52: 1-20.

Philip, E. (2007). Urban planning and development control regulations: Case study Kerala. *Institute of Town Planning India Journal*, 4(1):13-16.

Quagraine, V, K. (2011). Urban Landscape Depletion in the Kumasi Metropolis, In Adarkwa, K, K. (ed), Future of the Tree: Towards growth and development of Kumasi. Kumasi: University Printing Press.

Rashed, T and Jurgens, C. (2010).Remote Sensing of Urban and Suburban Areas. New York: Kluwer Press.

RCEP (2007). The Urban Environment, Royal Commission on Environmental Pollution (UK), London. http:// www.rcep.org.uk/urban/report/urban-environment.pdf.

Ribeiro, H., Oliveira, M., Ribeiro, N., Cruz, A., Ferreira, A., Machado, H., Reis, A. and Abreu, I. (2009). Pollen allergenic potential nature of some trees species: A multidisciplinary approach using aerobiological, immunochemical and hospital admissions data. Environmental Research 109: 328–333.

Rodenburg, C., Baycan-Levent, T., van Leeuwen, E. and Nijkamp, P. (2001). Urban Economic Indicators for Green Development in Cities. GMI 36 – European Union project on the Development of Urban Green Spaces to Improve the Quality of Life in Cities and Urban Regions (URGE).

Roelofs, J. (1999). Building and designing with nature: Urban design. In: J. Roelofs (Eds.), Greening cities: Building just and sustainable communities. New York: Bootstrap Press.

Rostow, W. W. (1960).*The Stages of Economic Growth: A Non-Communist Manifesto.* London, Cambridge University Press.

RurbanAfrica (2013).African Rural-City Connections. City Dynamics.Briefing 3.

Safavi, H. P. (2012). The Process of Urbanization and Its Implications for Tourism Sector-A Sustainability Approach: The Case of Famagusta/TRNC. MSc. Thesis, Institute of Graduate Studies and Research, Eastern Mediterranean University, Gazimağusa, North Cyprus.

Sandström, U. F. (2002).Green infrastructure planning in urban Sweden.*Planning Practice Research*, 17(4), 373–385.

Saraev, V. (2012). Economic benefits of green space: a critical assessment of evidence of net economic benefits. Forestry Commission Research Report. Forestry Commission, Edinburgh. i–vi + 1–38 pp.

Sarat, A, A. and Eusuf, M. A. (1985). An Experimental Study on Observed Heating Characteristics of Urban Pavement. *Journal of Surveying, Construction and Property Vol.3 Issue 1*.

Schipperijn, J. (2010). Use of urban green space. *Forest & Landscape Research* No. 45-2010. Forest & Landscape Denmark, Frederiksberg.155 pp.

Schmidt, S. (2005). 'Cultural influences and the built environment. An examination of Kumasi, Ghana', Journal of Urban Design, vol. 10 (5), pp.353-370.

Shan, X. Z. (2009). Urban Green Spaces in Guangzhou (China): Attitude, Preference, Use Pattern and Assessment. PhD. thesis submitted to the University of Hong Kong.

Shields, S. S. (undated).The Case Study Approach-The Use of Case Studies in Information Operations. The Joint Staff, J8. Warfighting Analysis Division Presentation.

Simon, D., McGregor, D. and Nsiah-Gyabaah, K. (2004). "The Changing Urban–rural Interface of African cities: Definitional Issues and an Application to Kumasi, Ghana. Environment & Urbanization Vol 16 No 2 October 2004

Sullivan, W.C., Kuo, F.E. and Depooter, S.F. (2004). The Fruit of Urban Nature: Vital Neighborhood Spaces. Environment and Behavior 36: 678-700.

Swanwick, C. (2004). The role of parks and open spaces in urban vitality: The research agenda. Rics Foundation.

Swanwick, C., Dunnett, N. and Woolley, H. (2003). Nature, role and value of green space in towns and cities: an overview, Built Environment, 29(2), 94-106.

Tamakloe, E. K. A. (1997). "Spatial and Urban Planning", An Unpublished Special Paper Submitted to the Department of Planning, KNUST, Kumasi and Ministry of Local Government and Rural Development, Accra. In Urbanisation and Changing Patterns of Urban Land Use in Ghana: Policy and Planning Implications for Residential Land Use in Kumasi.

TEP (2005). Advancing the delivery of green infrastructure: targeting issues in England's Northwest. The Environment Partnership.

Tipple, A. G. (1987). The development of housing policy in Kumasi, Ghana, 1901-1981, New Castle: University of New Castle upon Tyne.

Tontoh, A. G. (2011). *A study to ascertain the growth situation of the Kumasi Metropolitan Area (KMA): A remote sensing approach.* Master's thesis, Department of Geomatic Engineering, Kwame Nkrumah University of Science and Technology, Kumasi.

Torrens, P. M. (2000). How cellular models of urban systems work, WP-28, Centre for Advanced Spatial Analysis, University College London.

Town and Country Planning Association (2004). Biodiversity by Design: A guide for sustainable communities. TCPA, London.

Twumasi-Ankrah, K. (1995). Rural-Urban Migration and Socioeconomic Development in Ghana: Some Discussions. *Journal of Social Development in Africa*, 10, 2, 13-22.

Tyrväinen, L., Pauleit, S., Seeland, K. and de Vries, S. (2005). Benefits and uses of urban forests and trees. In: Nilsson, K., Randrup, T.B. and Konijnendijk, C.C. (eds.), Urban forests and trees in Europe: A reference book (pp.81-114). Springer-Verlag Berlin Heidelberg.

Uggla, Y. (2012). Construction of "nature" in urban planning: A case study of Stockholm. Town Planning Review, 83(1), 69-85.

UNFPA (1999). The State of World Population.

UNFPA (2000). The State of World Population.

United Nations (2000). The World's Women; Trends and Statistics.

United Nations (2000). World Urbanization Prospects.

United Nations (2001). The Components of Urban Growth in Developing Countries.

United Nations-HABITAT (2006). "World Urbanisation Prospects: The 2005 Revision". New York, Population Division, Department of Economic and Social Affairs, United Nations available at http://www.unhabitat.org.

United Nations (2014). World Urbanization Prospects.

URGE-Team (2004). URGE - Making greener cities: A practical guide. UFZ-Bericht Nr. 8/2004 (StadtökologischeForschungen Nr. 37), UFZ Leipzig-Halle GmbH.

Van der Ryn, S. and Cowan, S. (2007). Ecological design (10th Anniversary Edition ed.). Washington, D.C.: Island Press.

VonThünen, J. H. (1826). Der IsolierteStaat (English translation by C. M. Wartenberg, edited by P. Hall, von Thünen's Isolated State.(1966). Oxford: Pergamon Press).

Water Resources Commission (2008). Buffer zone policy for managing river basins in Ghana. Accra, Ghana

Weber, A. (1929). (translated by Carl J. Friedrich from Weber's 1909 book). Theory of the Location of Industries. The University of Chicago Press, ISBN-10: 0226264696, Chicago.

Weingaertner, C. (2005). Analysing Synergies between Urbanization and Sustainable Development: Developing a Draft Theory through Historical Pilot Studies. Licentiate Thesis in Infrastructure, Specialization in Built Environment Analysis, Royal Institute of Technology, Stockholm.

Williamson, K.S. (2003). Growing with Green Infrastructure. Heritage Conservancy, Doylestown, PA.

World Forestry Center (1993).A technical guide to urban and community forestry. Nebraska Forest Service, United States Forest Service Forestry Report R8-FR 16, Portland, Oregon.

Yeboah, I. E. A., Codjoe, S. N. A. and Maingi, J. K. (2013). Emerging Urban System Demographic Trends: Informing Ghana's National Urban Policy and Lessons for Sub-Saharan Africa. *Africa Today*, Volume 60, Number 1, Fall 2013, pp. 98-124 (Article).

Yu, S. (2002). The research of urban recreational greenbelt. Modern Urban Research, 17(2), 4-7. In Chen, C. Urban green space planning in post-1949 China: Beijing as a representative case study. PhD. Thesis submitted to Lincoln University, New Zealand.

Zitkovic, M. (2008). Managing Green Spaces for Urban Biodiversity. Brussels: Countdown 2010 Secretariat.

APPENDICES

Appendix A: Projection of Residential Facilities in the Kumasi

Table 3.1 Residential Facilities in the Kumasi Metropolis

Study Area	Number of houses (2010)	Projection for 2014*
Kotei	367	404
Atonsu	2489	2740
Fanti New Town	465	512
Total	3321	3656

Source: KMA, 2010 and Author's Construct, April, 2014.

*These are projected figures based on 2010 figures

The residential facilities are projected using the formula $P_t=P_oE^{(rt)}$

P_t=Future housing stock (2014)

P_o=Housing stock of the base year (2010)

E=Natural log (constant) =2.718283

r= Housing stock growth rate of KMA

(2.4 percent, from KMA medium term Dev. Plan, 2010)

t= Time frame (4 years)

Appendix B: Calculation of Sample Sizes

Assumption: Total Housing Stock is equal to total number of Landlord/ladies.

Confidence Interval $= 92\%$

Margin of error, $\alpha = 0.08$

From the table, the Sample Frame, $N = 94{,}364$

But Sample Size, n, is given by

$$n = \frac{N}{1 + N(\alpha)^2}$$

$$= \frac{3656}{1+3656(0.08)^2}$$

$$= 149.9$$

$$\approx 150$$

$$n = 149.9 \approx 150$$

Appendix C: Questionnaire for Landlords

Town…….

1. Age of Respondent 31-35 [ ] 36-40[ ] 41-45 [ ] 46-50 [ ] 51-55 [ ] 56-60 [ ] 61+ [ ]
2. Sex of Respondent Male [ ] Female [ ]
3. Are you an indigene of this town? Yes [ ] No [ ]
4. How long have you lived in the town? Less than 1 year [ ] 1-4 years [ ] 5-10 years [ ] 11-15 years [ ]
5. What motivates you to live in this Town? Social Ties [ ] Economic Benefits [ ]

Other reasons (specify)…… …… …

7. What form of education did you attain? Formal [ ] Non-Formal [ ]

8. If answer to 7 is formal what level did you attain?

Basic [ ] Secondary [ ] Tertiary [ ]

8. What is your employment status? Employer [ ] Employee [ ] Self Employed [ ] Unemployed [ ]

9. If employed what economic activity do you engage in? Agriculture [ ] Industrial [ ] Commerce and Service [ ]

10. How did you acquire your land?

Family land [ ] Purchased from a chief [ ] Others (specify)…… 11. Did you acquire a permit for your building?

Yes [ ] No [ ]

12. Are you aware of the community layout plan? Yes [ ] No [ ]

13. If yes, does your building conform to this plan
Yes [ ] No [ ]

14. What are the major land uses in the town? Residential [ ] Educational [ ] Commercial [ ] Green/open space [ ]

15. What types of green spaces exist in your community?

Wetlands [ ] Public parks [ ]

Private residences [ ] Public offices and working areas [ ]

Greens in educational areas [ ] Stretches along main roads and streets [ ]

Others (specify)……

16. Is there a green space at your residence/house? Yes [ ] No [ ]

17. If yes what kind of green space is it?

Lawn [ ] Gardens [ ]

Others (Specify)……

18. If answer to 17 is no, give reasons

Don't find it necessary [ ] High cost associated with the creation of green space [ ]

Planting materials difficult to come by [ ] Limited space [ ]

Green space not financially rewarding [ ]

Others (specify) ……..

19. Are there any benefits associated with green spaces? Yes [ ] No [ ]

20. If answer is yes, what are some of these benefits?

Beautification of the environment [ ] Prevention of soil erosion [ ]

Reduction of atmospheric CO_2 [ ] Reduction of wind speed [ ]

Spaces for social interaction [ ] Maintenance of micro-climate [ ]

Others (Specify)…….....

21. Are there any problems associated with green spaces in your community? Yes [ ] No [ ]

22. If answer to 3.1. is yes, what are some of the problems?

Physical threats to human safety [ ] A place for dumping domestic waste [ ]

A hiding place for criminals [ ] Breeding place for dangerous animals [ ]

A place for sexual violence [ ] Allergies from pollen grains of plants [ ]

Others (specify)…….....

23. Do you know of any local regulations, ordinances, etc. for the protection of green spaces, trees, nature areas, etc.? Yes [ ] No [ ]

24. If answer is yes, please provide examples of these.

Forest preservation laws [ ] Local nature protection areas [ ]

Zoning regulations for green space [ ] Others (Specify)……

25. If answer to 24 is yes, how did you know about them?

……

26. If answer to 25 is yes, are these regulations enforced? Yes [ ] No [ ]

31. Do you know of any green space/ nature reserve in your community that has been converted to a different land use? Yes [ ] No [ ]

32. If yes, where is it located and what land use has it been converted to?

Location……....

Converted/ new land use……

33. Which of these factors contribute(s) to the depletion of green spaces in your community?

Laxity in the enforcement of development controls [ ]

Lack of control over all lands by city authorities [ ]

Problem of ownership of green space lands [ ]

Uncooperative attitudes of the general public towards the preservation of green spaces [ ]

High land rent for other land uses in the city [ ]

Others (Specify)……

34. Which of the following infrastructural development contribute(s) to the depletion of green spaces in your community?

High tension electric power lines [ ] Building in waterways/wetlands [ ]

Road construction [ ] Residential facilities [ ]

Commercial facilities [ ] Burying of telecommunication cables [ ]

Burying of electrical cables [ ] Erection of telecommunication masts [ ]

Others (specify)…… ……..

35. Have you destroyed any green space on your premises due to expansion works or renovation of your house?

Yes [ ] No [ ]

36. If answer is yes, give reasons?

New development more financially rewarding than the green space [ ]

Others (specify)…… ……

37. What are the effects of green space depletion in your community?

Loss of urban biodiversity [ ] Depletion of spaces for social interactions [ ]

Urban heat island [ ] Reduction in urban agriculture [ ]

Air pollution [ ] Lack of places of recreation and social interactions [ ]

Others (Specify)…… ……

38. Suggest possible measures for the promotion of green spaces in your community.

Appendix D:Interview Guide for EPA, Ashanti.

1.0 . Definition of green space

1.1. What does the concept of green space mean to you?

2.0 . Spatial coverage of green spaces

2.1. What is the amount of green space within the metropolis?

2.1.1. Total Metropolitan area

2.1.2. Total area of green space

2.1.3. Area of green space per inhabitant

2.1.4. Percentage of green space under public control

3.0. Types of green spaces

3.1. What types of green spaces currently exist in the City?

4.0. Evaluation of green spaces

4.1. Does your agency have a Geographic Information System "GIS" or similar mapping software allowing evaluation of green spaces in the Metropolis?

4.1.1. If yes, how is it used?

5.0. State of green spaces

5.1. What is the current state of green spaces in the Kumasi Metropolis?

6.0. Benefits of green spaces

6.1. What are the main functions and benefits of green spaces in the Metropolis?

7.0. Planning and management of green spaces

7.1.Agency's role

7.1.2. What is the EPA's main role in the planning and management of green spaces?

7.2.Green space management plan

7.2.1. Does the EPA have a green space management plan?

7.2.1.1. If yes, what is the percentage of its implementation?

7.2.1.2. If answer to 7.2.1 is no, what factors have prevented the EPA from designing a green space management plan?

7.3. Actors involved

7.3.1. Which Metropolitan organization(s) are responsible for planning and management of the City's green spaces?

7.3.2. Are there other public actors, such as state institutions, that are involved in green space planning and management?

7.2.2.1. If yes, name these institutions.

7.4. Legislation/Laws

7.4.1. Do local regulations, ordinances, etc. exist for green spaces, trees, nature areas, etc.?

7.4.1.1. If answer is yes, please provide examples of these.

7.4.1.2. If answer to 7.3.1 is yes, how do these local regulations connect to national-level legislation for green space?

7.5. Stakeholders

7.5.1Which of the following groups is/are involved in green space planning and management?

Businesses / Companies [ ] Interest groups [ ]

The general public [ ] Others (Specify)……

7.5.2. Which instruments/procedures are used for involving stakeholders [if any; e.g., consultation procedures, surveys, sponsoring schemes (for businesses)]?

7.6. SWOT analysis of green spaces and their management

7.6.1. What are the most important Strengths, Weaknesses, Opportunities and Threats regarding the city's green spaces and their planning and management?

7.6.1.1. Strength…….

7.6.1.2. Weaknesses……

7.6.1.3. Opportunities……

7.6.1.4. Threats……

8.0. Social problems assessment of green spaces

8.1. What are some of the social problems associated with green spaces in the Metropolis?

Physical threats to human safety [ ] A place for dumping domestic waste [ ]

A hiding place for criminals [ ] Attracting dangerous wild animals [ ]

A place for sexual violence [ ] Others (specify)…….....

9.0. Depletion of green spaces

9.1. Re-zoning of green spaces?

9.1.1. Are there green spaces in the Metropolis which have been re-zoned for other land uses?

9.1.1.2. If answer to 9.1.1 above is yes, kindly give the locations of those re-zoned green spaces and the new land uses.

9.2. Encroachment on green spaces

9.2.1. Are there any areas within the Metropolis that were earmarked as nature reserves/ green spaces/ environmentally sensitive areas but have been encroached upon without your consent?

9.2.1.1 If answer to above is yes, please provide the names of the locations and the kinds of development activities taking place there.

9.3. Factors that contribute to green space depletion

9.3.1. What factors contribute to the depletion of green spaces in the Metropolis?

9.4. Infrastructural development

9.4.1. Which of the following infrastructural development contribute(s) to the depletion of green spaces in the Metropolis? (Please tick)

High tension electric power lines [ ] Building in waterways/wetlands [ ]

Construction/ expansion of roads [ ] Residential facilities [ ]

Commercial facilities [ ] Burying of telecommunication cables [ ]

Burying of electrical cables [ ] Erection of telecommunication masts [ ]

Others (specify)

10.0. Effects of depletion of green spaces

10.1. What are the effects of green space depletion in the Kumasi Metropolis?

11.0. Promotion of green spaces

11.1. How can green spaces be promoted in the Kumasi Metropolis?

11.2. What measures were/have been taken by your agency to reclaim encroached green spaces and to promote green spaces in Kumasi?

12.0. Any other comments

Appendix E:Interview Guide for Forestry Commission, Kumasi.

3.0 . Definition of urban forest

1.1. How does your commission define an urban forest?

2.0. Spatial coverage of urban forest

2.1. What is the amount of forest within the Metropolis?

2.1.1. Total area of forest land……

2.1.2. Area of forest land per inhabitant……

2.1.3. Percentage of forest land under public control……

3.0. Types of tree species

3.1. What are the predominant tree species in the City?

4.0. Evaluation of urban forests

4.1. Does your commission have a Geographic Information System "GIS" or similar mapping software allowing evaluation of forests in the Metropolis?

4.1.1. If yes, how is it used?

5.0. State of urban forests

5.1. What is the current state of forests in the Kumasi Metropolis?

6.0. Benefits of urban forests

6.1. What are the main functions and benefits of forests in the Metropolis?

7.0. Planning and management of green spaces

7.2.Commission's role

7.1.2. What is the commission's main role in the planning and management of urban forests?

7.2. Urban forest management plan

7.2.1. Does the commission have an urban forest management plan? Yes [ ] No [ ]

7.2.1.1. If yes, what is the percentage of its implementation?

7.2.1.2. If answer to 7.2.1 is no, what factors have prevented the commission from designing an urban forest management plan?

7.3. Actors involved

7.3.1. Which Metropolitan organization(s) are responsible for the planning and management of the city's forests?

7.3.2. Are there other public actors, such as state institutions, that are involved in urban forest planning and management?

7.2.2.1. If yes, name these institutions.

7.4. *Regulations/Laws on forest protection*

7.4.1. Do regulations, ordinances, etc. exist for the protection of, trees, green spaces, nature areas, etc.? Yes [ ] No [ ]

7.4.1.1. If answer is yes, please provide examples of these.

7.4.1.2. If answer to 7.4.1. is yes, are these local regulations enforced? Yes [ ] No [ ]

7.5. Stakeholders

7.5.1. Which of the following groups are involved in forest planning and management?

Businesses / Companies [ ] Interest groups [ ]

The general public [ ] Others (Specify)……

7.6. SWOT analysis of urban forests and their management

7.6.1. What are the most important Strengths, Weaknesses, Opportunities and Threats regarding the city's forests and their planning and management?

7.6.1.1. Strengths……

7.6.1.2. Weaknesses……

7.6.1.3. Opportunities……

7.6.1.4. Threats……

8.0. Social problems assessment of urban forests

8.1. What are some of the social problems associated with forests in the Metropolis?

Physical threats to human safety [ ] A place for dumping domestic waste [ ]

A hiding place for criminals [ ] Attracting dangerous wild animals [ ]

A place for sexual violence [ ] Others (specify)…….....

9.0. Depletion of urban forests

9.1. Re-zoning of urban forest lands?

9.1.1. Are there forest lands in the Metropolis which have been re-zoned for other land uses? Yes [ ] No [ ]

9.1.1.1. If yes, what informed the decision of the Assembly to re-zone those forest lands?

9.1.1.2. If answer to 9.1.1 above is yes, kindly give the locations of those re-zoned forest lands and the new land uses.

9.2. Encroachment on urban forest lands

9.2.1. Are there any areas within the Metropolis that were earmarked as forests/ nature reserves/ green spaces/ environmentally sensitive areas but have been encroached upon without your consent? Yes [ ] No [ ]

9.2.1.1 If answer to above is yes, please provide the names of the locations and the kinds of development activities taking place there.

9.4. Factors contributing to the depletion of urban forest

9.4.1. What factors contribute to the depletion of forests in the Metropolis?

9.3. Infrastructural development

9.3.1. Which of the following infrastructural development contribute(s) to the depletion of forests in the Metropolis? (Please tick)

High tension electric power lines [ ] Building in waterways/wetlands [ ]

Construction/ expansion of roads [ ] Residential facilities [ ]

Commercial facilities [ ] Burying of telecommunication cables [ ]

Burying of electrical cables Erection of telecommunication masts [ ]

Others (specify)……

10.0. Effects of depletion of urban forests

10.1. What are the effects of forest depletion in the Kumasi Metropolis?

11.0. Promotion of urban forestry

11.1. How can forestry be promoted in the Kumasi Metropolis?

11.2. What measures were/have been taken by your commission to reclaim encroached forest lands and to promote forestry in Kumasi?

12.0. Any other comments

Appendix F:Interview Guide for TCPD, KMA.

10. Definition of green space

1.1. What does the concept of green space mean to you?

2.0. Spatial coverage of green spaces

2.1. What is the amount of green space within the metropolis?

2.1.1. Total Metropolitan area

2.1.2. Total area of green space

2.1.3. Area of green space per inhabitant

2.1.4. Percentage of green space under public control

3.0. Types of green spaces

3.1. What types of green spaces currently exist in the City?

4.0. Evaluation of green spaces

4.1. Does your organization have a Geographic Information System "GIS" or similar mapping software allowing evaluation of green spaces in the Metropolis?

4.1.1. If yes, how is it used?

5.0. State of green spaces

5.1. What is the current state of green spaces in the Kumasi Metropolis?

6.0. Benefits of green spaces

6.1. What are the main functions and benefits of green spaces in the Metropolis?

7.0. Planning and management of green spaces

7.3.Department's role

7.1.2. What is the department's main role in the planning and management of green spaces?

7.2.Green space management plan

7.2.1. Does the assembly have a green space management plan?

7.2.1.1. If yes, what is the percentage of its implementation?

7.2.1.2. When was the first green space management plan designed by the assembly?

7.2.1.3. If answer to 7.2.1 is no, what factors have prevented the assembly from designing a green space management plan?

7.3. Actors involved

7.3.1. Which Metropolitan organization(s) are responsible for planning and management of the City's green spaces?

7.3.2. Are there other public actors, such as state institutions, that are involved in green space planning and management?

7.2.2.1. If yes, name these institutions.

7.4. Legislation/Laws

7.4.1. Do local regulations, ordinances, etc. exist for green spaces, trees, nature areas, etc.?

7.4.1.1. If answer is yes, please provide examples of these.

7.5. Stakeholders

7.5.1Which of the following groups is/are involved in green space planning and management?

Businesses / Companies Interest groups

The general public Others (Specify)……

7.6. SWOT analysis of green spaces and green space management

7.6.1. What are the most important Strengths, Weaknesses, Opportunities and Threats regarding the city's green spaces and their planning and management?

7.6.1.1. Strength…….

7.6.1.2. Weaknesses……

7.6.1.3. Opportunities……

7.6.1.4. Threats……

8.0. Social problems assessment of green spaces

8.1. What are some of the social problems associated with green spaces in the Metropolis?

Physical threats to human safety	A place for dumping domestic waste
A hiding place for criminals	Attracting dangerous wild animals
A place for sexual violence	Others (specify)…….....**.**

9.0. Depletion of green spaces

9.1. Re-zoning of green spaces?

9.1.1. Are there green spaces in the Metropolis which have been re-zoned for other land uses?

9.1.1.1. If yes, what informed your decision to re-zone those green spaces?

9.1.1.2. If answer to 9.1.1 above is yes, kindly give the locations of those re-zoned green spaces and the new land uses.

9.2. Encroachment on green spaces

9.2.1. Are there any areas within the Metropolis that were earmarked as nature reserves/ green spaces/ environmentally sensitive areas but have been encroached upon without your consent?

9.2.1.1 If answer to above is yes, please provide the names of the locations and the kinds of development activities taking place there.

9.3. Factors that contribute to green space depletion

9.3.1. What factors contribute to the depletion of green spaces in the Metropolis?

9.4. Infrastructural development

9.4.1. Which of the following infrastructural development contribute(s) to the depletion of green spaces in the Metropolis? (Please tick)

High tension electric power lines [ ] Building in waterways/wetlands [ ]

Construction/ expansion of roads [ ] Residential facilities [ ]

Commercial facilities [ ] Burying of telecommunication cables [ ]

Burying of electrical cables [ ] Erection of telecommunication masts [ ]

Others
(specify)……..

10.0. Effects of depletion of green spaces

10.1. What are the effects of green space depletion in the Kumasi Metropolis?

11.0. Promotion of green spaces

11.1. How can green spaces be promoted in the Kumasi Metropolis?

11.2. What measures were/have been taken by your department to reclaim encroached green spaces and to promote green spaces in Kumasi?

12.0. Any other comments

Appendix G:Interview Guide for Planning Unit, KMA.

10. Definition of green space

1.1. What does the concept of green space mean to you?

2.0. Spatial coverage of green spaces

2.1. What is the amount of green space within the metropolis?

2.1.1. Total Metropolitan area

2.1.2. Total area of green space

2.1.3. Area of green space per inhabitant

2.1.4. Percentage of green space under public control

3.0. Types of green spaces

3.1. What types of green spaces currently exist in the City?

4.0. Evaluation of green spaces

4.1. Does your department have a Geographic Information System "GIS" or similar mapping software allowing evaluation of green spaces in the Metropolis?

4.1.1. If yes, how is it used?

5.0. State of green spaces

5.1. What is the current state of green spaces in the Kumasi Metropolis?

6.0. Benefits of green spaces

6.1. What are the main functions and benefits of green spaces in the Metropolis?

7.0. Planning and management of green spaces

7.4.Department's role

7.1.2. What is the department's main role in the planning and management of green spaces?

7.2.Green space management plan

7.2.1. Does the assembly have a green space management plan?

7.2.1.1. If yes, what is the percentage of its implementation?

7.2.1.2. If answer to 7.2.1 is no, what factors have prevented the assembly from designing a green space management plan?

7.3. Actors involved

7.3.1. Which Metropolitan organization(s) are responsible for planning and management of the City's green spaces?

7.3.2. Are there other public actors, such as state institutions, that are involved in green space planning and management?

7.2.2.1. If yes, name these institutions.

7.4. Legislations/Laws

7.4.1. Do local regulations, ordinances, etc. exist for green spaces, trees, nature areas, etc.?

7.4.1.1. If answer is yes, please provide examples of these.

7.4.1.2. If answer to 7.3.1. is yes, how do these local regulations connect to national-level legislation for green space?

7.5. Stakeholders

7.5.1Which of the following groups is/are involved in green space planning and management?

Businesses / Companies [ ] Interest groups [ ]

The general public [ ] Others

(Specify)……..

7.6. SWOT analysis of green spaces and their management

7.6.1. What are the most important Strengths, Weaknesses, Opportunities and Threats regarding the city's green spaces and their planning and management?

7.6.1.1.

Strength……

7.6.1.2. Weaknesses……

7.6.1.3. Opportunities……

7.6.1.4. Threats……

8.0. Social problems assessment of green spaces

8.1. What are some of the social problems associated with green spaces in the Metropolis?

Physical threats to human safety A place for dumping domestic waste

A hiding place for criminals Attracting dangerous wild animals

A place for sexual violence Others (specify)…….....

9.0. Depletion of green spaces

9.1. Re-zoning of green spaces?

9.1.1. Are there green spaces in the Metropolis which have been re-zoned for other land uses?

9.1.1.2. If answer to 9.1.1 above is yes, kindly give the locations of those re-zoned green spaces and the new land uses.

9.2. Encroachment on green spaces

9.2.1. Are there any areas within the Metropolis that were earmarked as nature reserves/ green spaces/ environmentally sensitive areas but have been encroached upon without your consent?

9.2.1.1 If answer to above is yes, please provide the names of the locations and the kinds of development activities taking place there.

9.3. Factors that contribute to green space depletion

9.3.1. What factors contribute to the depletion of green spaces in the Metropolis?

9.4. Infrastructural development

9.4.1. Which of the following infrastructural development contribute(s) to the depletion of green spaces in the Metropolis? (Please tick)

High tension electric power lines [ ] Building in waterways/wetlands [ ]

Construction/ expansion of roads [ ] Residential facilities [ ]

Commercial facilities [ ] Burying of telecommunication cables [ ]

Burying of electrical cables [ ] Erection of telecommunication masts [ ]

Others (specify)……

10.0. Effects of depletion of green spaces

10.1. What are the effects of green space depletion in the Kumasi Metropolis?

11.0. Promotion of green spaces

11.1. How can green spaces be promoted in the Kumasi Metropolis?

11.2. What measures were/have been taken by your department to reclaim encroached green spaces and to promote green spaces in Kumasi?

12.0. Any other comments

Appendix H:Interview Guide for DPG, Kumasi.

1.0 Definition of green space

1.1. What does the concept of green space mean to you?

2.0 Spatial coverage of green spaces

2.1. What is the amount of green space within the metropolis?

2.1.1. Total Metropolitan area

2.1.2. Total area of green space

2.1.3. Area of green space per inhabitant

2.1.4. Percentage of green space under public control

3.0. Types of green spaces

3.1. What types of green spaces currently exist in the City?

4.0. Evaluation of green spaces

4.1. Does your department have a Geographic Information System "GIS" or similar mapping software allowing evaluation of green spaces in the Metropolis?

4.1.1. If yes, how is it used?

5.0. State of green spaces

5.1. What is the current state of green spaces in the Kumasi Metropolis?

6.0. Benefits of green spaces

6.1. What are the main functions and benefits of green spaces in the Metropolis?

7.0. Planning and management of green spaces

7.5.Department's role

7.1.2. What is the department's main role in the planning and management of green spaces?

7.2.Green space management plan

7.2.1. Does your department have a green space management plan?

7.2.1.1. If yes, what is the percentage of its implementation?

7.2.1.2. If answer to 7.2.1 is no, what factors have prevented you from designing a green space management plan?

7.3. Actors involved

7.3.1. Which Metropolitan organization(s) are responsible for planning and management of the City's green spaces?

7.3.2. Are there other public actors, such as state institutions, that are involved in green space planning and management?

7.2.2.1. If yes, name these institutions.

7.4. Legislation/Laws

7.4.1. Do local regulations, ordinances, etc. exist for green spaces, trees, nature areas, etc.?

7.4.1.1. If answer is yes, please provide examples of these.

7.5. Stakeholders

7.5.1Which of the following groups is/are involved in green space planning and management?

Businesses / Companies [ ] Interest groups [ ]

The general public [ ] Others (Specify)……

7.6. SWOT analysis of green spaces and management of green spaces

7.6.1. What are the most important Strengths, Weaknesses, Opportunities and Threats regarding the city's green spaces and their planning and management?

7.6.1.1. Strength……

7.6.1.2. Weaknesses……

7.6.1.3. Opportunities……

7.6.1.4. Threats……

8.0. Social problems assessment of green spaces

8.1. What are some of the social problems associated with the poor management of green spaces in the Metropolis?

Physical threats to human safety [ ] A place for dumping domestic waste [ ]

A hiding place for criminals [ ] Attracting dangerous wild animals [ ]

A place for sexual violence [ ] Others (specify)…….....

9.0. Depletion of green spaces

9.1. Re-zoning of green spaces

9.1.1. Are there green spaces in the Metropolis which have been re-zoned for other land uses?

9.1.1.2. If answer to 9.1.1 above is yes, kindly give the locations of those re-zoned green spaces and the new land uses.

9.2. Encroachment on green spaces

9.2.1. Are there any areas within the Metropolis that were earmarked as nature reserves/ green spaces/ environmentally sensitive areas but have been encroached upon without your consent?

9.2.1.1 If answer to above is yes, please provide the names of the locations and the kinds of development activities taking place there.

9.3. Factors that contribute to green space depletion

9.3.1. What factors contribute to the depletion of green spaces in the Metropolis?

9.4. Infrastructural development

9.4.1. Which of the following infrastructural development contribute(s) to the depletion of green spaces in the Metropolis? (Please tick)

High tension electric power lines [ ] Building in waterways/wetlands [ ]

Construction/ expansion of roads [ ] Residential facilities [ ]

Commercial facilities [ ] Burying of telecommunication cables [ ]

Burying of electrical cables [ ] Erection of telecommunication masts [ ]

Others (specify)……

10.0. Effects of depletion of green spaces

10.1. What are the effects of green space depletion in the Kumasi Metropolis?

11.0. Promotion of green spaces

11.1. How can green spaces be promoted in the Kumasi Metropolis?

11.2. What measures were/have been taken by your department to reclaim encroached green spaces and to promote green spaces in Kumasi?

12.0. Any other comments

Appendix I:Interview Guide for Traditional Authorities.

Town……

1. Who allocates land in your community for development purpose?
2. What efforts are you making as a Traditional Authority to ensure effective implementation of land use plans?
3. What are the major land uses in your community?.....
4. What types of green spaces are found within your community?.....
5. Does the Traditional Authority have a green space management plan?
6. If yes, what is the level of its implementation?.....
7. If answer to 7.2.1 is no, what factors have prevented the Authority from designing a green space management plan?.....
8. What is the Authority's main role in the planning and management of green spaces?
9. Do local regulations, ordinances, taboos, etc. exist for green spaces, trees, nature areas, etc.?
10. If answer is yes, please provide examples of these.
11. If answer to 11 is yes, are these regulations enforced?
12. What is the current state of green spaces in your community?
13. What are the functions and benefits of green spaces in your community?
14. What are the problems associated with green spaces in your community?
15. What factors contribute to the depletion of green spaces in your community?
16. Are there any areas within your community that were earmarked as nature reserves/ green spaces/ environmentally sensitive areas/ sacred grove but have been encroached upon without your consent?
17. What measures were/have been taken by your Authority to reclaim encroached green spaces and to promote green spaces in your community?
18. What are the effects of green space depletion in your community?
19. Any other comments.

Appendix J:Interview Guide for Assembly Members.

Electoral Area……

1.0. Types of green spaces

1.1. What types of green spaces exist in your community?

Wetlands [ ] Public parks [ ]

Private residences [ ] Public offices and working areas [ ]

Greens in educational areas [ ] Stretches along main roads and streets [ ]

Others (specify)……

2.0. Spatial coverage of green spaces

2.1. What is the amount of green space within your community?

2.1.1. Total land area of community

2.1.2. Total area of green space

2.1.3. Area of green space per inhabitant

2.1.4. Percentage of green space under public control

3.0. Relevance of green spaces

3.1. Are there any benefits associated with green spaces? Yes [ ] No [ ]

3.1.1. If answer is yes, what are some of these benefits?

Beautification of the environment [ ] Prevention of soil erosion [ ]

Reduction of atmospheric CO_2 [ ] Reduction of wind speed [ ]

Spaces for social interaction [ ]

Others (Specify)…….....

4.0. Problems associated with green spaces

4.1 Are there any problems associated with green spaces in your community? Yes [ ] No [ ]

4.1.1. If answer to 3.1 is yes, what are some of the problems?

Physical threats to human safety [ ] A place for dumping domestic waste [ ]

A hiding place for criminals [ ] Breeding place for dangerous animals [ ]

A place for sexual violence [ ] Allergies from pollen grains of plants [ ]

Others (specify)…….....

5.0. Evaluation of green spaces

5.1. Does your community have a Geographic Information System "GIS" or similar mapping software allowing evaluation of green spaces in the community?

5.1.1. If yes, how is it used?

6.0. State of green spaces

6.1. What is the current state of green spaces in your community?

7.0. Local RegulationsLaws

7.1. Does your community have any local regulations, ordinances, etc. for the protection of green spaces, trees, nature areas, etc.? Yes [ ]

No [ ]

7.1.1. If answer is yes, please provide examples of these.

Tree preservation orders [ ] Local nature protection areas [ ]

Zoning regulations for green space [ ] Others (Specify)……

7.1.2. If answer to 6.1. is yes, are these regulations enforced?

7.1.3. If answer to 6.1 is yes, how are they made known to the general public?

8.0. Planning and management of green spaces

8.1. Community's role

8.1.2. What is the community's main role in the planning and management of green spaces?

8.2. Green space management plan

8.2.1. Does the community have a green space management plan?

8.2.1.1. If yes, what is the percentage of its implementation?

8.2.1.2. If answer to 7.2.1 is no, what factors have prevented the community from designing a green space management plan?

8.3. Actors involved

8.3.1. Which Metropolitan organization(s) are responsible for planning and management of the community's green spaces?

8.3.2. Are there other public actors, such as state institutions, that are involved in the community's green space planning and management?

8.2.2.1. If yes, name these institutions.

8.5. Stakeholders

8.5.1Which of the following groups are involved in green space planning and management?

Businesses / Companies [ ] Interest groups [ ]

The general public [ ] Others (Specify)……

8.6. SWOT analysis of green spaces and their management

8.6.1. What are the most important Strengths, Weaknesses, Opportunities and Threats regarding the city's green spaces and their planning and management?

8.6.1.1. Strength……

8.6.1.2. Weaknesses……

8.6.1.3. Opportunities……

8.6.1.4. Threats……

9.0. Depletion of green spaces

9.1. Do you know of any green space/ nature reserve in your community that has been converted to a different land use? Yes [ ] No [ ]

9.1.1. If yes, where is it located and what land use has it been converted to?

Location……

Converted/ new land use……

9.2. Which of the following factors contribute to the depletion of green spaces in your community?

Laxity in the enforcement of development controls [ ]

Problem of ownership of green space lands [ ]

Uncooperative attitudes of the general public towards the preservation of green spaces [ ]

Poor maintenance culture for green spaces [ ]

Others (Specify)……

9.3. Which of the following infrastructural development contribute(s) to the depletion of green spaces in your community?

High tension electric power lines [ ] Building in waterways/wetlands [ ]

Road construction [ ] Residential facilities [ ]

Commercial facilities [ ] Burying of telecommunication cables [ ]

Burying of electrical cables [ ] Erection of telecommunication masts [ ]

Others (specify)……

9.4. Have you destroyed any green space in your community due to infrastructural provision or expansion works?

Yes [ ] No [ ]

9.4.1. If answer is yes, give reasons?

New development more financially rewarding than the green space [ ]

Others (specify)……

10.0. Effects of depletion of green spaces

10.1. What are the effects of green space depletion in your community?

Loss of urban biodiversity [ ]

Depletion of spaces for social interactions [ ]

Urban heat island [ ] Reduction in urban agriculture [ ]

Air pollution [ ] Others (Specify)……

10.0. Promotion of green spaces

10.1. Suggest possible measures for the promotion of green spaces in your community.